



SYLLBUS FOR
BACHELOR OF SCIENCE (HONS) AGRICULTURE
BASED ON FIFTH DEANS' COMMITTEE (ICAR) REPORT

AISECT UNIVERSITY
Near Gandhi Maidan, Matwari
Hazaribagh, Jharkhand-825301

FACULTY OF AGRICULTURE
AISECT University
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, AISECT University for their cooperation and assistance in preparing the present document. The typing and computer work done by Shri Man Singh, Office Assistant is also appreciable.

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BACHELOR OF SCIENCE (HONS) AGRICULTURE

SEMESTER 1

COURSE STRUCTURE OF B.Sc. (HONS) AGRICULTURE

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allocated Credits
Course Code	CourseType	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
ABHO 101	Core Course	Fundamentals of Horticulture	80	50	25	10	05	20	10	1	-	-	1
ABBT 101	Core Course	Fundamentals of Plant Biochemistry and Biotechnology	80	50	25	10	05	20	10	2	-	-	2
ABSC 101	Core Course	Fundamentals of Soil Science	80	50	25	10	05	20	10	2	-	-	2
ABIF 101	Core Course	Introduction to Forestry	80	50	25	10	05	20	10	1	-	-	1
HBEN 101	Core Course	Comprehension & Communication Skill in English	80	50	25	10	05	20	10	1	-	-	1
ABAG 101	Core Course	Fundamentals of Agronomy	80	50	25	10	05	20	10	3	-	-	3
ABRM 101 / ABRM 102	Remedial Course	Elementary Mathematics*/ Introductory Biology*	100	50	25	20	10	30	15	2	-	-	2
			80	50	25	10	05	20	10	1	-	-	1
ABRM 103	Remedial Course	Agricultural Heritage	100	50	25	20	10	30	15	1	-	-	1
ABEX 101	Core Course	Rural Sociology & Educational Psychology	100	50	25	20	10	30	15	2	-	-	2
ABPD 101	Non- gradial	Human Value and Ethics**	100	50	25	20	10	30	15	1**	-	-	-
Practical Group				Term End Practical Exam				Sessional					
ABHO 101	Practical	Fundamentals of Horticulture	20			20	10	-	-	-	-	1	1
ABBT 101	Practical	Fundamentals of plant Biochemistry and Biotechnology	20			20	10	-	-	-	-	1	1

ABSC 101	Practical	Fundamentals of Soil Science	20			20	10	-	-	-	-	1	1
ABIF 101	Practical	Introduction to Forestry	20			20	10	-	-	-	-	1	1
HBEN 101	Practical	Comprehension & Communication Skill in English	20			20	10	-	-	-	-	1	1
ABAG 101	Practical	Fundamentals of Agronomy	20			20	10	-	-	-	-	1	1
ABRM 102	Remedial Course	Introductory Biology*	20			20	10					1	1
NCC/NSS/ABPE 101	Non gradial	NSS/NCC/Physical Education&Yoga Practices**	100			100	50	-	-	-	-	2**	-
	Grand Total		1100							14	-	07	21

L- Lectures T- Tutorials P- Practical

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
SEMESTER 2

COURSE STRUCTURE OF B.Sc. (HONS) AGRICULTURE

Course Details				External Assessment		Internal Assessment				Credit Distribution			Alotted Credits
Course Code	CourseType	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
ABGP 201	Core Course	Fundamentals of Genetics	80	50	25	10	05	20	10	2	-	-	2
ABMB 201	Core Course	Agricultural Microbiology	80	50	25	10	05	20	10	1	-	-	1
ABAE 201	Core Course	Soil and Water Conservation Engineering	80	50	25	10	05	20	10	1	-	-	1
ABCP 201	Core Course	Fundamentals of Crop Physiology	80	50	25	10	05	20	10	1	-	-	1
ABEC 201	Core Course	Fundamentals of Agricultural Economics	100	50	25	20	10	30	15	2	-	-	2
ABPP 201	Core Course	Fundamentals of Plant Pathology	80	50	25	10	05	20	10	3	-	-	3
ABEN 201	Core Course	Fundamentals of Entomology	80	50	25	10	05	20	10	3	-	-	3
ABEX 202	Core Course	Communication Skill and Personality Development	80	50	25	10	05	20	10	1	-	-	1
ABEX 203	Core Course	Fundamentals of Agricultural Extension Education	80	50	25	10	05	20	10	2	-	-	2
Practical Group				Term End Practical Exam				Sessional					
ABGP 201	Practical	Fundamentals of Genetics	20			20	10	-	-	-	-	1	1
ABMB 201	Practical	Agricultural Microbiology	20			20	10	-	-	-	-	1	1

ABAE 201	Practical	Soil and Water Conservation Engineering	20			20	10	-	-	-	-	1	1
ABCP 201	Practical	Fundamentals of Crop Physiology	20			20	10	-	-	-	-	1	1
ABPP 201	Practical	Fundamentals of Plant Pathology	20			20	10	-	-	-	-	1	1
ABEN 201	Practical	Fundamentals of Entomology	20			20	10	-	-	-	-	1	1
ABEX 202	Practical	Communication Skill and Personality Development	20			20	10	-	-	-	-	1	1
ABEX 203	Practical	Fundamentals of Agricultural Extension Education	20			20	10	-	-	-	-	1	1
	Grand Total		900								16	8	24

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

Minor- Pre University Test

BACHELOR OF SCIENCE (HONS) AGRICULTURE

SEMESTER 3

COURSE STRUCTURE OF B.Sc. (HONS) AGRICULTURE

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
ABAG 302	Core Course	Crop Production Technology-I (Kharif Crop)	80	50	25	10	05	20	10	1	-	-	1
ABGP 302	Core Course	Fundamentals of Plant Breeding	80	50	25	10	05	20	10	2	-	-	2
ABEC 302	Core Course	Agricultural Finance and Cooperation	80	50	25	10	05	20	10	2	-	-	2
ABIT 301	Core Course	Agricultural Informatics	80	50	25	10	05	20	10	1	-	-	1
ABAE 302	Core Course	Farm Machinery and Power	80	50	25	10	05	20	10	1	-	-	1
ABHO 302	Core Course	Production Technology of Vegetables and spices	80	50	25	10	05	20	10	1	-	-	1
ABES 301	Core Course	Environmental Studies and Disaster Management	80	50	25	10	05	20	10	2	-	-	2
ABST 301	Core Course	Statistics Method	80	50	25	10	05	20	10	1	-	-	1
ABAH 301	Core Course	Livestock and Poultry Management	80	50	25	10	05	20	10	3	-	-	3
Practical Group				Term End Practical Exam				Sessional					
ABAG 302	Practical	Crop Production Technology-I (Kharif Crop)	20			20	10	-	-	-	-	1	1
ABGP 302	Practical	Fundamentals of Plant Breeding	20			20	10	-	-	-	-	1	1
ABEC 302	Practical	Agricultural Finance and cooperation	20			20	10	-	-	-	-	1	1
ABIT 301	Practical	Agricultural Informatics	20			20	10	-	-	-	-	1	1

ABAE 302	Practical	Farm Machinery and Power	20			20	10	-	-	-	-	1	1
ABHO 302	Practical	Production Technology of Vegetables and spices	20			20	10	-	-	-	-	1	1
ABES 301	Practical	Environmental Studies and Disaster Management	20			20	10	-	-	-	-	1	1
ABST 301	Practical	Statistics Method	20			20	10	-	-	-	-	1	1
ABAH 301	Practical	Livestock and Poultry Management	20			20	10	-	-	-	-	1	1
	Grand Total		900							14	-	9	23

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

Minor- Pre University Test

BACHELOR OF SCIENCE (HONS) AGRICULTURE SEMESTER 4

COURSE STRUCTURE OF B.Sc. (HONS) AGRICULTURE

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
ABAG 403	Core Course	Crop Production Technology-II (Rabi crops)	80	50	25	10	05	20	10	1	-	-	1
ABHO 403	Core Course	Production Technology for Ornamental Crops, MAP and Land Scraping	80	50	25	10	05	20	10	1	-	-	1
ABAE 403	Core Course	Renewable Energy and Green Technology	80	50	25	10	05	20	10	1	-	-	1
ABSC 402	Core Course	Problematic Soils and their Management	100	50	25	20	10	30	15	2	-	-	2
ABHO 404	Core Course	Production Technology for Fruit and Plantation Crops	80	50	25	10	05	20	10	1	-	-	1
ABGP 403	Core Course	Principles of Seed Technology	80	50	25	10	05	20	10	1	-	-	1
ABAG 404	Core Course	Farming System and Sustainable Agriculture	100	50	25	20	10	30	15	1	-	-	1
ABEC 403	Core Course	Agricultural Marketing Trade & Prices	80	50	25	10	05	20	10	2	-	-	2
ABAG 405	Core Course	Introductory Agro Meteorology & Climate Change	80	50	25	10	05	20	10	1	-	-	1
ABEL 401	Elective Course	Biopesticides & Biofertilizers	80	50	25	10	05	20	10	2	-	-	2
Practical Group				Term End Practical Exam				Sessional					
ABAG 403	Practical	Crop Production Technology-II (Rabi crops)	20			20	10	-	-	-	-	1	1

ABHO 403	Practical	Production Technology for Ornamental Crops, MAP and Land Scraping	20			20	10	-	-	-	-	1	1
ABAE 403	Practical	Renewable Energy and Green Technology	20			20	10	-	-	-	-	1	1
ABHO 404	Practical	Production Technology for Fruitand Plantation Crops	20			20	10	-	-	-	-	1	1
ABGP 403	Practical	Principles of Seed Technology	20			20	10	-	-	-	-	2	2
ABEC 403	Practical	Agricultural Marketing ,Trade & Prices	20			20	10	-	-	-	-	1	1
ABAG-507	Practical	Introductory Agro meteorology & Climate change	20			20	10	-	-	-	-	1	1
ABEL 401	Practical	Biopesticides & Biofertilizers	20			20	10	-	-	-	-	1	1
	Grand Total		1000							13	-	09	22

L- Lectures T- Tutorials P- Practical

Major- Term End TheoryExam

Minor- Pre University Test

**BACHELOR OF SCIENCE (HONS) AGRICULTURE
SEMESTERS**

COURSE STRUCTURE OF B.Sc (HONS) AGRICULTURE

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
ABPP-502	CoreCourse	Principles of Integrated Pest and Disease Management	80	50	25	10	05	20	10	2	-	-	2
ABSC 503	CoreCourse	Manures, Fertilizers and Soil Fertility Management	80	50	25	10	05	20	10	2	-	-	2
ABEN 502	CoreCourse	Pests of Crops and Stored Grain and their Management	80	50	25	10	05	20	10	2	-	-	2
ABPP-503	CoreCourse	Diseases of Field and Horticultural Crops and their Management –I	80	50	25	10	05	20	10	2	-	-	2
ABGP-504	CoreCourse	Crop Improvement-I (<i>Kharif Crops</i>)	80	50	25	10	05	20	10	1	-	-	1
ABEX 504	CoreCourse	Entrepreneurship Development and Business Communication	80	50	25	10	05	20	10	1	-	-	1
ABAG 506	CoreCourse	Geoinformatics and Nano-technology and Precision Farming	80	50	25	10	05	20	10	1	-	-	1
ABIP 501	Core Course	Intellectual Property Rights	100	50	25	20	10	30	15	1	-	-	1
ABEL-502	Elective Course	Applied Hi-tech Horticulture	80	50	25	10	05	20	10	2	-	-	2
Practical Group				Term End Practical Exam				Sessional					
ABPP-502	Practical	Principles of Integrated Pest and Disease Management	20			20	10	-	-	-	-	1	1

ABSC 503	Practical	Manures,Fertilizers and Soil Fertility Management	20			20	10	-	-	-	-	1	1
ABEN 502	Practical	Pests of Crops and Stored Grain and their Management	20			20	10	-	-	-	-	1	1
ABPP-503	Practical	Diseases of Field and Horticultural Crops and their Management –I	20			20	10	-	-	-	-	1	1
ABGP-504	Practical	Crop Improvement-I (Kharif Crops)	20			20	10	-	-	-	-	1	1
ABEX 504	Practical	Entrepreneurship Development and Business Communication	20			20	10	-	-	-	-	1	1
ABAG 506	Practical	Geo informatics and Nano-technology and Precision Farming	20			20	10	-	-	-	-	1	1
ABAG 507	Practical	Practical Crop Production–I (Kharif crops)	100			100	50	-	-	-	-	2	2
ABEL-502	Practical	Applied Hi-tech Horticulture	20			20	10	-	-	-	-	1	1
	Grand Total		1000							14	-	10	24

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

Minor- Pre University Test

BACHELOR OF SCIENCE (HONS) AGRICULTURE SEMESTER 6

COURSE STRUCTURE OF B.Sc (HONS) AGRICULTURE

COURSE STRUCTURE OF B.Sc (HONS) AGRICULTURE													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
ABAG-608	CoreCourse	Rain fed Agriculture & Watershed Management	80	50	25	10	05	20	10	1	-	-	1
ABAE-604	CoreCourse	Protected Cultivation and Secondary Agriculture	80	50	25	10	05	20	10	1	-	-	1
ABPP 604	CoreCourse	Diseases of Field and Horticultural Crops and their Management-II	80	50	25	10	05	20	10	2	-	-	2
ABHO-605	CoreCourse	Post-harvest Management and Value Addition of Fruits and Vegetables	80	50	25	10	05	20	10	1	-	-	1
ABEN-603	CoreCourse	Management of Beneficial Insects	80	50	25	10	05	20	10	1	-	-	1
ABGP 605	CoreCourse	Crop Improvement-II (<i>Rabi crops</i>)	80	50	25	10	05	20	10	1	-	-	1
ABAG-610	CoreCourse	Principles of Organic Farming	80	50	25	10	05	20	10	1	-	-	1
ABEC-604	CoreCourse	Farm Management, Production & Resource Economics	80	50	25	10	05	20	10	1	-	-	1
ABFN-601	CoreCourse	Principles of Food Science and Nutrition	100	50	25	20	10	30	15	2	-	-	2
ABEL-603	Elective Course	Agriculture Business Management	80	50	25	10	05	20	10	2	-	-	2
Practical Group				Term End Practical Exam				Sessional					

ABAG-608	Practical	Rain fed Agriculture & Watershed Management	20			20	10	-	-	-	-	1	1
ABAE-604	Practical	Protected Cultivation and Secondary Agriculture	20			20	10	-	-	-	-	1	1
ABPP 604	Practical	Diseases of Field and Horticultural Crops and their Management-II	20			20	10	-	-	-	-	1	1
ABHO-605	Practical	Post-harvest Management and Value Addition of Fruits and Vegetables	20			20	10	-	-	-	-	1	1
ABEN-603	Practical	Management of Beneficial Insects	20			20	10	-	-	-	-	1	1
ABGP 605	Practical	Crop Improvement-II (Rabi crops)	20			20	10	-	-	-	-	2	2
ABAG-609	Practical	Practical Crop Production –II (Rabi crops)	100			100	50	-	-	-	-	1	1
ABAG-610	Practical	Principles of Organic Farming	20			20	10	-	-	-	-	1	1
ABEC-604	Practical	Farm Management, Production & Resource Economics	20			20	10	-	-	-	-	1	1
ABEL-603	Practical	Agriculture Business Management	20			20	10	-	-	-	-	1	1
	Grand Total		1200							13	-	11	24

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

Minor- Pre University Test

*Non Credit courses

Educational Tour will be organized after 6th semester.

**BACHELOR OF SCIENCE (HONS) AGRICULTURE
SEMESTER 7**

COURSE STRUCTURE OF B.Sc. (HONS) AGRICULTURE											
Course Details				Term End Practical Exam						Credit Distribution	Allotted Credits
Course Code	CourseType	Course Title	Total Marks	Major		Minor		Sessional		No. of weeks	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks		
Practical Group				Term End Practical Exam				Sessional			
ABEC-705	Practical	Orientation and survey of village	50			50	25	-	-	1	1
ABAG-711	Practical	Agronomical Interventions	50			50	25	-	-	2	2
ABEN-704	Practical	Plant Protection Interventions	50			50	25	-	-	2	2
ABSC-704	Practical	Soil Improvement Interventions (Soil sampling and testing)	50			50	25	-	-	2	2
ABHO- 706	Practical	Fruits and Vegetable Production Interventions	50			50	25	-	-	2	1
ABAE-705	Practical	Food Processing and Storage Interventions	50			50	25	-	-	1	2
ABAH- 702	Practical	Animal Production Interventions	50			50	25	-	-	1	2
ABEX-704	Practical	Extension and Transfer of Technology activities	50			50	25	-	-	3	2
ABAI-701	Practical	Agro- Industrial Attachment	50			50	25	-	-	6	6
	Grand Total		450							20	20

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

BACHELOR OF SCIENCE (HONS) AGRICULTURE SEMESTER 8

COURSE STRUCTURE OF B.Sc. (HONS) AGRICULTURE													
CourseDetails				External Assessment		Internal Assessment				CreditDistribut ion			Allotte d Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subjec twise Distrib ution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Practical Group				Term End Practical Exam				Section al					
A student has to register for two modules of (0+10) credits each (total 20 credits) from the package of 12 modules in the VIII semester. (Department will notify to the Exam cell every year before semester start)			100			100	50			-	-	10	10
			100			100	50			-	-	10	10
	Grand Total		200							-	-	20	20

L- Lectures T- TutorialsP-

Practical Major- Term End Theory Exam

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

Mission

Aims 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 environment for research knowledge in agriculture and allied fields.
- To develop culture of continuous improvement, skill development and teamwork

Programme Objectives:

- 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	Maximum Marks Allotted					Duration of Examination		
	Theory			Practical		Total	Theory	Practical
	Major	Minor	Sessional.	Minor	Lab Work/ Assignment			
Theory + Practical	50	10	20	15	05	100	3 hr	2 hr
Theory	50	30	20	-	-	100	3 hr	-
Practical	50	50	100	-	3 hr

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

S.N	OGPA	Division
1.	5.000 – 5.999	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:

$$\begin{aligned}
 & \sum_{i=1}^n c_i p_i \\
 \text{SGPA} = & \frac{\sum_{i=1}^n c_i p_i}{\sum_{i=1}^n c_i}
 \end{aligned}$$

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 $i = 1, 2, \dots, m$, are the number of subject in the semester

$$\begin{aligned}
 & \sum_{j=1}^n SG_j NC_j \\
 \text{CGPA} = & \frac{\sum_{j=1}^n SG_j NC_j}{\sum_{j=1}^n NC_j}
 \end{aligned}$$

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 number 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.

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

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	ABAG 101	4(3+1)
Crop Production Technology – I (<i>Kharif crops</i>)	ABAG 302	2(1+1)
Crop Production Technology – II (<i>Rabi crops</i>)	ABAG 403	2(1+1)
Farming System & Sustainable Agriculture	ABAG 404	1(1+0)
Introductory Agro-meteorology & Climate Change	ABAG 405	2(1+1)
Geoinformatics and Nanotechnology and Precision Farming	ABAG 506	2(1+1)
Practical Crop Production - I (<i>Kharif crops</i>)	ABAG 507	2(0+2)
Rainfed Agriculture & Watershed Management	ABAG 608	2(1+1)
Practical Crop Production - II (<i>Rabi crops</i>)	ABAG 609	2(0+2)
Principles of Organic Farming	ABAG 610	2(1+1)
Genetics & Plant Breeding		
Fundamentals of Genetics	ABGP 201	3(2+1)
Fundamentals of Plant Breeding	ABGP 302	3(2+1)
Principles of Seed Technology	ABGP 403	3(1+2)
Crop Improvement-I (<i>Kharif crops</i>)	ABGP 504	2(1+1)
Crop Improvement-II (<i>Rabi crops</i>)	ABGP 605	2(1+1)
Soil Science & Agricultural Chemistry		
Fundamentals of Soil Science	ABSC 101	3(2+1)
Problematic soils and their Management	ABSC 402	2(2+0)
Manures, Fertilizers and Soil Fertility Management	ABSC 503	3(2+1)
Entomology		
Fundamentals of Entomology	ABEN 201	4(3+1)
Pests of Crops and Stored Grain and their Management	ABEN 502	3(2+1)
Management of Beneficial Insects	ABEN 603	2(1+1)
Agricultural Economics		
Fundamentals of Agricultural Economics	ABEC 201	2(2+0)
Agricultural Finance and Co-Operation	ABEC302	3(2+1)
Agricultural Marketing Trade & Prices	ABEC 403	3(2+1)
Farm Management, Production & Resource Economics	ABEC 604	2(1+1)
Agricultural Engineering		
Soil and Water Conservation Engineering	ABAE 201	2(1+1)
Farm Machinery and Power	ABAE 302	2(1+1)
Renewable Energy and Green Technology	ABAE 403	2(1+1)

Protected Cultivation and Secondary Agriculture	ABAE 604	2(1+1)
Plant Pathology		
Fundamentals of Plant Pathology	ABPP 201	4(3+1)
Principles of Integrated Pest and Disease Management	ABPP 502	3(2+1)
Diseases of Field and Horticultural Crops and their Management-I	ABPP 503	3(2+1)
Diseases of Field and Horticultural Crops and their Management-II	ABPP 604	3(2+1)
Horticulture		
Fundamentals of Horticulture	ABHO 101	2(1+1)
Production Technology for Vegetables and Spices	ABHO 302	2(1+1)
Production Technology for Ornamental Crops, MAP and Landscaping	ABHO 403	2(1+1)
Production Technology for Fruit and Plantation Crops	ABHO 404	2(1+1)
Post-harvest Management and Value Addition of Fruits and Vegetables	ABHO 605	2(1+1)
Food Science & Technology		
Principles of Food Science & Nutrition	ABFN 601	2(2+0)
Agricultural Extension and Communication		
Rural Sociology & Educational Psychology	ABEX 101	2(2+0)
Communication Skills and Personality Development	ABEX 202	2(1+1)
Fundamentals of Agricultural Extension Education	ABEX 203	3(2+1)
Entrepreneurship Development and Business Communication	ABEX 504	2(1+1)
Biochemistry / Physiology / Microbiology/ Environmental Sciences		
Fundamentals of Plant Biochemistry and Biotechnology	ABBT 101	3(2+1)
Fundamentals of Crop Physiology	ABCP 201	2(1+1)
Agricultural Microbiology	ABMB 201	2(1+1)
Environmental Studies & Disaster Management	ABES 301	3(2+1)
Introduction to Forestry	ABIF 101	2(1+1)
Statistics, Computer Application and I.P.R.		
Statistical Methods	ABST 301	2(1+1)
Agri- Informatics	ABIT 301	2(1+1)
Intellectual Property Rights	ABIP 501	1(1+0)
Animal Production		
Livestock and Poultry Management	ABAH 301	4(3+1)
Language		
Comprehension & Communication Skills in English	HBEN 101	2(1+1)

Remedial Courses		
Elementary Mathematics	ABRM 101	2(2+0)
Introductory Biology	ABRM 102	2(1+1)
Agricultural Heritage	ABRM 103	1(1+0)
Non-Gradial Courses		
Human Values & Ethics	ABPD 101	1(1+0)
NSS/NCC/Physical Education & Yoga Practices	NCC/NSS/ ABPE 401	2(0+2)
Educational Tour	ABET 601	2(0+2)

SEMESTER I / FIRST YEAR

S. N.	Subject Code	Subject Name	Credit
1	ABHO 101	Fundamentals of Horticulture	2(1+1)
2	ABBT 101	Fundamentals of plant Biochemistry and Biotechnology	3(2+1)
3	ABSC 101	Fundamentals of Soil Science	3(2+1)
4	ABIF 101	Introduction to Forestry	2 (1+1)
5	HBEN 101	Comprehension & Communication Skill in English	2(1+1)
6	ABAG 101	Fundamental of Agronomy	4(3+1)
7	ABRM 102/ABRM 101	Introductory Biology* / Elementary Mathematics*	2(1+1) /2(2+0)
8	ABRM 103	Agriculture Heritage	1(1+0)
9	ABEX 101	Rural Sociology & Educational Psychology	2(2+0)
10	ABPD 101	Human Value and Ethics**	1(1+0)
11	NCC/NSS/ ABPE 401	NCC/NSS/Physical Education & Yoga Practices**	2(0+2)
Total Credit *R: Remedial course; **NC: Non-gradial courses			18 (12+6) + 03*+03**

COURSE CODE: ABHO 101

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, pollinizerhs 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.

Lecture Schedule

1. Horticulture–Definition-Divisions of horticulture with suitable examples.
2. Scope and importance of horticulture - Importance of horticulture in terms of income, employment generation, industry, religious, aesthetic, food & nutritive value and export.
3. Horticultural classification based on soil, climate and botanical classification.
4. Climate and soil for horticultural crops - Influence of environmental factors on horticultural

Crop production–Temperature, humidity, wind, rainfall and solar radiation– Influence of soil factors – Soil type, pH, EC.

5. Propagating structures- Plant propagation- Methods - Sexual and asexual – Propagation by cuttings – Definition of cutting – Stem cuttings – Leaf cuttings – Root cuttings.
6. Propagation by Layering - Types of layering (tip, simple, compound, mound, trench, air layering) - Natural modifications of layering (runners, suckers, stolon, offset) - Propagation by separation-Bulbs, corms; division (rhizome, stemtuber, tuberous roots).
7. Grafting, budding -Rootstock and scion selection – Grafting methods – Attached scion methods of grafting, simple or approach grafting, detached scion methods
of grafting (side grafting - Veneer grafting, apical grafting- epicotyl grafting, double, soft wood grafting, cleft grafting, tongue grafting, whip grafting) - Graft incompatibility – Types – Translocated and localized incompatibility; Budding – Methods of budding – T- budding, inverted T-budding, patch budding and ring budding – Top working.
8. Principles of orchard establishment – Points to be kept in mind while selecting site for the establishment of orchards - Principles and steps in orchard establishment - Layout of orchards – Systems of planting - Square, rectangle, quincunx, hexagonal and contour systems of planting-their merits and demerits.
9. Principles and methods of training and pruning - Definition of training, objectives and training, principles and methods of training of fruit crops- Open centre, closed centre and modified leader systems their merits and demerits - Definition of pruning, objectives of pruning, principles and methods of pruning of fruit crops.
10. Juvenility and flower bud differentiation – Methods for shortening juvenility - Application of growth regulators (Gibberellins, Auxins, cytokinins, Abscissic acid, Ethylene), environmental methods (photoperiod, temperature) - Cultivation techniques (grafting, pruning, girdling, irrigation, nutrition) - Bearing habits of fruit trees.
11. Unfruitfulness, factors (physiological, phylogenical, management, parasitical, climatological) pollination- Self and Cross pollination, pollinizers and pollinators
- Fertilization and parthenocarpy –Types.
12. Types of vegetables Gardens – Kitchen Garden, market garden, truck garden,vegetable

forcing, garden for processing, seed production garden and floating garden. Ornamental garden types – Formal – Informal – Wild Garden – Parts/ features of an ornamental garden.

13. Lawn making–Selection of Grass–Bermuda grass–Korean grass–Poa grass–Fescue grass–Kentucky blue grass–Grasses for shady areas–Site Selection–Soil
- Preparation of soil – Drainage – Digging – Manuring and grading – Methods of planting– Sowing of seeds–Dibbling–Turfig–Maintenance of lawn–Mowing
– Rolling – Sweeping –Scraping – Raking – Weeding – Irrigation – Top dressing with compost and fertilizers - Diseases and other problems – Fairy ring – Pale Yellow Laws.
14. Use of plant bio-regulators (PBR) in horticulture – Introduction – Applications of PBR in fruit crops.
15. Irrigation methods in horticulture crops - Different methods followed in horticultural crops (check basin, furrow, ring basin, basin, flood, pitcher, funnel, drip and sprinkler).
16. Fertilizer application- Different methods of application to horticultural crops- Broad casting, top dressing, localized placement, contact placement Band placement, row placement, pellet, foliar application, starter solution, fertigation.

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 shrubbery 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

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

Reference Books

1. Dr. Jitendra Singh, Fundamental of Horticulture
2. S. N. Gupta Instant Horticulture
3. Bijendra Singh & Ashok Chouhan Horticulture
4. Dr. Shyam Sundar Shrivastav Horticulture
5. Dr. Jitendra Singh, Basic Horticulture
6. Prasad & Kumar Principles of Horticulture

COURSE CODE: ABBT 101

**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 live stock, 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 Monosaccharide's, 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.

Lecture Schedule

1. Importance of Biochemistry. Properties of Water, pH and Buffer
2. Carbohydrat Importance and classification
3. Structures of Monosaccharides
4. Reducing and oxidizing properties of Monosaccharides
5. Mutarotation; Structure of Disaccharides and Polysaccharides
6. Lipid: Importance and classification
7. Structures and properties of fatty acids
8. Storage lipids and membrane lipids.
9. Proteins: Importance of proteins and classification;
10. Structures, titration and zwitterions nature of amino acids.
11. Structural organization of proteins
12. Enzymes: General properties
13. Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots.
14. Introduction to all osteric enzymes
15. Nucleic acids: Importance and classification; Structure of Nucleotides, A , B & Z DNA; RNA: Types and Secondary & Tertiary structure.
16. Metabolism of carbohydrates
17. Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain, Metabolism of lipids.
18. Beta oxidation, Biosynthesis of fatty acids
19. Concepts and applications of plant biotechnology
20. Scope, organ culture, embryo culture.
21. Cell suspension culture
22. Callus culture, another culture, pollen culture and ovule culture and their
23. Applications; Micro-propagation methods; organogenesis and embryogenesis

24. Synthetic seeds and their significance.
25. Embryo rescue and its significance; somatic hybridization and cybrids.
26. Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant DNA methods
27. Physical (Gene gun method), chemical (PEG mediated) and Agro bacterium mediated gene transfer methods.
28. Transgenic and its importance in crop improvement; PCR techniques and its applications.
29. RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

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

COURSE OUTCOMES

- Knowledge of production of micro-propagation and DNA finger printing.
- Knowledge of concepts and applications of plant biotechnology
- Clear understanding of structures of Monosaccharides

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., NewYork.
- Conn, E.E and Stumpf, P.K. 1989. *Outline of Biochemistry*. Wiley Eastern Ltd. NewDelhi.
- Frank M. Mallette, Paul M. Althouse and Carl O. Glagett. 1960. *Biochemistry of Plants and Animals*. Published by Wiley Wastern Pvt Ltd., NewDelhi
- Jain, J.L. 2001. *Fundamentals of Biochemistry*. 5th Edn. Published by S.Chand &Company, NewDelhi
- Lehninger, A. 1984. *Principles of Biochemistry*. Published by CBS Publishers and Distributers, New Delhi Mazur, Aand Harrows, B.1971.

Reference Books

- *Basic Chemistry of Life*. 2nd Edn. Published by Appleton-Century-Crofts, NewYork.
- *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, NewDelhi

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 landuse.
- 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.

Lecture Schedule

1. Soil as a natural body, Pedological and edaphological concepts of soil
2. Soil genesis: soil forming rocks and minerals classification
3. Weathering of rocks- Chemical, Physical and Biological
4. Factors of soil formation, fundamental and specific soil forming processes
5. Soil Profile
6. Definition and components of soil

7. Soil Physical properties- Soil texture, classifications of soil separates, Importance of soil texture, particle size analysis. Stoke's law
8. Soil structure and types of soil structure, mechanism of soil structure Formation, management of soil structure.
9. Bulk density, particle density and porosity, factors affecting them, agricultural significance and manipulation
10. soil consistence and plasticity and their agricultural significance
11. Soil colour and expression of soil colour with munsell soil colour chart
12. soil taxonomical classification and soils of India
13. Soil water classification, forces of soil water retention
14. Movement of soil water and availability to plants
15. Soil air, composition, gaseous exchange and its composition, importance and

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

- The Nature and Properties of Soil (13th Ed.)– Brady, N.C. & Weil, R.R., Macmillan Publishing Co. New York.
- Soil Physics – Marshall, T.J., Holmes, J.W. & Rose, C.W., Cambridge Univ. Press
- 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
- Soil, Plant, Water and Fertilizer Analysis – Gupta, P.K. 2007–Agribios

Reference Books

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

COURSE CODE: ABIF 101

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.

Lecture Schedule

1. Introduction – definitions of basic terms related to forestry, Indian forest, target area, productivity
2. Influence of forest on climate, soil, floods, erosion, human health and recreation.
3. Objectives of silviculture, forest classification, salient features of Indian forest policies.
4. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers.
5. Artificial regeneration – objectives, choice between natural and artificial regeneration, planting methods, essential preliminary considerations. Crown classification.
6. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.
7. Principles and practices of social forestry nurseries- types of nurseries - success in nursery production.
8. Afforestation in different sites - shifting sand dunes, saline soils, ravine lands, wet lands, lateritic soils, dry rocky soils, canal banks, road sides and watershed areas.
9. Village wood lots, selection of species - measures for shortage of fuel wood-Properties of fuel wood- management and advantages of energy plantations-Suitable tree species
10. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement-shadow and single pole method;
11. Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement;
12. Tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.
13. Major and minor forest products
14. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry
15. Different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens.
16. Cultivation practices of Subabul, Eucalyptus and Casuarina tree species.

Practical

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

COURSE OUTCOME:

- Gain knowledge of tree species.
- Knowledge of nursery lay-out for forestry.
- Maintenance of forest products.

Suggested Readings

1. Agriculture Competitive at a Glance, Satyakumari Sharma (2017) Kushal Publications and Distributors 1st Edition, 2017edition.
2. Chadha, K.L. and Chowdhury, B, 1992. *Ornamental Horticulture in India*. ICAR NewDelhi
3. Desai, B.L. 1979. *Planning and Planting of Home Gardens*. Indian Council of Agricultural Research, NewDelhi.
4. Chadha. K.L. and Gupta. R. 1995. Advance in Horticulture Vol. 11 Medicinal & Aromatic plants. Malhotra Pub. House., NewDelhi.
5. Farooqui, A.A., Khan, M.M. and Sreeramu, B.S. 1997. Cultivation of medicinal and aromatic crops in India. Naya Prakash,Kolkatta.
6. Jain S.K. 1979. Medicinal Plants. National Book Trust of India, NewDelhi.

COURSE CODE: HBEN 101

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 War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B.Shaw.

UNIT-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 in nature).
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 reading skills.
5. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability.
6. Group Discussions.

COURSE OUTCOME:

- Importance of professional writing.
- Knowledge about oral presentation of reports.
- Understanding reading skills.

Suggested Reading:-

- Current English for Colleges, By N.Krishnaswamy &T.Sriraman, Macmillan India Limited, Madras,1995;
- War Minus shooting – The sporting spirit George Orwell
- ADilemma–Alaymanlooksat science RaymondB.Fosdick Youand Your English Spoken English and Broken English G.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, water logging.
- 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.

Lecture schedule:

1. Agriculture-definition and importance of agriculture
2. Agronomy-meaning and scope of Agronomy
3. Types of seeds, dormancy of seeds
4. Viability of seeds, seed treatment
5. Sowing-methods, depth, plant density
6. Nursery bed and transplanting
7. Crop density and geometry

8. Optimum plant population
9. Tillage-definition and types of tillage including minimum and no tillage.
10. Tillage-definition and characteristics of good tillage.
11. Crop nutrition-essential nutrients-classification
12. Nutrient mobility in plants, Factors affecting nutrient availability
13. Functions and deficiency symptoms of primary nutrients
14. Manures–types, nutrient content ,
15. Green manures, compost
16. Fertilizers ,INM
17. Nutrient use efficiency
18. Irrigation : definition and objectives
19. Water resources and irrigation development in India and M.P.

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, seeddrill.
11. Study of soil moisture measuring devices.
12. Measurement of field capacity, bulk density and infiltration rate.
13. Measurement of irrigation water.

COURSE OUTCOME

- Basic knowledge of branches of agriculture.
- Basic elements of climate and weather required for crop production.
- 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

COURSE CODE: ABRM 101

ELEMENTARY MATHEMATICS CREDITS 2 (2+0)

DEPARTMENT: REMEDIAL COURSES

COURSE OBJECTIVE:

- To able to calculate and analysis data for statistical analysis.
- To study distance, circle, angle and differential calculus, matrices and determinants
- To study continuity, straight lines and slope-point form of equation of line.

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 of 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 diameter 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.

Lecture Schedule

1. Straight lines: Distance formula, section formula (internal and external division), Change of axes (only origin changed).
2. Equation of co-ordinate axes, Equation of lines parallel to axes, Slope intercept form of equation of line.
3. Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation line.
4. Angles between two st. lines, Parallel lines Perpendicular lines.
5. Equation of circle whose centre and radius is known.
6. Circle: Equation of circle passing through three given points, Equation of circle whose diameter 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).
7. Definition of function, limit and continuity, Simple problems on limit.
8. Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum.
9. Product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it).
10. Differentiation by substitution method and simple problems based on it.
11. Differentiation of Inverse Trigonometric functions.
12. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it).
13. Integral Calculus: Integration of simple functions.
14. Integration by substitution method.
15. Matrices and Determinants: definition of Matrices.
16. Addition Subtraction, Multiplication, Transpose and Inverse up to 3rd Order,
17. Properties of determinates up to 3rd order and their evolution

COURSE OUTCOME

- To able to calculate and analysis date 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.

COURSE CODE: ABRM 102

Introductory Biology

CREDITS 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.

Lecture Schedule

1. Introduction to living world
2. Diversity of living organism
3. Characteristics of different forms of life
4. Origin of life
5. Evolution & Eugenics
6. Binomial Nomenclature of living organism
7. Classification of living organism
8. Ultrastructure of Cell
9. Types of Cell division
10. Morphology of Flowering plants
11. Characters & Types of Seed
12. Seed germination & their types
13. Characteristics of Brassicaceae

14. Characteristics of Fabaceae
15. Characteristics of Poaceae
16. 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

COURSE CODE: ABRM 103

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 modern era;
- 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 prospects.

Lecture Schedule

1. Introduction of Indian agricultural heritage
2. Ancient agricultural practices,
3. Relevance of heritage to present day agriculture
4. Past and present status of agriculture and farmers in society
5. Journey of Indian agriculture and its development from past to modern era;
6. Plant production and protection through indigenous traditional knowledge;
7. Crop voyage in India and world;
8. Agriculture-scope; Importance of agriculture and agricultural resources available in India;
9. Crop significance and classifications;

- 10 Classification of crops-botanical, agronomic, seasonal.
- 11 Classification of crops based on lifespan, special purposes i.e. cover, green manure, catch, trap, cash, soiling.
- 12 National agriculture setup in India;
- 13 Current scenario of Indian agriculture;
- 14 Indian agricultural concerns and future prospects.

COUSE OUTCOME:

- Knowledge of crop scenery in India and world.
- 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 Manoharlal 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, Asian Agri-History Foundation.
2. D.Kumari, Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy.
3. ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research, New Delhi. (<http://www.agrimoon.com/wp-content/uploads/Introductory-Agriculture.pdf>)

COURSE CODE: ABEX 101

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.
- UNITV-** Theories of Motivation, Intelligence.

Lecture Schedule

1. Sociology and Rural Sociology - Meaning, definition, scope, its significance in Agricultural Extension - Importance of Rural Sociology in Agricultural Extension and their inter relationship.
2. Indian rural society - Characteristics, differences and relationship between rural and urban society.
3. Social group(s) – Meaning, definition, classification, factors to be considered in formation of groups-Role of social groups in Agricultural Extension.
4. Social Stratification – Meaning, definition, bases and forms of social stratification, characteristics and differences between classy stem and caste system.
5. Different cultural concepts - Culture, tradition, customs, folkways, mores, taboos, ritual-

Definition, meaning, concept and examples and their role in Agricultural Extension.

6. Social values - Meaning, definition and types; social control - Meaning, definition, need of social control and means of social control and attitudes - Types and their role in Agricultural Extension.
7. Social institution–Types –Family, education, religious, economic (Co-operative society) & political (Panchayat) - Characteristics, functions and their importance/ role in Agricultural Extension.
8. Social change-Meaning, definition, nature of social change, dimensions of social change and factors of social change & development.
9. Psychology and educational psychology - Meaning, definition, scope and its importance in Agricultural Extension – Behavior - Cognitive, affective and psychomotor domains.
10. Intelligence-Meaning, types, factors and importance in Agricultural Extension.
11. Perception-Meaning, types, factors and importance in Agricultural Extension.
12. Emotions and frustration- Meaning, types, factors and importance in Agricultural Extension.
13. Personality - Meaning, definition, types, factors influencing personality and importance in Agricultural Extension.
14. Motivation-Meaning, types of motives, theories of motivation and importance of motivation in Agricultural Extension.
15. Teaching, learning, learning experience, learning situation - Meaning and definition, elements of learning situation and its characteristics.
16. Principles of learning, their implications in teaching and steps in extension teaching.

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 andLearninginAgriculture–AGuideforagricultural education,FAO, Rome,
- Chandrakantan, K and Palaniswamy, (2000). Advances in communication Technology, Indian Publishers
- Rogers, E.M. (1983). Diffusion of Innovations. Free Press, NewYork.
- Lesche, R. (1997). How to write, speak and think more effectively. Happer &Row, NewYork.

COURSE CODE: ABPD 101

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.

Lecture Schedule

1. Meaning and definitions of values, & Ethics.
2. Types of values.
3. Formation of values.
4. Positive work ethics.
5. Goal, mission & vision of life and our university.
6. Principles & Philosophy of life.
7. Self exploration.
8. Self-awareness.
9. Decision making.
10. Motivation success.
11. Success.
12. Self confidence.

13. Case study of ethical (lives).
14. Positive Spirit.
15. Spirituality quotient.
16. Developing effective personality

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	ABGP 201	Fundamentals of Genetics	3(2+1)
2	ABMB 201	Agriculture Microbiology	2(1+1)
3	ABAE 201	Soil and Water Conservation Engineering	2(1+1)
4	ABCP 201	Fundamentals of Crop Physiology	2 (1+1)
5	ABEC 201	Fundamentals of Agricultural Economics	2 (2+0)
6	ABPP 201	Fundamentals of Plant Pathology	4 (3+1)
7	ABEN 201	Fundamentals of Entomology	4(3+1)
8	ABEX 202	Communication Skill and Personality Development	2(1+1)
9	ABEX 203	Fundamentals of Agricultural Extension Education	3 (2+1)
Total Credits			24(16+8)

COURSE CODE: ABGP 201

FUNDAMENTALS OF GENETICS

CREDITS 3(2+1)

DEPARTMENT: GENETICS & PLANT BREEDING

COURSE OBJECTIVES

- To study about chromosome and gene morphology.
- Detailed knowledge of cytoplasmic inheritance.

Theory:-

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.

Lecture Schedule

1. Pre Mendelian concepts of heredity–Early history of heredity, inheritance of acquired traits, pre formation theory, pangenesis and germplasm theory.
2. Chromosome-Structure of chromosome, types of chromosomes based on position of centromere.
3. Cell division–Cell cycle–Mitosis–Process of mitosis–Significance.
4. Meiosis–Process–Differences between mitosis and meiosis–Significance.
5. Mendelian principles of heredity – Terminology, Mendel's experiments – Reasons for

Selection of pea as experimental material- characters studied - Reasons for Mendel's success.

6. Mendel's laws—Law of segregation—Law of independent assortment—Principle of dominance – Principle of unit characters – Exceptions to Mendel's laws – Rediscovery of Mendelian principles.
7. Probability and Chi-square – Concept of probability, predicting results of a monohybrid cross, predicting results of a dihybrid cross—Chi-square test.
8. Dominance relationships – Complete dominance, incomplete dominance, co-dominance, over dominance, pseudodominance, lethal factors.
9. Gene interaction—Non epistatic interaction—Interaction of factors; epistatic interactions – Complementary epistasis, dominant epistasis.
10. Recessive epistasis, duplicate dominant gene action, dominant suppression or inhibitory gene action, duplicate genes with cumulative effect.
11. Multiple alleles – Characteristics of multiple alleles - Blood groups in humans, coat colour in rabbits, self incompatibility alleles in plants—pleiotropism, penetrance and expressivity.
12. Linkage—Definition—Classification of linkage—Characteristic features of linkage—Linkage groups.
13. Detection of linkage – Estimation of linkage - Importance of test cross in linkage studies – significance in plant breeding.
14. Crossing over mechanisms - Mechanism of crossing over – Types of crossing over – Factors affecting crossing over.
15. Significance of crossing over in plant breeding—Cytological proof of crossing over in *Drosophila*.
16. Chromosome mapping - 2-point and 3-point test cross – Cytological maps and genetical maps—Coincidence and interference.
17. Sex determination – Various mechanisms of sex determination – Chromosomal sex determination, genic balance mechanism of sex determination in *Drosophila melanogaster*, male haploidy, single gene effects etc.
18. Sex linkage— White eye colour in *Drosophila*, colour blindness and haemophilia in humans—sex influenced traits – Horns in sheep, baldness in humans, sex limited—Milk production in cattle, beard in man—Pseudo hermaphrodites—Gynandromorphs.
19. Qualitative and Quantitative traits, Polygene and continuous variations - Definition Inheritance and their differences, multiple factor hypothesis.
20. Cytoplasmic inheritance – Definition – Chloroplast inheritance (leaf variegation in *Mirabilis jalapa*) - mitochondrial inheritance (cytoplasmic male sterility in maize) - Characteristic features of cytoplasmic inheritance - Differences between chromosomal and extra chromosomal inheritance.
21. Nature and structure of genetic material - DNA and its structure - Watson and Crick's model - Function—Experiments to prove DNA as genetic material.
22. Replication of DNA- Modes of DNA replication—Semi-conservative DNA replication Experimental proof.
23. Types of RNA - Messenger RNA, ribosomal RNA and transfer RNA - structure of tRNA, differences between DNA and RNA.
24. Protein synthesis – Central dogma, transcription and translational mechanism of genetic

material- Genetic code–Properties of genetic code–Wobble hypothesis.

25. Steps in protein synthesis- Transcription and translation.
Gene regulation – Lacoperon concept– Gene concept–Cistron–Recon–Muton.
26. Mutation - Classification - Gene mutations - Introduction - Definition - Types of mutations
Spontaneous and induced mutations-Point mutations-Characters of mutations - Xenia and
metaxenia–Chimeras Types and their significance in plant breeding.
27. Methods of inducing mutations, Physical and chemical mutagens - Detection of sex linked
lethal in *Drosophila* (CIB method given by Muller).
28. Molecular basis of mutations-Transitions,trans versions and frame shift mutations
- Importance of mutations in plant breeding.
29. Structural changes in chromosome - Breakage - fusion - bridge cycle - Deletions
(deficiency)-Duplications and their significance in plant breeding.
30. Inversions-pericentricin versions and paracentricin versions-in versions as cross over
suppressors.
31. Translocations-simple and reciprocal-their role in plant breeding.

Practical:-

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 &Som
- Strickberger M.W. 2005 Genetics (III Ed) Prints Hall New Delhi,India
- Gupta P.K. 2002, Genetics, RastogiPublications
- Singh, B.D. Pre 2017, Principles of Genetics, Kalyani Publishers

COURSE CODE: ABMB 201

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 biodegradation.

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

Lecture Schedule

1. Introduction- Definition- The hidden world of microbiology- How microbes evolved on earth- General classification of microbes-Microorganisms and principles of microbiology- Scope of microbiology. Brief History of microbiology
- Spontaneous generation theory- Contributions of Antony Van Leeuwenhoek- Francesco Redi- Lazzaro Spallanzani- Franz Schulze- Schroder and Von Dusch- Louis Pasteur- John Tyndall.
2. Role of microbes in fermentation-Contributions of Cagnaird Latour-Theodor Schwann, F.Kutzing- Louis Pasteur - Germtheory of disease - Contribution of Hippocrates-Louis Pasteur-

- Robert Koch - Pure Culture Methods- Joseph Lister- Robert Koch- Beijerinck- Winogradsky- Francois Appert- Schroder and Von Dush- John Tyndall.
3. Protection against infection-Contributions of Edward Jenner- F. Loeffler- Behring-Kitasasto- Louis Pasteur - Applied aspects of Microbiology- Agricultural microbiology- Industrial microbiology-Food Microbiology - Medical microbiology– Water Microbiology - Geochemical Microbiology- Pollution microbiology – Air microbiology – Exo-Microbiology – Microbial biotechnology.
 4. Morphological types of Bacteria, Bacteria cell Structure- External and internal cell structures- Differences between Prokaryotes and Eukaryotes.
 5. Microbial Nutrition- Autotrophy - Chemoautotrophy-Photo autotrophy
 6. Heterotrophy – Metabolic pathways-Glycolysis-HMP-ED-TCA cycle.
 7. Growth of Microorganisms - Cell Division - Growth cycle of bacteria [Lag phase, Log phase, Stationary and Death phase]- Generation time- Growth rate- Growth yield- Synchronous – Diauxic growth.
 8. Bacterial genetics- Genetic recombination- Transformation- Conjugation- Transduction- Plasmids-Transposon.
 9. Role of microbes in fertility of soils and plant growth - Rhizosphere- Rhizoplane- Phyllosphere- Phylloplane - Microflora- Carbon cycle- Carbon di oxide fixation.
 10. Nitrogen cycle - Mineralisation- Immobilisation- Nitrification- Denitrification- Nitrogen Fixation - Phosphorus cycle, phosphorus solubilisation – Oxidation – Reduction - Sulphur cycle-Oxidation and reduction.
 11. Biological nitrogen fixation - Symbiotic- Associative- Asymbiotic- Nitrogen fixation In Azolla - Blue green algae - Actinorhizal symbiosis - Frankia, Phosphate solubilizing microorganisms - Bacillus - Pseudomonas- Mycorrhiza for Phosphorous uptake.
 12. PGPR Organisms - Bacillus – Pseudomonas – Azotobacter – Azospirillum -Rhizobium -Microbes in human welfare.
 13. Types of fermentations - Batch - Batch fed- Continuous - Solid State Fermentations, Common microbial fermentations-Alcohol- Lactic acid- Butyric acid- Formic acid- Butanediol- PropionicAcid- MixedAcid-Fermentationtechnology-Alcoholic beverages production.
 14. Biofertilizers (Bacterial-Cyanobacterial-Fungal) production technology- Silage Production Technology.
 15. Biopesticides- Viruses (Nucleo polyhedrosis virus - Granular viruses) – Bacteria (Bacillus thuringiensis, Bacillus papilliae) - fungi (Beauveria - Verticillium) - Protozoa (Malameba locustae-Mattesia Spp)-Mode ofaction.
 16. Biofuel Production- Biodegradation - Biogas, Biomanures and Composting Technologies.

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 Prentic Halb India Learning Priedc 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. ATTB Pub.India.

COURSE CODE: ABAE 201

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

Lecture Schedule

1. Introduction to soil and water conservation and causes of soil erosion.
2. Definition and agents of soil erosion, water erosion - Forms of water erosion - Gully classification and control measures.
3. Soil loss estimation by universal soil loss equation - Soil loss measurement techniques.
4. Principles of erosion control-Introduction to contouring, strip cropping.
5. Contour bund-Graded bund and bench terracing.

6. Grassed water ways and their design.
7. Wind erosion-Mechanics of wind erosion, types of soil movement-Principles of wind erosion control and its control measures.
8. Introduction to irrigation – Classification of irrigation projects.
9. Importance of irrigation water measurements-Volumetric, area velocity, discharge methods - Weirs, orifice, flumes.
10. Open channel hydraulics – Discharge calculations.
- 11&12.Types of wells-Water lifting devices-Classification of pumps, their capacity, power requirement and discharge calculations.
13. Functional components and working principle of underground pipeline systems. 14 &15. Functional components of microirrigation systems and its design like drip, sprinkler irrigation systems etc.
16. Water harvesting techniques-Lining of ponds, tanks and canal systems.

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 water ways.
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 Edition2001
- Ojha, T.P. and A.M. Michael. *Principles of Agricultural Engineering*, Vol.II. Jain Brothers New Delhi 3rd Edition2001
- 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

COURSE CODE: ABCP 201

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.

Lecture Schedule

1. Introduction to Crop Physiology and its importance in Agriculture.
- 2 & 3. Plant cell - The endomembrane system - Plasma membrane, endoplasmic reticulum, nuclear envelope, golgi apparatus, vacuole and endosomes - Structure and functional characteristics - Plastids, mitochondria, oil bodies, peroxisomes and glyoxysomes - Structure and functions.
- 4 & 5. Metabolic changes during seed development - Seed viability and seed vigor - Tests of viability and vigor - Physiological maturity, harvestable maturity - Indices of physiological maturity in crops - Seed germination - Metabolic changes during seed germination.
6. Growth and Development-Definition-Growth analysis-Growth parameters

- Definitions and mathematical formulae
- 7, 8 & 9. Absorption of water - Diffusion and osmosis - water potential and its components - Importance of water potential – Active and passive uptake of water – Stomatal complex – Transpiration – Water use efficiency – Water use efficiency of C₃, C₄ and CAM plants – Water requirement/ Transpiration ratio
 - Factors affecting WUE.
- 10 to 13. Mineral nutrition of plants – Essential mineral elements – Criteria of essentiality of mineral elements – Mengel's classification of mineral nutrients - Nutrient uptake mechanisms – Functional roles of N, P, K, S, Ca and Mg – Functional roles of Fe, Mn, Cu, Zn, B, Mo, Cl, Na, Co and Si – Deficiency symptoms of macro and micronutrients.
- 14 & 15. Assimilation of mineral nutrients – Nitrate assimilation – Ammonium assimilation in plants – Biological nitrogen fixation – Free-living and symbiotic bacteria
 - Nodule formation – Nitrogenase enzyme complex.
- 16 to 19. Photosynthesis – Reactions of photosynthesis – Energy synthesis – Principle of light absorption by plants – Light reactions - Cyclic and non cyclic photophosphorylation – CO₂ fixation – C₃ and C₄ pathways – Significance of C₄ pathway – CAM pathway and its significance – Photorespiration and its significance
 - Photosynthetic efficiency of C₃, C₄ and CAM plants - Factors affecting photosynthesis (light, CO₂, temp and water stress) – Relationship of photosynthesis and crop productivity.
- 20. Respiration – Energy balance – Significance of respiration – Oxidative Pentose Phosphate Pathway (OPPP) and its significance – Growth respiration and maintenance respiration – Alternate respiration – Salt respiration – Wound respiration.
- 21. Lipid metabolism – Biosynthesis of fatty acids in plastids – Functions of lipids - Significance of lipids in plant metabolism.
- 22 & 23. Physiology of flowering – Photoperiodism and flowering – Importance of photoperiodism – Classification of plants based on photoperiodic responses
 - Perception of photoperiodic stimulus – Biological clock – Phytochrome – Flowering hormones – Vernalization and flowering – importance of vernalization in agriculture.
- 24 to 29. Plant growth regulators – Auxins – Occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses. – Gibberellins – occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses – Cytokinins – Occurrence, transport, biosynthesis, mode of action and physiological roles
 - commercial uses – ABA – Occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses – Ethylene – Occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses.
- 30. Senescence and abscission – Definition – Classification of senescence – Physiological and biochemical changes that occur during senescence - Prevention of leaf and flower senescence – Abscission and its relationship with senescence.
- 31 & 32. Post harvest physiology – Dormancy – Types of dormancy – Advantages and disadvantages of dormancy - Causes of dormancy – Remedial measures for breaking seed dormancy - Fruit\

ripening - Climacteric and non climacteric fruits – Metabolic changes during fruit ripening - Hormonal regulation of fruit ripening – Ripening induction and ripening inhibition – Use of hormones in increasing vase life of flowers.

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 Hill of India (P) Ltd., New Delhi
- Plant Physiology by S.N. Pandey & B.K. Sinha Published by – Vikas Publishers

COURSE CODE: ABEC 201

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.

Lecture Schedule

1. Introduction to Economics– Economic activity and concept of economy and its functions, basic economic problems, three main economic actors-households, firms, governments as basic decision making units.
2. Economics - Meaning, definitions, its importance as a subject to science students.
3. Scope of study of economics as a science -Subject matter of economics – Traditional approach – Consumption, production, exchange, distribution and public finance/ public policy - Modern Approach – Microeconomics and macroeconomics.
4. Methods of economic investigation – Deduction and induction approaches, positive and normative analysis - Nature of economic theory - Rationality assumption, economic laws as generalization of human behavior.
5. Basic concepts: goods and services - Characteristics and classification, scarcity, choice, decision making, wants, substitutes and complements - Utility – Cardinal and ordinal approaches, forms of utility, marginal utility.
6. Cost and price, value and wealth and their characteristics, capital, income, investment, welfare, efficiency, equilibrium and firm.
7. Demand - Meaning, law of demand, demand schedule and demand curve characteristics, determinants, types of demand - Income demand, price demand, cross demand - Product demand, firm demand, market demand.
8. Market dynamics due to changes/ shifts in demand and prices - Contraction and extension, increase and decrease in demand.
9. Law of diminishing marginal utility – Statement, assumptions of law, explanation, limitations

of the law - Importance and applications.

10. Law of equi-marginal utility – Meaning, assumptions, explanation of the law - Practical importance and applications, limitations.
11. Consumer's surplus – Meaning, assumptions, explanation with examples, difficulties in measuring, consumer's surplus - Importance and applications - Engels law of family expenditure.
12. Indifference curve analysis - Indifference curves - Meaning, basic assumptions, properties and their importance in economics.
13. Budget line and its properties - Consumer's equilibrium - Graphical and algebraic expressions and its importance.
14. Elasticity of demand – Meaning, elastic and inelastic demand, measurement of elasticity of demand - Types of elasticity of demand - Price elasticity, income elasticity and cross elasticity of demand.
Kinds of elasticity of demand - Perfectly elastic, perfectly inelastic, relatively elastic, relatively inelastic, unitary elastic demand - Factors affecting elasticity of demand, practical importance of elasticity of demand.
15. Production - Meaning of production process, creation of utility, factors of production and input - output relationship and production function –Meaning.
16. Laws of returns - Increasing, decreasing and constant laws of returns - Meaning and explanation with examples.
17. Cost - Seven production costs - Meaning and formulas, cost and output relationships - Short run and long run cost curves.
18. Supply – Meaning, definition, law of supply, supply schedule, supply curve and properties, determinants of supply - Market dynamics due to changes/ shifts in supply and prices - Increase and decrease in supply, contraction and extension of supply.
19. Elasticity of supply and its measurement - Kinds of elasticity of supply – Perfectly elastic, perfectly inelastic, relatively elastic, relatively inelastic and unitary elastic - Factors affecting elasticity of supply.
20. Markets and market structure – Meaning, classification of markets based on market structure - Competition and its meaning, basic features of perfectly competitive and imperfect competitive markets.
- 22 & 23. Characteristics of monopolistic competition, monopoly, duopoly, oligopoly, monopsony, duopsony and oligopsony with examples.
24. Price determination under perfect competition – Equilibrium analysis - Numerical and graphical explanation.
25. Distribution theory - Meaning, factor market - Concepts of rent - Meaning, types of rent Ricardian theory of rent.
26. Wages - Meaning, nominal and real wages, working population in India - Labour participation rate, employment rate, unemployment rate - Interest- Meaning of interest and interest rate - Profit and income - Meaning, difference between income and profit.

27. Pricing of factors of production - Modern theory of distribution.
28. Public finance/ Public policy – Meaning, role and importance of public finance/Public policy - Functions of the government – Differences between public finance and private finance - Public revenue - Meaning, major and minor sources of public revenue.
29. Tax – Meaning - Classification – Direct and indirect taxes, methods of taxation - Proportional, progressive, regressive and digressive taxation, agricultural taxation - VAT and GST.
30. Canons of taxation – Adam Smith’s canons of taxation – Equality, economy, certainty and convenience – Other canons of taxation.
31. Public expenditure–Meaning, need for public expenditure-Principles of public expenditure – Budget – Meaning - Balanced budget and deficit budget - Fiscal policy - Meaning and its policy instruments.
32. National income accounting system – Meaning and importance, circular flow in the economy.
33. Concepts of national income accounting - Gross domestic product, gross national product, net national product, net domestic product- National income at factor cost, personal income, disposable income, per capita income.
34. Approaches to measurement of national income – Product method, income method, expenditure method and value added method, difficulties in measurement.
35. Trends in contribution of different sectors’ to GDP - Indian economy in the globalised world economy.
36. Importance of population in the economy - Malthusian theory, escaping from the Malthusian stagnation - Innovations, technological transition and economic growth.
37. Money - Meaning, evolution of money, functions of money, the money market - Types of demand and supply of money in the economy.
38. Credit - Meaning of credit, borrowing and lending, investments and their role in the modern economy - Credit controls and credit policy.
39. Role of banking in the modern economy, functions of central bank and commercial banks, monetary policy and its instruments.
40. Inflation – Meaning, definition, deflation - Meaning, causes of inflation - Demand pull and cost push inflation.
41. Types of inflation - Comprehensive and sporadic inflation – Suppressed and repressed inflation – Creeping, walking, running and galloping inflation – Mark up inflation.
42. General price index, wholesale price index, consumer price index - Rate of inflation Measurement.
43. Other causes of inflation – Remedial measures – Monetary and fiscal measures.
44. Economic system - Meaning, importance of study of economy in systems approach - Types of economic systems.
45. Capitalism- Meaning and its characteristic features, socialism and its characteristic features - Mixed economies and their characteristic features.
46. Economic planning - Meaning, importance of planning in management of resources and

institutions in the economy, elements of economic planning.

47 & 48. Brief history of planning system in India - Annual plans, five year plans meaning and objectives, role of planning commission of India and NITI Ayog.

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, NewYork.
- Reddy, S., Raghuram, P., Neelakantan, T.V., Bhavani D. I.2004.
- *Agricultural Economics*. Oxford and IBH Publishers, NewDelhi.
- Agricultural Economics By – S. Subba Reddy P. Raghu RamReddy
- Indian Economy , By-Misra E- Puri , Himalaya Publication published by oxford E-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 – Kushal Publication
- Principles of Economics By – M.L.Jhingan
- Jhingam, M.L.2001. *Micro Economic Theory*. Konark publishers, New Delhi.
- Ahuja H.L. 2015. Macro economics theory & policy. S.Chand & comp. Ltd.
- Ahuja H.L. 2015. Principles of microeconomics. S.Chand & comp. Ltd.

COURSE CODE: ABPP 201

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 post penetration.
- 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 plant diseases.
- 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 and classes.
- 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:

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

Lecture Schedule: Theory

S.N	Topic	No. of lectures
1	Introduction: Importance of plant diseases, scope and objectives of Plant Pathology	02
2	History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology	02
3	Pathogenesis. Causes/factors affecting disease development: disease triangle and tetrahedron	02
4	Classification of plant diseases,	01
5	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.	07
6	Fungi: general characters, definition, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual).	03
7	Nomenclature, Binomial system of nomenclature, rules of nomenclature.	01
8	Classification of fungi (key to Domain to Phylum).	04
9	Bacteria and mollicutes: general morphological characters	02
10	Reproduction and classification of plant pathogenic bacteria.	02
11	Viruses: nature, structure, replication and transmission.	02
12	Nematodes: General morphology, reproduction and classification	02
13	Symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina and Radopholus).	02

14	Growth and reproduction of plant pathogens	02
15	Liberation / dispersal and survival of plant pathogens.	02
16	Types of parasitism and variability in plant pathogens.	01
17	Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants.	04
18	Epidemiology: Factors affecting disease development.	01
19	Principles and methods of plant disease management	02
20	Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.	04
	Total	48

Lecture schedule: Practical

S.No	Topic	No. of lectures
1	Acquaintance with various laboratory equipments and microscopy.	01
2	Collection and preservation of disease specimen	01
3	Preparation of media, isolation and Koch's postulates.	02
4	General study of different structures of fungi.	01
5	Study of representative fungal genera	03
6	Staining and identification of plant pathogenic bacteria.	01
7	Study of phanerogamic plant parasites.	01
8	Study of morphological features and identification of plant parasitic nematodes	01
9	Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.	02
10	Study of fungicides and their formulations.	01
11	Methods of pesticide application and their safe use.	01
12	Calculation of fungicide sprays concentrations	01
	Total	16

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 KaurMann)
- 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

COURSE CODE: ABEN 201

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 upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemo receptor.

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, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Lecture Schedule

1. History of Entomology in India.
2. Major points related to dominance of Insecta in Animal kingdom.
3. Classification of phylum Arthropoda up to classes.
4. Structure and functions of insect cuticle and molting.
5. Morphology of grasshopper: Body segmentation- structure of head, Thorax and abdomen.
6. Structure and modifications of insect antennae.
7. Structure and modifications of insect mouthparts.
8. Structure and modifications of insect leg.
9. Wing venation, modifications and wing coupling apparatus.
10. Structure of genital organs and sensory organs (simple and compound eyes, chemoreceptor).

11. Metamorphosis in insects, types of larvae and pupae.
12. Structure and functions of digestive system.
13. Structure and functions of circulatory and excretory system.
14. Structure and functions of respiratory system.
15. Structure and functions of nervous system.
16. Structure and functions of secretory (endocrine) system
17. Structure and functions of reproductive system and types of reproduction in insects.
19. Orthoptera: Acrididae, Gryllidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae. Thysanoptera: Thripidae.
21. Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Bombycidae.
22. Coleoptera: Coccinellidae, Galerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonitidae.
23. Hymenoptera: Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae.
24. Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae; Neuroptera: Chrysopidae.

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 life cycle
- 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 understanding 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 text book 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., Ananthakrishnan, 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 asia crop pest and their Management A.S. Atwal and G. S. Dhaliwal
5. Applied Entomology D. S. Reddy

COURSE CODE: ABEX 202

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

DEPARTMENT: Agricultural Extension and Communication

COURSE OBJECTIVE:

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

Theory

- UNIT-1** Communication, meaning and process of communication, Listening and note taking skills, writing skills
- UNIT-2** Nature of communication, objectives, Functions, and importance of communication Oral presentation skills, field Diary and Lab record Preparation
- 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 of personality development, Reading and comprehension of articles, precise writing summarizing
- UNIT-5** Developing effective personality personal communication skills, group presentation, public speaking, group discussions, organizing seminars and conferences.

Lecture schedule

1. Communication – meaning, Definitions
2. Characteristics/nature of communication
3. Objectives of communication, Functions of communication
4. Importance of communication, Principles of communication
5. Advantages of communication

6. Qualities of an effective communication system. Seven “C”S of effective communication
7. Guide lines for effective communication
8. Verbal and Non verbal communication Advantages and Disadvantages
9. Personal communication skills
10. Personality, Elements of developing a magnetic personality
11. Personality development, Benefits of personality development
12. Important steps for developing an effective personality

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: 978-93-847524-1-5) 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 (PartridgeIndia)

Reference Books

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

COURSE CODE: ABEX 203

**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.

Lecture Schedule

1. a) Education - Meaning, definition and Types – Formal, non-formal and informal education.
(b) Extension Education – Meaning, definition, concepts - Characteristics, scope and process.
2. Objectives and principles of extension education.
3. Extension programme planning – Meaning, process, principles.
4. Extension programme planning – Steps in programme development.
5. Extension systems in India.
6. Extension efforts in pre-independence era – Sriniketan, Marthandam, Sevagram, Firka Development Scheme, Gurgaon Experiment etc.
7. Extension efforts in post-independence era - Etawah pilot project, Nilokheri experiment etc.
8. Extension/Agriculture development programme launched by ICAR/Govt. of India IADP, IAAP and HYVP.
9. Extension / Agriculture development programme launched by ICAR / Govt. of India – SFDA, MFAL and T & V System.
10. a) Extension / Agriculture development programme launched by ICAR / Govt. of India, KVK, ORP and ND.
b) IVLP.
11. a) Extension / Agriculture development programmes launched by ICAR / Govt. of India – NATP, ATMA, SREP, ATIC.
b) NAIP.
12. New trends in agriculture extension – Privatization extension and cyberextension / e-extension.
13. New trends in agriculture extension – Market led extension, farmer-led extension, expert systems etc.
14. Community development – Meaning, definition, concept and principles - Philology of C.D.
15. Rural development - Meaning, definitions, concept, characteristics, objectives, importance and problems in rural development.
16. Rural development launched by Govt. of India – National Extension Service (NES), Panchayat Raj Systems/ Democratic Decentralization and Panchayat Raj –Need.
17. Rural development launched by Govt. of India – Three tiers of Panchayat Raj system – Powers, functions and organization set up -Mandal system in Andhra Pradesh. Social justice and poverty alleviation programmes – ITDA, IWDP and NERP.

18. Social justice and poverty alleviation programmes – IRDP, JRY, SGRY, SGSY and MGNREGP.
19. Social justice and poverty alleviation programmes – IRDP, JRY, SGRY, SGSY and MGNREGP.
20. Women development programmes – ICDS, DWCRA, RMK, MSY, ANTWA and IKP.
21. Participatory Rural Appraisal (PRA)
22. Rural leadership - Meaning, definition and concept, types of leaders in rural context, roles of leaders and different methods in selection of a leader.
23. Training of leaders – Lay and professional leaders, advantages and limitations in using local leaders in Agricultural Extension.
24. Extension administration - Meaning, definition and concept, principles and functions - Monitoring and evaluation – Meaning, definition and concept, objectives - Types and importance and monitoring and evaluation of extension programmes.
25. Transfer of technology - Concept and models and capacity building of extension personnel farmers – Training – Meaning, definition, types of training – Pre-Service training - In-service, orientation, induction training, refresher training and training for professional qualification.
26. Training of farmers, farm women and rural youth – Farmers’ Training Centre (FTC) - Objectives – Training organized - District Agricultural Advisory and Transfer of Technology Centre (DAATTC) –Objectives.
27. Extension teaching methods - Meaning, classification, individual, group and mass contact methods, media mix strategies and communication - Meaning and definition
28. Functions of communication, models – Aristotle, Shannon, Weaver, Berlo, Schramm, J.P. Leagans, Rogers and Shoemaker, Litterer, Westley – Macleans and barriers to communication.
29. Agriculture journalism – Meaning – Scope – Importance - Characteristics of News – Factors determining the News value – Types of News and sources of News.
30. Diffusion and adoption of innovation - Meaning, definition, concepts and process and stages and Models of adoption process – Five (5) and Seven (7) stage models - Attributes of innovation – Relative advantage, compatibility, complexity, trialability – observability and predictability.
31. Innovation – Decision process – Meaning – Stages (Knowledge, persuasion, decision, implementation and confirmation) - Decision process – Meaning – Stages (Knowledge, persuasion, decision, implementation and confirmation) - Concepts - Dissonance – Rejection – Active rejection and passive rejection -Discontinuance – Replacement and disenchantment discontinuance – Over adoption – Rate of adoption and innovativeness.
32. Adopter categories and their characteristics - Factors influencing adoption process Social, personal and situational.

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)

COURSE CODE: ABAG302

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

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of kharif crops.

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

UNIT– II Pulses- pigeonpea, 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.

Lecture Schedule

1. Cereals – Importance and special features of cereals - Rice- Origin - geographical distribution nutritional value – area, production and productivity in India and Madhya Pradesh
2. Economic importance - soil and climatic requirements
3. Classification of rice plant types - growth Stages of rice -different types of rice ecosystems
4. Land Preparation –physico – chemical and biological changes under submerged soils
5. Crop establishment techniques in rice - Climate resilient technologies
Nutrient management with special emphasis on nitrogen dynamics, micro nutrients-INM
6. Water management in rice under different rice ecosystems
7. Weed management including weed management in rice nurseries –IWM

8. Harvesting -Yield attributes - yield - post harvest operations - milling office
9. Value added products of rice – export potential - rice grain classification, cropping systems in rice
10. Maize- Origin- geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh- soil and climatic requirements - growth stages - Classification of maize
11. Land Preparation – zero tillage - seeds and sowing - nutrient management - water management - weed management - climate resilient technologies
12. Harvesting - yield attributes – yield - post harvest operations - value addition – cropping systems
13. Jowar- Origin - geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements - zones of jowar cultivation - growth Stages - Land Preparation - seeds and sowing
14. Nutrient management - water management - weed management – harvesting- yield attributes – yield - post harvest operations - value addition- sorghum effect, mid season corrections – cropping systems
15. Millets- Economic importance - constraints and strategies for increasing the production of millets - climate resilient technologies
16. Pearl millet – Origin - geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh- soil and climatic requirements -growth Stages - land preparation - seeds and sowing - Nutrient management - water management - weed management – harvesting- yield attributes– yield - post harvest operations - value addition – cropping systems
17. Finger millet- Origin - geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh- soil and climatic requirements, growth Stages - land preparation, seeds and sowing - nutrient management - water management - weed management – harvesting - yield attributes – yield - post harvest operations - value addition – cropping systems
18. Pulses- Economic importance - constraints for achieving higher productivity of pulses, strategies for improving the pulse production in India - climate resilient technologies
19. Pigeonpea- Origin - geographical distribution - economic importance- area, production and productivity in India and Andhra Pradesh-soil and climatic requirements- growth Stages-land Preparation - seeds and sowing – varieties - nutrient management - water management - weed management – harvesting- yield attributes – yield - post harvest operations - cropping systems
20. Greengram / Mungbean – Origin - geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements growth stages - land Preparation- seeds and sowing – varieties- nutrient management -water management- weed management- harvesting- yield attributes – yield - post harvest operations – cropping systems
21. Blackgram / urdbean – Origin- geographical distribution,- economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements - growth stages - land Preparation - seeds and sowing – varieties- nutrient management - water management- weed management - harvesting- yield attributes – yield - post harvest operations – cropping systems
22. Oilseeds- Economic importance - constraints for achieving higher productivity of pulses, strategies for improving the pulse production in India - climate resilient technologies
23. Groundnut- Origin - geographical distribution - economic importance- area, production and productivity in India and Andhra Pradesh- soil and climatic requirements-growth Stages-land Preparation - seeds and sowing – varieties - nutrient management - water management - weed management – harvesting- yield attributes – yield - post harvest operations - cropping systems
24. Soybean – Origin - geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements growth stages - land Preparation- seeds and sowing – varieties- nutrient management -water management- weed

- management- harvesting- yield attributes – yield - post harvest operations – cropping systems
25. Fibre crops- Economic importance - constraints for achieving higher productivity of pulses, strategies for improving the pulse production in India - climate resilient technologies
 26. Cotton- Origin - geographical distribution - economic importance- area, production and productivity in India and Andhra Pradesh- soil and climatic requirements-growth Stages-land Preparation - seeds and sowing – varieties - nutrient management - water management - weed management – harvesting- yield attributes – yield - post harvest operations - cropping systems
 27. Jute – Origin - geographical distribution - economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements growth stages - land Preparation- seeds and sowing – varieties- nutrient management -water management- weed management- harvesting- yield attributes – yield - post harvest operations – cropping systems
 28. Forage crops- Economic importance - constraints for achieving higher productivity of pulses, strategies for improving the pulse production in India - climate resilient technologies
 29. Forage Sorghum- Origin - geographical distribution - economic importance- area, production and productivity in India and Andhra Pradesh- soil and climatic requirements- growth Stages- land Preparation - seeds and sowing – varieties - nutrient management - water management - weed management – harvesting- yield attributes – yield - post harvest operations - cropping systems
 30. Cowpea- Origin - geographical distribution- economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements - growth Stages - land preparation- seeds and sowing- varieties - nutrient management- water management- weed management- harvesting- yield attributes– yield - post harvest operations – cropping systems.
 31. Clusterbean- Origin - geographical distribution- economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements - growth Stages - land preparation- seeds and sowing- varieties - nutrient management- water management- weed management- harvesting- yield attributes– yield - post harvest operations – cropping systems.
 32. Napier Grass- Origin - geographical distribution- economic importance - area, production and productivity in India and Andhra Pradesh - soil and climatic requirements - growth Stages - land preparation- seeds and sowing- varieties - nutrient management- water management- weed management- harvesting- yield attributes– yield - post harvest operations – cropping systems.

Practical

1. Rice nursery preparation, transplanting of Rice.
2. Sowing of soybean, pigeonpea, 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 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.
- Kharif Crop Production RL Arya & Keshv Arya

COURSE CODE: ABGP 302

FUNDAMENTALS OF PLANT BREEDING CREDITS 3(2+1)

DEPARTMENT: GENETICS AND PLANT BREEDING

COURSE OBJECTIVE:

- To study the different principles of plant breeding.
- To gain knowledge about different breeding methods.

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, cultivar options.

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 and hybridization.

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.

Lecture Schedule

- 1 Historical developments, concept, nature and role of plant breeding, major achievements and future prospects - Definition, aim, objectives, history and developments of plantbreeding,

scientific contributions of eminent scientists - Landmarks in plant breeding - Scope of plant breeding.

- 2 Modes of reproduction and apomixis - Asexual reproduction (vegetative reproduction and apomixis) and sexual reproduction - Their classification and significance in plant breeding.
- 3 Modes of pollination - Classification of crop species on the basis of mode of pollination– self pollination – mechanisms promoting self pollination – Genetic consequences of self pollination – Cross pollination – Mechanisms promoting cross pollination – Genetic consequences of cross pollination – Often cross pollinated crops.
- 4 Self- incompatibility - Classification – Heteromorphic, homomorphic, gametophytic and sporophytic systems of incompatibility – Advantages and disadvantages – Utilization in crop improvement.
- 5 Male sterility- Genetic consequences, cultivar options - Different types – Genetic, cytoplasmic and cytoplasmic genetic male sterility – Inheritance and maintenance– utilization of male sterile lines in hybrid seed production – Their advantages and disadvantages.
- 6 Domestication, acclimatization and introduction - Plant introduction – Primary introduction and secondary introduction – Plant introduction agencies in India – National Bureau of Plant Genetic Resources (NBPGR) and its activities – Procedure of plant introduction – Merits and demerits of plant introduction.
- 7 Centre of origin/diversity - Centres of diversity– Centres of origin – Classification – law of homologous series – Types of centres of diversity – Germplasm collections – Genetic erosion – Main reasons of genetic erosion – Extinction - Gene sanctuaries - Introgression – Gene banks – Types of gene banks.
- 8 Breeding methods in self pollinated crops - Modes of selection - Selection – Natural and artificial selection – Basic principles of selection – Basic characteristics and requirements of selection – Selection intensity – Selection differential, heritability (narrow and broad sense) – Genetic advance as percent of mean.
- 9 Mass selection – Procedure for evolving a variety by mass selection – Modification of mass selection – Merits, demerits and achievements.
- 10 Pure line selection - Johannsen's pure line theory and its concepts and significance
– Origin of variation in pure lines – Characters of pure lines – Progeny test, genetic basis of pure line selection – General procedure for evolving a variety by pure line selection – Merits, demerits and achievements – Comparison between mass and pure line selection.
- 11 Hybridization techniques - Hybridization – Aims and objectives – Types of hybridization – Pre-requisites for hybridization – Procedure / steps involved in hybridization.
- 12 Handling of segregating population - Pedigree method – Procedure – Merits, demerits and achievements.
- 13 Bulk method – Procedure – Merits, demerits and achievements – Comparison between pedigree and bulk methods - Single seed descent method – Merits and demerits.
- 14 Backcross method of breeding–Its requirements and applications – Procedure for transfer of single dominant gene - Procedure for transfer of single recessive gene – Merits, demerits and achievements - comparison between pedigree and backcross method.
- 15 Multiline concept - Definition – Characteristics of a good multiline – Development of multiline varieties –Achievements.
– Concepts of population genetics and Hardy - Weinberg Law - Hardy Weinberg Law Factors affecting equilibrium frequencies in random mating populations - Selection without progeny testing–Selection with progeny testing- Merits and demerits of progeny selection– Line

- breeding– achievements.
- 16 Recurrent selection – Different types – Detailed procedure of simple recurrent selection and other recurrent selection methods – Conclusion on the efficiency of different selectionschemes.
 - 17 Heterosis - Heterosis and hybrid vigour – Luxuriance – Heterobeltiosis – Brief history– heterosis in cross pollinated and self pollinated species – Manifestations ofheterosis-
 - Genetic basis of heterosis – Dominance, over dominance and epistasis hypotheses Objections and their explanations – Comparison between dominance and over- dominance hypotheses – Physiological basis of heterosis – Commercial utilization.
 - 18 Inbreeding depression - Brief history – Effects of inbreeding – Eegrees of inbreeding depression – Procedure for development of inbred lines and their evaluation.
 - Development of inbred lines and hybrids - Exploitation of heterosis – History of hybrid varieties – Important steps in production of single and double cross hybrids Brief idea of hybrids in maize, pearl millet, sunflower and rice.
 - 19 Composite and synthetic varieties - Production procedures – Merits, demerits and achievements – Factors determining the performance of synthetic varieties – Comparison between synthetics and composites.
 - 20 Breeding methods in asexually propagated crops, clonal selection and hybridization- Characteristics of asexually propagated crops – Characteristics of clones –Clonal selection – Procedure – Advantages and disadvantages – Problems in breeding asexually propagated crops – Genetic variation within a clone – Clonal degeneration
 - Achievements – Comparison among clones, purelines and inbreds - Breeding of annual asexually propagated species through hybridization – Interspecific hybridization.
 - Wide hybridization and pre breeding - History – Objectives – Barriers for the production of distant hybrids– Techniques for production of distant hybrids – applications of wide hybridization in crop improvement – Sterility in distant hybrids Limitations and achievements - use of gene pools to develop intermediate breeding material.
 - 21 Polyploidy in relation to plant breeding - Polyploidy –Autopolyploids – Origin and production – Morphological and cytological features– Applications in crop improvement – Limitations– Allopolyploidy – Morphological and cytological features– Applications in crop improvement – Limitations.
 - 22 Mutation breeding - Methods and uses - Mutation breeding – Procedure of mutation breeding – Applications – Advantages, limitations and achievements.
 - 23 Breeding for important biotic and abiotic stresses - Disease resistance – Mechanisms of disease resistance in plants (disease escape, tolerance, resistance, immunity and hypersensitivity) – Genetic basisof disease resistance – Gene for gene hypothesis –sourcesof disease resistance– Breedingmethods fordisease resistance –Achievements.
 - 24 Insect resistance – Mechanism of insect resistance in plants (non preference, antibiosis, tolerance and avoidance) – Nature of insect resistance – Genetics of insect resistance – Horizontal and vertical resistance– Sources of insect resistance – breeding methods for insect resistance – Problems in breeding for insect resistance
 - Achievements.
 - 25 Drought resistance – Mechanisms of drought resistance (drought escape, avoidance, tolerance, and resistance) – Features associated with drought resistance – Sources of drought resistance – Breeding methods for drought resistance – Limitations – achievements - Resistance to water logging – Effects of water logging - Mechanism of tolerance – Ideotype for flooded areas.
 - 26 Salt tolerance – Response of plants to salinity – Symptoms – Mechanisms of salt tolerance –

Breeding methods for salt tolerance – Problems – Achievements. Cold tolerance – Chilling resistance – Effects of chilling stress on plants – Mechanism of chilling tolerance – Sources of chilling tolerance – Selection criteria.

- 27 Biotechnological tools - DNA markers and marker assisted selection - Definition and classification of DNA markers and applications.
- 28 Participatory plant breeding - Definition – Goals – Methodology – Advantages and limitations.

Practical

1. Plant Breeder's kit, Study of germplasm of various crops.
2. Study of floral structure of self-pollinated and cross pollinated crops.
3. Emasculation and hybridization techniques in self & cross pollinated crops.
4. Consequences of inbreeding on genetic structure of resulting populations.
5. Study of male sterility system.
6. Handling of segregation populations.
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
- Essentail of Plant Breeding – PhundanSingh
- Padap Prajanan (Hindi) – Dr. Chandra PrakashShukla
- Phasal Prajanan Ke Mool Siddhant (Hindi) – Dr. HariRam

Reference Books

- Alard, R.W. 2000.Principles ofPlant Breeding. John Willey & Sons, NewYork.
- 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. PlantBreeding- 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 farmloan.
- To identify the credit needs and classification.
- To give and 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.

UNITI - 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.

Lecture Schedule

1. Agricultural Finance - Meaning, definition, nature and scope - Significance - Micro and macrofinance – Capital and credit problems, need and their importance in Agriculture.
2. Credit - Meaning and definition - Classification of credit based on different criteria with Examples.
3. Credit analysis - Economic feasibility tests - 3 R's of credit analysis - Returns to investment - Repayment capacity - Meaning, causes of poor repayment capacity of farmers, suggestions to improve repayment capacity - Risk bearing ability - Meaning, sources of risk, means to strengthen RBA.
4. Five Cs of credit – Character – Capacity – Capital - Condition and Commonsense - Seven Ps of credit - Principle of Productive purpose - Principle of personality - Principle of productivity - Principle of phased disbursement - Principle of proper utilization - Principle of payment and Principle of protection.
5. Social control and nationalisation - Meaning, objectives and their importance - Privatisation of commercial banks - Need and importance for institutional sources and structure of agricultural lending from different sources.
6. Lead bank scheme - Origin, objectives, functions - District credit plan - Regional Rural Banks (RRBs) - Origin, objectives, functions — RRBs in Andhra Pradesh.
7. Crop loan system - Objectives, importance, features of crop loan system - Scale of finance - Meaning and estimation and role of district level consultative committee - Term loans – Objectives and meaning of unit costs, fixation of unit costs and NABARD guidelines.
8. Financial inclusion - Meaning and importance - Micro finance - Meaning, importance, agencies providing microcredit banks, NBFCs, NGOs, and Govt. agencies - SHGs and their role in microfinance and bank linkages - Micro finance lending and control act in Andhra Pradesh – Objectives and important features.
9. Schemes for financing weaker sections - Differential interest rate (DIR) - Integrated rural development programme (IRDP) – Swarnajayanti gram swarozgar yojana (SGSY)
10. Self help groups (SHGs) etc., Srinidhi, MUDR.
11. Higher financing agencies - Reserve Bank of India (RBI) - Objectives and functions and role in agricultural development and finance. National Bank for Agricultural and Rural Development (NABARD) - Origin, functions, activities and role in agricultural development.
12. World Bank (WB) - Objectives and functions - World Bank group institutions – role and functions of International Bank for Reconstruction and Development (IBRD)

13. International Development Agency (IDA)- International Finance Corporation (IFC), MIGA, ISID.
14. Crop insurance - Meaning and its advantages and limitations in application - Agricultural insurance company of India - Objectives and functions - Indemnity - Meaning, premiums and claims - Prime Minister's Fasal Bhima Yojana (PMFBY) - Salient features - Weather based crop insurance - Salient features and its importance.
15. Agricultural project - Meaning, characteristics of agril. projects, project cycle and explanation of different phases of project cycle - Basic guidelines for preparation of project reports.
16. Co-operation - Meaning, Scope, importance and definition - Principles - Objectives of co-operation, significance of cooperatives in Indian agriculture.
17. Brief history of cooperative movement development in India - Recent developments in Indian cooperative movement - Shortcomings of Indian co-operative movement and remedies.
18. Agricultural Cooperative institutions in India - co-operative credit structure in India and Andhra Pradesh – Objectives and functions of state level (APCOB), district level (DCCB) and Village level (PACS) cooperative societies - Functions of marketing, consumer societies, multi-purpose cooperatives, farmers'service cooperative societies, dairy cooperatives- Andhra Pradesh mutually aided Co-operative Societies Act (1995) - Role of International Cooperative Alliance (ICA), National cooperative Union of India (NCUI), National Cooperative Development Council (NCDC).

Practical

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 agril. 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.
- Singh Joginder, P.R. *Agricultural Finance and Management*. Kalyani Publication.
- Reddy, S., and Ram, P.R. *Agricultural Finance and Management*. Oxford and IBH, New Delhi

Reference Books

K Nirmal Ravi Kumar, *Objective Agricultural Economics*. Astral Publicaiton.

COURSE CODE: ABIT 301

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.

Lecture Schedule

1. Introduction to computers- Advantages- Disadvantages- Applications - Anatomy of Computers- Input / output devices -Memory Concepts - Units of Memory - RAM – ROM – PROM – EPROM- EAPROM-CacheMemory.
2. Operating system - Definition and types - WINDOWS OS – Features – Desktop – Iconsetc.
3. Applications of MS-Office - MS-Word - Creating - Editing and formatting a document.
4. MS Word - Features of good word processor - Mail merge – Drop cap- Auto text- Track changes – Equation editoretc.
5. MS- Excel - Data presentation, Tabulation – Merging of cells and graph creation - Mathematicalexpressions.
6. MS- Excel - Data analysis tool pack – Pivot table and graph etc.
7. MS Access – Database - concepts and types - creating database - Uses of DBMS in agriculture.
8. MS Access - Objects of data base – Types of fields etc.,
9. Internet and World Wide Web (WWW)–Concepts-Components and creation of web.
10. HTML – XML coding.
11. e-Agriculture - Concepts - Design and development - Application of innovative ways to use information and communication technologies (IT) in Agriculture.
12. ICT for Data Collection - Formation of development programmes - Monitoring and evaluation of Programmes - 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.
13. 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.,
14. Geospatial technology – Concepts – Techniques - Components and uses for generating valuableagri-information.
15. Decision support systems – Taxonomy – Components – Framework - Classification and applications in Agriculture - DSS - Agriculture Information/Expert System - Soil Information Systems etc for supporting Farm decisions.
16. 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/Crop Syst/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 Wrisskp of (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)Teachyourself MS Office visually. IDG Books Worldwide Inc., New York.
- Fundamental of Computer- P. K.Sinha

- M.S. Office – Nitin kNagle
- Computer Fundamental - Nitin kNagle
- Management of Information Systems - Gordon B.Davis
- Microcontrollers, Principles and Applications – Ajit pal – PHI Ltd., -2011.
- Willem Zip. Improving the Transfer and Use of Agricultural Information - A Guide to Information Technology. The World Bank, Washington
- Meera SN. ICTs in Agricultural Extension: Tactical to Practical
- R Saravanan, C Kathiresan & T Indra Devi, 2011. Information & communication technology for agriculture and rural development. New India Publ.Agency.

Referece Books

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

COURSE CODE: ABAE 302

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.
- Sowing 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.

Lecture Schedule

1. Farm power – Source of different farm power, advantages and disadvantages.
2. Internal combustion engine - Different components and their functions - Working principle of four stroke and two stroke cycle engine - Comparison between diesel and petrol engine - Difference between four and two stroke engine.
3. Terminology related to engine power - IHP, BHP, FHP, DBHP, compression ratio, stroke

bore ratio, piston displacement, and mechanical efficiency - Numerical problems on calculation of IHP, BHP, C.R., stroke bore ratio, piston displacement volume.

4. Fuel supply and cooling system of I.C. engine – Types, components and their functions, working principle of forced circulation cooling system.
5. Ignition and power transmission system of I.C engine – Types, components and their functions, working principle of battery ignition system.
6. Lubrication system of I.C. engine – Types, purpose, components and their functions, working principle of forced feed system - Tractors classification, types, points to be considered in selection of tractors, estimating the cost of operation of tractor power.
7. Tillage - Primary and secondary tillage - M.B. plough – Functions, constructional features, operational adjustments and maintenance.
8. Disc plough – Functions, constructional details, operational adjustments and maintenance.
9. Numerical problems on M.B. plough and disc plough.
10. Harrows – Types, functions, operation of disc harrows - Cultivators – Rigid and spring loaded tynes - Puddlers, cage wheel, rotovators - Intercultural implements – Hoes and weeders for dry and wetland cultivation.
11. Sowing equipment - Seed cum fertilizer drills – Types, functions, types of metering mechanisms, functional components, calibration- Paddy transplanters.
12. Harvesting equipment – Sickles, self propelled reaper, alignment and registration - Combines, functions of combines.
13. Plant protection equipment – Types of sprayers, constructional features of knapsack sprayer, hand compression sprayer, foot sprayer, rocker sprayer and power sprayer, care and maintenance of sprayers.
14. Dusters – Hand rotary and power operated dusters, care and maintenance of dusters.
15. Tractor mounted equipments for land development and soil conservation – Functions of bund former, ridger, and leveling blade.
16. Threshing equipment and principles of combine harvester.

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 in 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 edition2001.
- Sahay, Jagdiswar. *Elements of Agricultural Engineering*. Agro book Agencies1977 Singhal, O.P. *Agricultural Engineering*, 1977

Reference Books

- Principles of Farm Machinery” byKepner
- Agricultural Mechanics: Fundamentals and Applications” by Ray VHerren

COURSE CODE: ABHO 302

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

Lecture Schedule

1. Importance of vegetables and spices in human nutrition and national economy – Classification of vegetables - 1) Botanical 2) Based on Hardiness 3) Parts Used 4) Method of culture 5)Season.
2. Tomato- Botanical Name – Family – Origin – Area – Production- Improved varieties and cultivation practices such as time of sowing - Sowing - Transplanting techniques - Planting distance - Fertilizer requirements - Irrigation - Weed management – Harvesting Yield - Storage - Physiological disorders - Disease and pest control and seed production.
3. Brinjal and Chilli - Botanical name – Family - Origin - Area - Production - Improved varieties and cultivation practices such as time of sowing - Sowing - Transplanting techniques - Planting distance - Fertilizer requirements - Irrigation - Weed management Harvesting - Yield - Storage - Disease and pest control and seed production.
4. Okra and Leafy vegetables (Amaranthus and Gogu) - Botanical name – Family - Originarea-

- Production - Improved varieties and cultivation practices such as time of sowing Sowing - Planting distance - Fertilizer requirements – Irrigation Weed management - Harvesting - Yield - Storage - Disease and pest control and seed production.
5. Cucurbits – Flowering, sex expression, sex ratio - Cucumber, Ridge gourd, Bitter gourd, Bottle gourd- Botanical name – Family - Origin - Area - Production - improved varieties and cultivation practices such as time of sowing - Sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management - Harvesting - Yield - Storage - Physiological disorders - Disease and pest control and seed production.
 6. Melons – Watermelon and Muskmelon - Botanical name – Family - Origin - Area - Production - Improved varieties and cultivation practices such as time of sowing sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management - Harvesting - Yield – Production of seedless watermelons – Storage Physiological disorders - Disease and pest control and seed production.
 7. Cole crops- Cabbage and Cauliflower -Botanical name – Family - Origin - Area - production Improved varieties and cultivation practices such as time of sowing sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management - Harvesting - Yield – Storage - Physiological disorders - Disease and pest control and seed production.
 8. Peas and beans (Cluster bean, French bean, Dolichos) - Botanical name – Family - Origin - Area - Production - Improved varieties and cultivation practices such as time of Sowing - sowing - Planting distance - Fertilizer requirements – Irrigation Weed management - Harvesting - Yield –Storage - Physiological disorders - Disease and pest control and seed production.
 9. Root crops (Carrot and Radish) - Botanical name – Family - Origin - Area - Production Improved varieties and cultivation practices such as time of sowing - Sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management – Harvesting Yield - Storage - Physiological disorders (splitting, forking and cavity spot) - Disease and pest control and seed production.
 10. Tapioca and Sweet potato - Botanical name – Family - Origin - Area – Production Improved varieties and cultivation practices such as time of sowing - Sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management – Harvesting Yield - Storage - Physiological disorders - Disease and pest control and seed production.
 11. Perennial vegetables – Drumstick and Curry Leaf- Botanical name – Family – Origin Area - Production - Improved varieties and cultivation practices such as time of sowing - Sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management - Harvesting - Yield - Storage - Physiological disorders - Disease and pest control and seed production.
 12. Bulb crops – Onion and Garlic - Botanical name – Family - Origin - Area - Production Improved varieties and cultivation practices such as time of sowing - Sowing - Planting distance - Fertilizer requirements - Irrigation - Weed management - Harvesting-Yield - Storage - Physiological disorders - Disease and pest control and seed production.
 13. Black pepper - Botanical name – Family - Origin - Introduction - Varieties - Climate- Soil – Systemsofcultivation-Ppropagation-Planting-Shade regulation Training and pruning

Fertilizer requirements - Irrigation – Intercultural operations - Harvesting – Processing - Yield - Pests and diseases.

14. Cardamom - Botanical name – Family - Origin - Introduction - Varieties - Climate- soil Systems of cultivation - Propagation - Planting - Shade regulation – Fertilizer requirement - Irrigation - Intercultural operations - Harvesting – Processing - Yield - Pests and diseases.
15. Ginger and Turmeric – Botanical name – Family - Origin - Introduction - Varieties Climate- Soil – Systems of cultivation - Propagation - Planting - Mulching – Fertilizer requirement - Irrigation - Intercropping - intercultural operations - Harvesting – Processing - yield - Pests and diseases – Preservation of seed rhizomes.
16. Cinnamon - Coriander and Fenugreek- Botanical name – Family - Origin - Area - Production - Improved varieties and cultivation practices such as time of sowing, sowing - Transplanting techniques - Fertilizer requirements - Irrigation - Intercultural operations - Harvesting - Pests and Diseases.

- Practical**
- Identification of vegetables & spices crops and their seeds.
 - Nursery raising.
 - Direct seed sowing and transplanting.
 - Study of morphological characters of different vegetables & spices.
 - Fertilizers applications.
 - Raising of nursery of vegetables & spices.
 - Vegetables & spices seed extraction.
 - Harvesting & preparation for market.
 - Economics of vegetables and spices cultivation.

COURSEOUTCOME:

- To give knowledge about the production technology of spices, medicinal and aromatic plants.
- To give knowledge about the site selection of nursery and their management

Suggested Readings Books:-

Text Books

- Choudhury, B.1983. Vegetables. National Book Trust, New Delhi.
- Das, P. C.1993. Vegetable crops in India. Kalyani Publishers

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

Reference Books

- Vegetable Growing S.C. Dey
- A₂Z Solution Vegetable, Spices and Condiments Dr. A.S.Salariya
- Vegetable Science Neeraj Pratap Singh
- Hazra, P. and Som, M. G. 1999. Technology for vegetable Production and Improvement. Naya Prokash, Calcutta
- Bose, T. K. and Som, M. G. 1990. Vegetable crops in India. Naya Prokash, Calcutta.
- Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Delhi.

COURSE CODE: ABES 301

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 Tim berextraction, 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.

Lecture Schedule

- 1 Environmental studies - Definition – Scope and importance, need for public awareness, people and institutions in environment.
- 2 Natural resources – Renewable and non renewable resources – Forest resources–Functions of forests – Causes and consequences of deforestation.
- 3 Water resources – Sources, uses and over utilization of surface and groundwater - Dams – Benefits and problems – Sustainable management of water.
- 4 Food resources – Food sources, world food problems and food security.
- 5 Energy resources – Renewable and non-renewable energy sources and their impact on environment.
- 6 Land resources – Land degradation, desertification and land use planning – Role of an individual in conservation of natural resources.
- 7 Biodiversity – Definition – Types of biodiversity – Bio-geographical classification in India – Methods of measuring biodiversity – Biodiversity Act – Functions of National Biodiversity Board.
- 8 Threats to biodiversity–Habitat loss–Poaching of wildlife–Man-wild life conflicts – Conservation of biodiversity – In situ and ex situ.
- 9 Environmental pollution – Causes, effects and control measures of air and water pollution – Tolerable limits for toxic gases in air.
- 10 Causes, effects and control measures of soil pollution – Bioremediation – Tolerable limits for heavy metals in soil.
- 11 Causes, effects and control measures of thermal, marine and noise pollution, nuclear hazards.
- 12 Solid waste management – Need of waste management – Types of solid waste – Management processing technologies.
- 13 & 14 Disaster management - Natural Disasters – Meaning and nature of natural disasters, types and effects - Floods, 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, road accidents, rail accidents, air accidents, sea accidents. – International strategy for disaster reduction - Concept of disaster management - National disaster management framework - Financial arrangements - Role of NGOs, community based organizations and media, Central, state, district and local administration, Armed forces, police and other organizations in disaster response.
15. Social issues and the environment – Unsustainable to sustainable development – The Environment Protection Act – The air (prevention and control of pollution) act
The water (prevention and control of pollution) act – The wild life protection act
Forest conservation act.
16. Woman and child welfare – Human immuno-deficiency virus (HIV)/ Acquired Immunodeficiency Syndrome (AIDS) – Role of information technology on environment and human health.

Practical

- Pollution case studies. Case Studies- 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 Physical. 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.
- Banjerji, 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

COURSE CODE: ABST 301

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 2002 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.

Lecture Schedule

1. Introduction and various definitions of Statistics - Singular and plural reference of Statistics - A comprehensive definition of Statistics - Importance of Statistics in agriculture - limitations of statistics.
2. Frequency Distribution- Exclusive and inclusive methods - Discrete and continuous variables - Graphical representation of data
3. Central tendency-Definition - Measures of Central tendency - List of all the different measures and study of Arithmetic Mean – Median - Mode in detail (including merits and demerits) for ungrouped and grouped data.

4. Measures of Dispersion – Meaning of measures of Dispersion - Standard Deviation for ungrouped and grouped data- Coefficient of Variation (C.V) - Standard Error (S.E.) and difference between S.D. and S.E.
5. Definition of Probability – Addition - Multiplication theorems - Binomial and Poisson distributions
6. Normal Curve and its properties - Identification of normality through data i.e., criterion. etc., expression for frequency function of Normal distribution
7. Testing of Hypothesis – Concept - Null hypothesis - Type I and Type II Errors - Level of Significance - Critical region - General setup of testing - Large Sample Test with known and unknown
8. Small Sample test (t-test for one and two samples and Paired t- test) and F-test
9. Chi-Square test for 2x 2 and m x n contingency Table - Yate's correction for Continuity
10. Correlation – Scatter diagram - Positive and negative correlation and its testing
11. Regression – Fitting of linear regression equation of Y on X and X on Y and the inter relationship with “r” and testing of regression coefficients
12. Analysis of Variance (ANOVA) - Definition and assumptions - ANOVA with One-way classification (CRD) layout and analysis with equal and unequal repetitions, Advantages and disadvantages
13. ANOVA with Two way Classification (RBD) - Layout and analysis, Advantages and disadvantages
14. ANOVA with three way classification (LSD) – Layout and Analysis - Advantages and disadvantages.
15. Introduction to Sampling - Sampling Vs Census - Purposive and Random Sampling
16. Simple Random Sampling - Method of selection - Estimates of population mean and total and the estimates of their variances and confidence limits.

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

Reference Books

- Basic Statistics – Rand R.Wilcok
- Elements of Agricultural Statistics – Ramesh Chandra Bharti Anil Kumar Bharti

COURSE CODE: ABAH 301

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.

Lecture Schedule

- 1 Population dynamics of live-stock and role in Indian economy.
- 2 Reproduction in live-stock and poultry.
- 3 Housing systems live-stock and poultry.
- 4 Design and construction of live-stock and poultry buildings.
- 5 Selection of site and General principles affecting the design.

- 6 Building materials
- 7 Indian breeds of cattle, buffalo, sheep, goat, swine and poultry
- 8 Exotic breeds of cattle, buffalo, sheep, goat, swine and poultry
- 9 Management of calves, growing heifers and milch animals
- 10 Management of sheep, goat and swine
- 11 Incubation, hatching and brooding
- 12 Digestion and metabolism live-stock and poultry.
- 13 Classification of feedstuffs for live-stock and poultry. Nutrients and their functions.
- 14 Feed ingredients for ration- Balanced ration.
- 15 General principles of computation of ration.
- 16 Formulation of rations and feeding dairy cattle and buffaloes.
- 17 Feed supplements Feed additives in the rations of live-stock and poultry.
- 18 Feeding of live-stock and poultry.
- 19 Diseases of cattle and buffaloes.
- 20 Diseases of Poultry.
- 21 Sanitation – Sanitation of live-stock and poultry houses.
- 22 Prevention of infectious diseases in live-stock and poultry.
- 23 Vaccination schedule for cattle and buffaloes sheep, goat.
- 24 Vaccination schedule for poultry.
- 25 Control of infectious diseases in live-stock and poultry.

Practical

- Formulation of concentrate mixtures.
- Clean milk production, milking methods.
- Hatchery operations, incubation and hatching equipments.
- Management of chicks, growers and layers, debeaking, and vaccination.
- External body parts of cattle, buffalo, sheep, goat, swine and poultry.
- Handling and restraining of livestock.
- Identification methods of farm animals and poultry.
- Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records.
- Judging of cattle, buffalo and poultry.
- Culling of livestock and poultry.
- 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
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- vk/kqfud i'kq mRiknu ,oa izca/ku & MkW- jkek/kkj flag &vkbZ-lh-, -vkj-
- i'kqiky & txnh'k izlkn &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 (Rabicrops)	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)

COURSE CODE: ABAG 403

**CROP PRODUCTION TECHNOLOGY-II (RABI CROPS)
CREDITS 2(1+1)**

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- Better knowledge for the cultivation of growing rabi season crops.
- To identify the different weed species in rabi season crops.
- To study the basis elements of crop production and their role in agricultural economy.
- To study the requirement of new technology for commercial based cultivation.

Theory

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

UNIT-1 Cereals-wheat and barley

UNIT- II Pulses-chickpea, lentil, peas

UNIT- III Oilseeds-rape seed, Mustard and sunflower;

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

UNIT-V Forage crops-berseem, Lucerne and oat.

Lecture Schedule

1. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of wheat crop.
2. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of barley crop.
3. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of chickpea crop.
4. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of lentil crop.

5. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of pea crop.
6. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of rapeseed crop.
7. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of Mustard crop.
8. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of sunflower crop.
9. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of sugarcane crop.
10. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of menthe crop.
11. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of lemon grass crop.
12. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of citronella crop.
13. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of berseem crop.
14. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of Lucerne crop.
15. Origin, geographical distribution, Economic importance, Soil and climatic requirements, Varieties, cultural practices and yield of oat crop.

Practical

- Sowing methods of wheat and sugarcane.
- Identification of weeds in *rabi* season crops.
- Study of morphological characteristics of *rabi* crops.
- Study of yield contributing characters of *rabi* season crops.
- Yield and juice quality analysis of sugarcane.
- Study of important agronomic experiments of *rabi* crops at experimental farms. 6. Study of *Rabi* forage experiments.
- Oil extraction of medicinal crops, visit to research stations of related crops.

COURSE OUTCOME:

- To knowledge the best cultivation use in cultivation of rabi crops
- To import knowledge on Eugenics and animals 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 knowledge about the NUE increase in rabi season crops.

Suggested Reading

Text Books

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

Reference Books

- Prasad, R. (Ed.). 2001. *Field Crop Production*. ICAR, NewDelhi
- Modern Techeniques of Rising field Crops Chhidda Singh & PremSingh
- Das, P.C. 1997. *Oilseed Crops of India*, Kalyani Publishers., New Delhi. ICAR [Indian CouncilofAgriculturalResearch].2006.*HandBookofAgriculture*.ICAR,NewDelhi
- Chidda Singh, Prem Singh and Rajbir Singh. 2003. *Modern Techniques of Raising Field Crops* (2nd ed.). Oxford &IBH , New Delhi.
- Rabi Crop Productino RL Arya & KeshvArya

COURSE CODE: ABHO 403

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 aromaticcrops.
- To give the knowledge based on different type classification in medicinal crops and aromatic crops crops.

Theory

UNIT-1 Importance and scope of ornamental crops, medicinal and aromatic plants andlandscaping. Principles of landscaping.Landscape uses of trees, shrubs and climbers.

UNIT-2 Production technology of important cut flowers like rose, gerbera, carnation, liliium 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*. Quantum Books 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 NewDelhi
- 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, NewDelhi.
- 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.

COURSE CODE: ABAE 403

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 Solar cooker
8. Solar water heater, application of solar energy
9. Solar drying, solar pond, solar distillation
10. Solar photovoltaic system and their application
11. Introduction of wind energy and their application

Practical

1. Familiarization with renewable energy gadgets. To study biogas plants,
2. To study gasifier, To study the production process of biodiesel,
3. To study briquetting machine,
4. To study the production process of bio-fuels. Familiarization with different solar energy gadgets.
5. To study solar photovoltaic system: solar light, solar pumping, solar fencing.
6. To study solarcooker,
7. To study solar dryingsystem.
8. To study solar distillation and solar pond.

COURSE OUTCOMES

- Knowledge of production of Liquid biofuel.
- Knowledge of wind energy and their mills.
- Clear understanding of principles of agricultural wastes.

Suggested Readings

- Rai G.D., (2010) RenewableEnergy.
- Climatic Changes & Their Remedial Measures, (2001), Rathore N.S., Kurchania A.K., Shubhi Publications, Gurgaon, Delhi, pages 228. ISBN 10: 818722651X ISBN 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., Kurchania A.K., Himanshu Publications, New Delhi. ISBN9788179061282
- Renewable Energy Theory & Practice, (2006), Rathore NS, Panwar NL, Kurchania AK, ISBN 9788179061282, Himanshu Publications, New Delhi,
- Non Conventional Energy Sources, (2007), Rathore N.S., Panwar N.L., Kurchania A.K., ISBN 9788179061664. Himanshu Publications, New Delhi,
- Non Conventional Energy Sources, (2007), Rathore N.S., Panwar N.L., Kurchania A.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 P Sukhatme
- Solar Engineering of Thermal Processes” by JA Duffie and WA Beckman
- Biomass Regenerable Energy” by D D Hall and RP Grover

COURSE CODE: ABSC 402

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

Lecture schedule

1. Soil quality and health
2. Distribution of Waste land and problem soils in India, Their categorization based on properties
3. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils
4. Irrigation water – quality and standards, utilization of saline water in agriculture
5. Remote sensing and GIS in diagnosis and management of problem soils

6. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification
7. 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, New Delhi.
3. Introductory of soil Science, Das, D.K. (2015), Kalyani Publishers.

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

DEPARTMENT: HORTICULTURE

COURSE OBJECTIVES

- To give Basic knowledge about all Fruits crops.
- To give Basic knowledge Fruit crop cultivation and Fruit crops classification based 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 root stocks;

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

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

UNITV 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 -Stemborer - 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 - Rhizomerot-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 -Butter fly - 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- Pink berries.
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 mildew Footrot–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- Leaf curl.
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- Fruit cracking.
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 technology of 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 Pink disease –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- Blister blight.

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 – Pink disease.

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

COURSE CODE: ABGP 403

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, Pigeonpea, Lentil, Gram, Field bean, pea.
- Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard.

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

Lecture Schedule

1. Farming System–introduction–scope of farming system–importance–concept– principles of

Farming system.

2. Types of farming systems – advantages and limitations - suitability – factors affecting the farming system
3. Farming systems – system and systems approach – determinants of farming system
- Cropping systems (navadhanya concept) and related terminology
4. Allied enterprises – significance of integrating crop and livestock enterprises – components and maintenance- dairying and sheep and goat rearing – breeds – housing – feed and fodder requirements – biogas plant
5. Allied enterprises – poultry farming – breeds – housing – feed and fodder requirements – apiculture – species and management
6. Allied enterprises – sericulture – moriculture and silkworm rearing – agro-forestry systems suitable for dryland farming
7. Tools for determining production and efficiencies in different farming and cropping systems.
8. Adverse effects of modern agriculture – sustainable agriculture – definition – concept
- goals – elements.
9. Problems related to soil, water and environment - adaptation and mitigation strategies - indicators of sustainability.
10. Conservation agriculture – concept – need - management of natural resources - land, water and vegetation.
11. Techniques for sustainability- Low External Input Agriculture (LEIA) and Low External Inputs for Sustainable Agriculture (LEISA) and HEIA (High External Input Agriculture).
12. Integrated farming system- historical background, objectives and characteristics- advantages,
13. Site specific development of IFS models for different agroclimatic zones of India and A.P.
14. Resource use efficiency – optimization of resource use by different methods in an IFS (Annapurna model)
15. Resource cycling- flow of energy in different farming systems.
16. 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, NewDelhi
- Chidida Singh, Prem Singh and Rajbir Singh.2003. *Modern Techniques of Raising FieldCrops* (2nd Ed.).Oxford & IBH, New Delhi.
- Lekshmikantan, M. 1983. *Technology in Sugarcane Growing*. Oxford &IBH Publishing Co., Pvt. Ltd., New Delhi
- Purseglove, 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

COURSE CODE: ABEC 403

**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 agri-commodities nature and determinants of demand and supply of farm products, producer's surplus—meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.

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 futures 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 agri-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 agri-commodities:
- Nature and determinants of demand and supply of farm products

- Producer's surplus—meaning and its types, marketable and marketed surplus
- Factors affecting marketable surplus of agri-commodities 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 rations 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 defichannel; number of channel levels;
- Integration, efficiency, costs and prices pread: Meaning, definition and types of marketinteg
- Marketing efficiency; marketing costs, margins and price spread;
- Factor saffecting cost of marketing; reasons for higher marketing costs of farmco mmodities; 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 strading
- 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-Firstedition.
4. Kahlon, A.S. and George, M.V., 1985, Agricultural Marketing and Price Policy, Allied Publication Pvt. Ltd., New Delhi.
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. AstralPublicaiton.
2. Kohls, Richard L. and Uhl, Joseph N., 1980, Marketing of Agricultural Products, Macmillan Publishing Co., Inc. NewYork FABE
3. Acharya, S.S. and Agarwal, N.L., 1994, Agricultural Price Analysis and Price Policy, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Acharya S.S Agrawal N.L, 2019. Agricultural marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi

COURSE CODE: ABAG 405

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, longwave 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 rain making.

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; Modification 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 heatflux.
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 windrose.
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
- A Practical Guide on Agrometeorology- K.K.Agrawal and A.P.Upadhyay

Reference Books

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

COURSE CODE: ABEL 401

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 bio rationales. 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 bio pesticide.

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

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

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 influencingthe efficacy of bio fertilizers.

Lecture Schedule:

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

3. Definitions, concepts and classification of bio pesticides viz. pathogen, botanical pesticides, and bio rationales.
4. Botanicals and their uses.
5. Mass production technology of bio-pesticides
6. Virulence, pathogen city 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 bio pesticide.
10. Bio fertilizers - Introduction, status and scope.
11. Structure and characteristic features of bacterial biofertilizers-*Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*
12. Cynobacterial biofertilizers- *Anabaena*, *Nostoc*
13. Hapalosiphon 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 bio fertilizers
19. Application technology for seeds, seed- lings, tubers, sets etc.
20. Application technology for seeds, seed- lings, tubers, sets etc.
21. Bio fertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of bio fertilizers

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 bio pesticides.
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)

COURSE CODE: ABPP 502

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 & IDM0)

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 natural enemies.

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., NewDelhi.
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. Thaplial, 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 – 1
Pests, Disease and Weeds - By Ruth M. Kerriush and Phillip W. Unger
4. Hand Book of Entomology by T. V. Prasad

COURSE CODE: ABSC 503

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.

Lecture Schedule

- Introduction - History of soil fertility and plant nutrition - Concepts of soil fertility, soil

productivity, Navadhanya and Annapurna concepts in relation to soil fertility- Soil as a source of plant nutrients - Nutrient Elements - Arnon's criteria of essentiality Essential, functional and beneficial elements.

- Scientists responsible for the essentiality of nutrients -Ionic forms of plant nutrients in soil- Mechanism of nutrient transport - Movement of ions from soils to roots – Mass low, diffusion, root interception and contact exchange.
 - Essential nutrients – Classification and their functions in plants.
 - Deficiency symptoms of nutrients - Corrective measures – Toxicity symptoms of different nutrients.
 - Nitrogen - Occurrence, content and distribution - Factors influencing the content of nitrogen in soil. Forms of soil nitrogen - Nitrogen Cycle – Transformations in soils – Mineralization (amination and ammonification) - Fate of released ammonia – Factors affecting ammonium fixation - Nitrification – Factors affecting nitrification
 - Fate of released nitrate nitrogen.
 - Leaching losses of nitrate nitrogen – Nitrification inhibitors-Denitrification – Immobilization, Nitrogen fixation - Different types – Biological fixation of nitrogen
 - Symbiotic and non symbiotic – Nitrogen balance sheet – Gains and losses.
 - Phosphorus - P – Cycle – Content in soils – Forms of phosphorus in soil - Inorganic and organic phosphorus compounds – Phosphorus fixation – Mechanisms of phosphate fixation - Factors affecting phosphate fixation in soil - Quantity and intensity parameters.
 - Potassium - Content in soil – Source – Forms of soil potassium - Potassium fixation - Factors affecting potassium fixation – Quantity and Intensity parameters – Luxury consumption.
 - Calcium - Sources and content – Forms of calcium in soil, factors affecting the availability of calcium in soil –Magnesium - Sources – Content – Forms of magnesium in soils - Factors affecting availability of magnesium -Functions.
 - Sulphur - S – Cycle – Occurrence – Forms of Sulphur in soil - Sulphur transformation in soils – Mineralization and immobilization - Sulphur Oxidation – Factors affecting oxidation in soils - Sulphide injury – Causes, symptoms and remedial measures.
 - Micronutrient - Sources – Forms in soil solution – Pools of micronutrients – Predisposing factors for occurrence of micronutrient deficiencies in soil and plants
 - Zn and Mn - Content – Forms in soils – Critical limits in soils and plants - Factors affecting their availability.
 - Fe and Cu - Content – Forms in soils – Critical limits in soils and plants. Factors affecting their availability.
 - Boron and Molybdenum - Content – Forms in soil - Critical limits in soils and plants. Factors affecting their availability.
 - Chlorine - Content – Forms in soils – Critical limits in soils and plants. Factors affecting its availability – Beneficial Elements- Sodium, Cobalt, Vanadium and Silicon
 - Soil fertility Evaluation: - Approaches – Soil testing – Objectives of soil testing – Chemical methods for estimating available nutrients.
 - Plant analysis – Rapid tissue tests – Indicator plants - Biological methods of soil fertility evaluation, A- value – Microbiological methods – Sackett and Stewart techniques – Mehlich technique – Cunninghamella plaque method – Mulder's Aspergillus niger technique – Mistcherlich's pot culture method.
2. Soil test based fertilizers recommendation:- Critical nutrient concept (Cate and Nelson)– Critical levels of nutrients in soils - General recommendations Use of empirical equations for scheduling fertilizer doses - Targeted yield approach
 3. Nutrient use efficiency:- Soil, plant and management factors influencing Nutrient use efficiency in respect of N, P, K, S, Fe and Zn fertilizers–Foliar application–

Fertigation – Liquid fertilizers.

4. Methods of application of nutrients under rainfed and irrigated conditions
5. Introduction and importance of organic manures - Definition and difference between manures and fertilizers-Classification of manures (Bulky & Concentrated) with suitable examples. Importance of manures in soil fertility management.
6. Bulky organic manures – Preparation of FYM – Methods of collection and storage. Losses of nutrients from FYM during collection and storage -Ways to minimize these losses.
7. Compost and composting – Different methods of composting including the starters and raw materials
8. Methods of preparation of rural and urban compost. Mechanical compost plants – Their advantages over conventional composting–Vermi-composting
9. Green manures – Classification with examples. Advantages and limitations of green manuring and green leaf manuring. Biogas plant – Principles of operation and its advantages.
10. Definitions of penning, sewage, sewerage, sullage, poudrette, Activated compost process. Concentrated organic manures – Oil cakes, blood meal, bone meal, horn meal, fish meal, meat meal and guano.
11. Chemical fertilizers – Classification with examples – Nitrogenous fertilizers – composition and properties of major nitrogenous fertilizers viz., Ammonium sulphate, urea and calcium ammonium nitrate.
12. Phosphatic fertilizers – Composition of Rock phosphate – Occurrence, types and properties-properties of SSP, TSP and basic slag – Potassic fertilizers –MOP, SOP properties.
13. Secondary and micronutrient fertilizers –Different sources of these nutrients and their contents - Conditions leading to their deficiency - Methods of application and mode of action of NPK fertilizers in soils.
14. Amendments – Role of important organic and inorganic amendments and synthetic conditioners as amendments - Complex fertilizers – Types, composition of DAP, MAP, UAP, important nitrophosphates.
15. Mixed fertilizers – Advantages and disadvantages over straight fertilizers - Nano- fertilizers-Fertilizer grade – Fertilizer ratio – unit value of fertilizers – Problems - INM- Components - Advantages.
16. Fertilizer Control Order (FCO) – Its importance and regulations - Specifications for important fertilizers - Fertilizer storage – Specifications - Problems during storage.

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 fertilize, 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*. Agrl. 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 Plantgrowth* 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

COURSE CODE: ABEN 502

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.

Lecture Schedule

General account on nature and type of damage by different arthropod pests. Scientific name, order, family, host range, distribution, marks of identification, bionomics, nature of damage, and management of major, minor insect pests and other important arthropod pests of various field

crops.

- 1 Introduction of Economic Entomology and Economic Classification of Insect Pests
- 2 Rice-Yellow stem borer and other borers, gall midge, brown - planthopper, green leafhopper, hispa, leaf folder, ear head bug, grasshoppers, root weevil, swarming caterpillar, climbing cutworm, case worm, whorl maggot, leaf mite and panicle mite-IPM practices.
- 6-8 Sorghum and other millets- Sorghum shoot fly, stem borer, pink borer, sorghum midge, ear head bug, red hairy caterpillar, deccan wingless grasshopper, aphids, maize shoot bug, flea beetle, blister beetles, ragi cutworm, ragi root aphid and army worm- IPM practices.
Wheat- Ghujia weevil, ragi pink borer and termites- IPM practices.
- 9-11 Sugarcane- Early shoot borer, internode borer, top shoot borer, scales, leafhoppers, white grub, mealybugs, termites, whiteflies, woolly aphid and yellow mite- IPM Practices.
- 12-14 Cotton- Spotted bollworm, American bollworm, pink bollworm, tobacco caterpillar, leafhopper, whiteflies, aphid, mites, thrips, red cotton bug, dusky cotton bug, leaf roller, stem weevil, grasshoppers, and mealybug - IPM Practices.
- 15-16 Jute- Semilooper, stem weevil, stem girdler and Bihar hairy caterpillar. Mesta- Hairy caterpillars, stem weevil, mealybugs, leafhopper and aphid. Sunhemp- Hairy caterpillars, stem borer and flea beetle. IPM Practices.
- 17-18 Pulses- Gram caterpillar, plume moth, pod fly, stem fly, spotted pod borer, cowpea aphid, cowbug, pod bug, leafhopper, stink bug, green pod boring caterpillar, blue butterflies, leaf webber/borer and redgram mite. Soyabean- Stem fly, stem girdler, ragi cutworm, leaf miner and whitefly- IPM Practices. Pea- pea leaf miner and pea stemfly
19. Castor-Semilooper, shoot and capsule borer, tobacco caterpillar, leafhopper, butterfly, whitefly, thrips, castor slug and mite- IPM Practices.
20. Groundnut-White grub, leafminer, red hairy caterpillar, tobacco caterpillar, leaf hopper, thrips, aphid, pod bug, bud borer, wire worms and jewel beetle- IPM Practices.
21. Sesamum-Leaf and pod borer, gall fly and sphinx caterpillar. Safflower- Aphids and leaf eating caterpillars- IPM Practices.
22. Mustard- Aphid, sawfly, diamondback moth and paintedbug.
Sunflower- Helicoverpa and Spodoptera, leafhopper, Bihar hairy caterpillar and thrips – IPM Practices.
23. Stored grains Pests- Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain
- 24-25 Stored grain Insect pests - Rice weevil, lesser grain borer, khapra beetle, pulse beetle, groundnut bruchid, flour beetles, saw-toothed beetle, cigarette beetle, angoumois grain moth and rice moth
- 26-27 Stored grains - Non insect Pests- Mites, rodents, birds and microorganisms associated with stored grain - Storage structures and methods of grain storage and fundamental principles of grain store management.
28. Locusts- Locusts and their management

29. Mites- Economically important phytophagous mites of field crops and their management
30. Nematodes-White tip nematode of rice, cyst and gall nematode of wheat, and their management.
31. Rodents- Rodents damaging field crops and stored grains - Keys for identification of rodents and their management.
32. Birds- Various birds infesting crops and their management.
*Important insects and their scientific names may only be chosen for examination purpose.

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

- *Principles of Entomology* By Dr. Mathur and Uppadhyay
- *Principles of Plant Pathology* By Dr. Mathur and Uppadhyay
- *Fundamentals of Agriculture* Vol I 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 Uppadhayay
4. Hand Book of Entomology T. V. Prasad
5. South east asia crop pest and their Management A.S. Atwal and G. S.Dhaliwal
6. Applied Entomology D. S.Reddy

COURSE CODE: ABPP 503

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

Lectures Schedule: Theory

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

S.N	Topic	No. of lectures
1	Rice: Blast, brown spot, bacterial blight, sheath blight, false smut khaira and tungro.	03
2	Maize: Stalk rots, downy mildews, leaf spots	02
3	Sorghum: smut, grain mold and anthracnose	02
4	Bajra: Downy mildew and ergot.	01
5	Groundnut: Early & late leaf spots, wilt	01
6	Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic	02
7	Pigeonpea: Phytophthora blight, wilt and sterility mosaic.	01
8	Finger millet: Blast and leaf spot	01
9	Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic.	02
10	Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.	02
11	Guava: wilt and anthracnose.	01
12	Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top	02
14	Papaya: foot rot, leaf curl and mosaic	01
15	Pomegranate: bacterial blight	01
16	Cruciferous vegetables: Alternaria leaf spot and black rot	01
17	Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight	02
18	Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic	02
19	Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight	02
20	Ginger: soft rot; Colocasia: Phytophthora blight	01
21	Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust	02
	Total	32

Lecture Schedule: Practical

Identification and histopathological studies of following selected diseases of field and horticultural crops. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

S.N	Topic	No. of lectures
1	Rice: Blast, Brown spot, Bacterial blight, Khaira, Tungro .	02
2	Maize: Leaf blight & Downy mildew	01
3	Sorghum: Grain smut; Bajra: Downy mildew and ergot & Finger millet: Leaf spot	02
4	Groundnut: Tikka diseases; Soybean: Rhizoctonia blight, mosaic	01
5	Pigeonpea: Wilt, sterility mosaic; Black & Green gram: Web blight & yellow mosaic	01
6	Castor: Phytophthora blight; Tobacco: Black shank	01
7	Guava: Wilt, & pomegranate: Bacterial blight	01
8	Banana: Bunchy top, Sigatoka, Panama wilt; papaya: Leaf curl	01
9	Cruciferous vegetable: Alternaria leaf spot	01
10	Tomato: Early & late blight, Leaf curl, Damping off; Brinjal: Little leaf	01
11	Beans: Bacterial blight, Anthracnose; Okra: YVM	01
12	Ginger: Soft rot; Colocasia: Phytophthora blight	01
13	Coconut: Wilt, Bud rot, Tea: Blister blight; Coffee: Rust	01
14	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 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. 8thed. 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. NewDelhi.
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. NewYork.
2. MishraA,BohraAandMishra,A.2005.PlantPathology.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.

COURSE CODE: ABGP 504

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 decent 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.

Lecture Schedule:

1. Crop improvement aspects in rice as mentioned in the syllabus such as Centers of origin, of species Floral biology breeding objectives and procedures etc & hybrid seed production
2. Crop improvement aspects in maize as mentioned in the syllabus such as Centers distribution of species Floral biology breeding objectives and procedures etc & h
3. Crop improvement aspects in sorghum as mentioned in the syllabus such as Center distribution of species Floral biology breeding objectives and procedures etc & hybrid seed
4. Crop improvement aspects in bajra as mentioned in the syllabus such as
5. Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production
6. Crop improvement aspects in urd, mung and cowpea as mentioned in the syllabus such of origin, distribution of species Floral biology breeding objectives and procedures etc
7. Crop improvement aspects in pigeonpea as mentioned in the syllabus such as Center distribution of species Floral biology breeding objectives and procedures etc & hybrid seed p
8. Crop improvement aspects in soybean as mentioned in the syllabus such as Centers distribution of species Floral biology breeding objectives and procedures etc.
9. Crop improvement aspects in sesame as mentioned in the syllabus such as Centers distribution of species Floral biology breeding objectives and procedures etc.
10. Crop improvement aspects in groundnut as mentioned in the syllabus such as Center distribution of species Floral biology breeding objectives and procedures etc.
11. Crop improvement aspects in cotton and castor as mentioned in the syllabus such as origin, distribution of species Floral biology breeding objectives and procedures etc.
12. Crop improvement aspects in chilli as mentioned in the syllabus such as Centers of origin, of species Floral biology breeding objectives and procedures etc.

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 crops 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.

COURSE CODE: ABEX 504

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 qualityManagement
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 PublishingHouse, Meerut.
3. Karthikeyan, C. et al. 2008.. A Text Book of Agricultural Extension Management. Atlantic Publishers, NewDelhi.
4. Natrajan,K. and Ganeshan, K.P. 2012.Principles of Management. Himalaya Publishing House, NewDelhi.

5. Balasubramanyam M. 1985. Business Communication. Vani Educational Books, NewDelhi.
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. IBDCPublishers.
8. Nandan H. 2011. Fundamentals of Entrepreneurship. PHI Learning Pvt LtdIndia.
9. Poornima Charantimath. 2006. Entrepreneurship Development: Small Business Enterprise. PearsonEducation.
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. NewDelhi.
12. Mohanty S K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., NewDelhi.
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 at462001
14. How to communication effectively-Ashish Singh ISBN – 978-1-4828-1919-9 (PartridgeIndia)

Reference Books

1. Harold Koontz & Heinz Weihrich. 2004. Essentials of Management: An International Perspective, 2nd Ed. Tata Mc-Graw Hill Publishing PvtLtd.
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., NewJersey
5. Thomas W Zimmer and Norman M Scarborough. 1996. Entrepreneurship. Prentice-Hall, NewJersey.
6. The Dynamics of personality development J.R.Bhatti

COURSE CODE: ABAG 506

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 agricultural: 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, spatia 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, NewDelhi.
2. *Systematic Agricultural Geography*. Husain, M. 1996. Rawat Publications,Jaipur
3. Textbook of Field Crops Production: Foodgrain Crops Vol. I, Rajendra Prasad, 2013. New Dehli.
4. Textbook of Field Crops Production: Foodgrain Crops Vol. II, Rajendra Prasad, 2013. New Dehli.

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.

COURSE CODE: ABIP 501

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 farmer rights.

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 intellectual property.
2. Introduction to GATT, WTO, TRIPs and WIPO.

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.

COURSE CODE: ABEL 502

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.
- UNITIV** 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 shadenet houses.
2. Intercultural operations, tools and equipments.
3. identification and application, micro propagation, nursery portrays, micro - EC, pH based fertilizer 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 InternationalUK.
- 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).

COURSE CODE: ABAG 507

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 import knowledge on Eugenics and animals 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.
- Bala subramaniyan, 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)

COURSE CODE: ABAG 608

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 to references 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 moistures 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.

COURSE CODE: ABAE 604

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 solardryer).

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 green house
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 oilseed.
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 houses 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. Agro Tech. publication,Udaipur
3. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.
4. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. NewDelhi.
5. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, NewYork.
6. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

COURSE CODE: ABPP 604

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 field crops.
- To study disease of horticulture crops Mango, Citrus, Apple, etc. and their management

Theory:

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

(A) Field crops

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 Pokkah Boeng

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

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 leaf spot.

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 Pokkah Boeng	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, Ascochta blight , 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 field crops.
- Knowledge of symptoms, disease cycles of horticulture crops.

Suggested Reading:

Text Books

1. Gupta V K and Paul, Y S 2008. IInd ed. Diseases of field crops. Kalyani Publishing Co.ND.
2. Mehrotra R S and Aggarwal A. 2012. 12th ed. Plant Pathology, Tata Mc Graw-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. 8thed. 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. Pathak, V.N. 1980 Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd,New Delhi.
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, New Delhi.

COURSE CODE: ABHO 605

**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

COURSE CODE: ABEN603

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, weed killers 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 soft he 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., New Delhi.

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

COURSE CODE: ABGP 605

**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 decent 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., NewDelhi.
2. Mandal, A.K.,P.K. Ganguli and S.P. Banerjee. 1991. *Advances in Plant Breeding* Vol. I and II. CBS Publishers and Distributors, NewDelhi.
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*. AVIPublishing Co... INC, East Port, Conneacticut,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

COURSE CODE: ABAG 610

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 Operationalstructure ofNPOP;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. Postharvestmanagement; 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

COURSE CODE: ABEC 604

**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 farm layout.
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 planning and budgeting
9. Linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concepts of risk and uncertainty
10. Concept of risk and uncertainty occurs in agriculture production, Nature and sources of risks and its management strategies Concepts of resource economics
11. Differences between NRE and agricultural economics unique properties of natural resources

COURSE OUTCOME

- Clear understanding crop and livestock enterprises
- Knowledge of different types of farms
- Knowledge of farm inventory and factor-product relationship
- Determination of least cost combination of inputs.

References:

1. Bhavani Devi,P. Raghu Ram,S. Subba Reddy,T.V. Neelakanta Sastry, 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. and D. V.S. Rao, 2002, "Economics of Farm Production and Management", 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).

COURSE CODE: ABFN-601

PRINCIPLES OF FOOD SCIENCE AND NUTRITION
CREDIT 2(2+0)

DEPARTMENT: FOOD SCIENCE & TECHNOLOGY

COURSE OBJECTIVE:

- To study about the food Science.
- To study about the composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions).
- To study the processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).
- 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 systems etc.).
- UNIT-II** Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions).
- UNIT-III** Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods);
- UNIT-IV** Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).
- UNIT - V** Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

Lecture Schedule:

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

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

COURSE CODE: ABEL-603

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 agri business 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, retails trade commodity trading, and value added products.
4. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD.
5. Preparations of projects and Feasibility reports for agribusiness entrepreneur.
6. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques.
7. Case study of agro-based industries.
8. Trend and growth rate of prices of agricultural commodities.
9. Net present worth technique for selection of viable project. 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.

COURSE CODE: ABET 601

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 / FOURTHYEAR

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, Post harvest-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 (RAWE & 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. Landscaping 3(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 Standards 3(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, Inter cultural 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, regeneration 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-propagation, 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 Agroadvisory 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- conceptual 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.