B.Sc. (Hons) Agriculture

Syllabus

(with effect from July 2018)

School of Agriculture and Animal Sciences

The Gandhigram Rural Institute
(Deemed to be University)
Gandhigram – 624 302 Tamil Nadu

SCHOOL OF AGRICULTURE AND ANIMAL SCIENCE
B.Sc. (Hons) Agriculture (2017-2018 onwards) Scheme of Examination

S. No	Subject Code	Name of the Course	Credit		Scheme of Examination				
					Marks				Total
					Theory		Practical		
			T	P	CFA	ESE	CFA	ESE	
I Semester									
1	17AGRU0101	Fundamentals of Agronomy	3	1	24	36	24	16	100
2	17SACU0101	Fundamentals of Soil Science	2	1	24	36	24	16	100
3	17PBGU0101	Fundamentals of Genetics	2	1	24	36	24	16	100
4	17HORU0101	Fundamentals of Horticulture	1	1	24	36	24	16	100
5	17ACPU0101	Fundamentals of Crop Physiology	1	1	24	36	24	16	100
6	17AEXU0101	Rural Sociology & Educational Psychology	2	0	40	60	-	-	100
7	17AGLU0101	Comprehension & Communication Skills in English	1	1	24	36	24	16	100
8	17AGBU0101 17AMMU0101	Introductory Biology*/ Elementary Mathematics*	2 (1+1) / 2 (2+0)		24 40	36 60	24 -	16 -	100
9	17AGRU0102	Agricultural Heritage*	1	0	40	60	-	-	100
10	17GTPU0001	Gandhi's Life, Thought and Work **	2	0	40	60	-	-	100
11.	17SHSU0001	Shanti Sena**	0	1	-	-	-	100	100
12	17NSSU0001 17SPOU0001 17YOGU0001	NSS / Physical Education & Yoga Practices**	0	1	-	-	-	100	100
		Total *R: Remedial course; **NC: Non-gradial courses	**16+09/ 17+08**						**1200**
II Semester									
1	17APBU0201	Fundamentals of Plant Biochemistry and Biotechnology	2	1	24	36	24	16	100
2	17AGBU0202	Agricultural Microbiology	1	1	24	36	24	16	100
3	17AENU0201	Fundamentals of Entomology	3	1	24	36	24	16	100
4	17APPU0201	Fundamentals of Plant Pathology	3	1	24	36	24	16	100
5	17AGEU0201	Soil and Water Conservation Engineering	1	1	24	36	24	16	100
6	17AGRU0203	Introduction to Forestry	1	1	24	36	24	16	100
7	17AECU0201	Fundamentals of Agricultural Economics	2	0	40	60	-	-	100
8	17AEXU0201	Fundamentals of Agricultural Extension Education	2	1	24	36	24	16	100
9	17AGLU0202	Communication Skills and Personality Development	1	1	24	36	24	16	100
10	17NSSU0001 17SPOU0001 17YOGU0001	NSS / Physical Education & Yoga Practices**	0	1	-	-	-	100	100
Total			**(16+9)**						**1000**

S. No	Subject Code	Name of the Course	Credit		Scheme of Examination				
					Marks				Total
					Theory		Practical		
			T	P	CFA	ESE	CFA	ESE	
III Semester									
1	17AGRU0304	Crop Production Technology – I *(Kharif Crops)*	1	1	24	36	24	16	100
2	17PBGUO302	Fundamentals of Plant Breeding	2	1	24	36	24	16	100
3	17HORU0302	Production Technology for Vegetables and Spices	1	1	24	36	24	16	100
4	17AECU0302	Agricultural Finance and Cooperation	2	1	24	36	24	16	100
5	17AGEU0302	Farm Machinery and Power	1	1	24	36	24	16	100
6	17SACU0302	Environmental Studies and Disaster Management	2	1	24	36	24	16	100
7	17ACSU0301	Agri- Informatics	2	1	24	36	24	16	100
8	17AMMU0302	Statistical Methods	1	1	24	36	24	16	100
9	17LPMU0301	Livestock and Poultry Management	3	1	24	36	24	16	100
		Total	**(15+9)**						**900**
IV Semester									
1	17AGRU0405	Introductory Agro-meteorology & Climate Change	1	1	24	36	24	16	100
2	17AGRU0406	Farming System & Sustainable Agriculture	1	0	40	60	-	-	100
3	17AGRU0407	Crop Production Technology –II *(Rabi Crops)*	1	1	24	36	24	16	100
4	17SACU0403	Problematic Soils and their Management	2	0	40	60	-	-	100
5	17PBGU0403	Principles of Seed Technology	1	2	24	36	24	16	100
6	17HORU0403	Production Technology for Fruit and Plantation Crops	1	1	24	36	24	16	100
7	17HORU0404	Production Technology for Ornamental Crops, MAP and Landscaping	1	1	24	36	24	16	100
8	17AGEU0403	Renewable Energy and Green Technology	1	1	24	36	24	16	100
9	17AECU0403	Agricultural Marketing Trade & Prices	2	1	24	36	24	16	100
10	17ELEU0401	Elective Course	2	1	24	36	24	16	100
Total			**(13+9)**						**1000**

S. No	Subject Code	Name of the Course	Credit		Scheme of Examination				
					Marks				Total
					Theory		Practical		
			T	P	CFA	ESE	CFA	ESE	
V Semester									
1	17SACU0504	Geoinformatics and Nano-technology and Precision Farming	1	1	24	36	24	16	100
2	17AGRU0508	Practical Crop Production – I (*Kharif*crops)	0	2	-	-	-	100	100
3	17SACU0505	Manures, Fertilizers and Soil Fertility Management	2	1	24	36	24	16	100
4	17PBGU0504	Crop Improvement-I *(Kharif Crops)*	1	1	24	36	24	16	100
5	17AENU0502	Pests of Crops and Stored Grain and their Management	2	1	24	36	24	16	100
6	17APPU0502	Diseases of Field and Horticultural Crops and their Management -I	2	1	24	36	24	16	100
7	17AENU0503	Principles of Integrated Pest and Disease Management	2	1	24	36	24	16	100
8	17ARCU0503	Intellectual Property Rights	1	0	40	60	-	-	100
9	17AEXU0503	Entrepreneurship Development and Business Communication	1	1	24	36	24	16	100
10	17ELEU0502	Elective Course	2	1	24	36	24	16	100
Total			**(14+10)**						**1000**
VI Semester									
1	17AGRU0609	Principles of Organic Farming	1	1	24	36	24	16	100
2	17AGRU0610	Rainfed Agriculture & Watershed Management	1	1	24	36	24	16	100
3	17AGRU0611	Practical Crop Production –II (*Rabi* crops)	0	2	-	-	-	100	100
4	17AGRU0612	Study Tour – I	0	1	-	-	-	100	100
5	17PBGU0605	Crop Improvement-II *(Rabi crops)*	1	1	24	36	24	16	100
6	17AENU0604	Management of Beneficial Insects	1	1	24	36	24	16	100
7	17APPU0603	Diseases of Field and Horticultural Crops and their Management-II	2	1	24	36	24	16	100
8	17HORU0605	Post-harvest Management and Value Addition of Fruits and Vegetables	1	1	24	36	24	16	100
9	17AECU0605	Farm Management, Production & Resource Economics	1	1	24	36	24	16	100
10	17AGEU0604	Protected Cultivation and Secondary Agriculture	1	1	24	36	24	16	100
11	17AFSU0604	Principles of Food Science and Nutrition	2	0	40	60	-	-	100
12	17ELEU0603	Elective Course	2	1	24	36	24	16	100
Total			**(13+12)**						**1200**

S. No	Subject Code	Name of the Course	Credit		Scheme of Examination				
					Marks				Total
			T	P	Theory		Practical		
					CFA	ESE	CFA	ESE	
VII Semester									
1	17AEXU0704	Rural Agricultural Work Experience - RAWE (VSP+ADA/KVK+NGO+AgroIndustry)	0	20	-	-	-	100	100
2	17AGRU0713	Study Tour -II	0	1	-	-		100	100
Total			**(0+21)**						**200**
VIII Semester									
1	17AEXU0805	Project Work	0	4	-	-	-	100	100
2	17SDEU0801	Skill Development and Entrepreneurship-I	0	10	-	-	-	100	100
3	17SDEUO802	Skill Development and Entrepreneurship-II	0	10	-	-	-	100	100
Total			**(0+24)**						**300**

*** 50 % marks required each in practical and theory and aggregate of 60 % for pass**

ABSTRACT OF SEMESTER-WISE CREDITS

Semester	No. of Courses	Credit		
		Theory	Practical	Total
I	12	17	8	25
II	10	16	9	25
III	9	15	9	24
IV	10	13	9	22
V	10	14	10	24
VI	12	13	12	25
VII	2	0	21	21
VIII	3	0	24	24
	Total	**88**	**102**	**190**

B.Sc. (Hons.)Agriculture Programme
Discipline wise Distribution of courses – 2017-2018

I. AGRONOMY

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17AGRU0101	Fundamentals of Agronomy	3	1	4
2	17AGRU0102	Agricultural Heritage *R	1	0	1
3	17AGRU0203	Introduction to Forestry	1	1	2
4	17AGRU0304	Introductory Agro-meteorology & Climate Change	1	1	2
5	17AGRU0405	Crop Production Technology – I (*Kharif*crops)	1	1	2
6	17AGRU0406	Crop Production Technology – II (*Rabi* crops)	1	1	2
7	17AGRU0407	Farming System & Sustainable Agriculture	1	0	1
8	17AGRU0508	Practical Crop Production - I *(Kharif*crops*)*	0	2	2
9	17AGRU0609	Practical Crop Production - II *(Rabi* crops*)*	0	2	2
10	17AGRU0610	Principles of Organic Farming	1	1	2
11	17AGRU0611	Rainfed Agriculture & Watershed Management	1	1	2
12	17AGRU0612	Study Tour –I	0	1	1
13	17AGRU0713	Study Tour –II	0	1	1
		Total	**11**	**13**	**24**

II. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17SACU0101	Fundamentals of Soil Science	2	1	3
2	17SACU0302	Environmental Studies and Disaster Management	2	1	3
3	17SACU0403	Problematic soils and their Management	2	0	2
4	17SACU0504	Geoinformatics and Nanotechnology and Precision Farming	1	1	2
5	17SACU0505	Manures, Fertilizers and Soil Fertility Management	2	1	3
Total			**9**	**4**	**13**

III. GENETICS & PLANT BREEDING

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17PBGU0101	Fundamentals of Genetics	2	1	3
2	17PBGU0302	Principles of Seed Technology	1	2	3
3	17PBGU0403	Fundamentals of Plant Breeding	2	1	3
4	17PBGU0504	Crop Improvement-I (*Kharif*crops)	1	1	2
5	17PBGU0605	Crop Improvement-II (*Rabi* crops)	1	1	2
Total			**7**	**6**	**13**

IV. AGRICULTURAL ENTOMOLOGY

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17AENU0201	Fundamentals of Entomology	3	1	4
2	17AENU0502	Pests of Crops and Stored Grain and their Management	2	1	3
3	17AENU0503	Management of Beneficial Insects	1	1	2
4	17AENU0604	Principles of Integrated Pest and Disease Management	2	1	3
Total			**8**	**4**	**12**

V. PLANT PATHOLOGY

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17APPU0201	Fundamentals of Plant Pathology	3	1	4
2	17APPU0502	Diseases of Field and Horticultural Crops and their Management-I	2	1	3
3	17APPU0603	Diseases of Field and Horticultural Crops and their Management-II	2	1	3
Total			**7**	**3**	**10**

VI. HORTICULTURE

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17HORU0101	Fundamentals of Horticulture	1	1	2
2	17HORU0302	Production Technology for Fruit and Plantation Crops	1	1	2
3	17HORU0403	Production Technology for Vegetables and Spices	1	1	2
4	17HORU0404	Production Technology for Ornamental Crops, MAP and Landscaping	1	1	2
5	17HORU0605	Post-harvest Management and Value Addition of Fruits and Vegetables	1	1	2
Total			**5**	**5**	**10**

VII. AGRICULTURAL ENGINEERING

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17AGEU0201	Soil and Water Conservation Engineering	1	1	2
2	17AGEU0302	Farm Machinery and Power	1	1	2
3	17AGEU0403	Renewable Energy and Green Technology	1	1	2
4	17AGEU0604	Protected Cultivation and Secondary Agriculture	1	1	2
Total			**4**	**4**	**8**

VIII. ANIMAL SCIENCES

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17LPM0301	Livestock and poultry Management	3	1	4
		Total	**3**	**1**	**4**

IX. AGRICULTURAL ECONOMICS

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17AECU0201	Fundamentals of Agricultural Economics	2	0	2
2	17AECU0302	Agricultural Finance and Co-Operation	2	1	3
3	17AECU0403	Agricultural Marketing Trade & Prices	2	1	3
4	17AECU0504	Farm Management, Production & Resource Economics	1	1	2
5	17AECU0605	Intellectual Property Rights	1	0	1
		Total	**8**	**3**	**11**

X. AGRICULTURAL EXTENSION AND COMMUNICATION

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17AEXU0101	Rural Sociology & Educational Psychology	2	0	2
2	17AEXU0202	Fundamentals of Agricultural Extension Education	2	1	3
3	17AEXU0503	Entrepreneurship Development and Business Communication	1	1	2
4	17AEXU0704	Rural Agricultural Work Experience - RAWE (VSP+ADO/KVK+NGO+AgroIndustry)	0	20	20
5.	17AEXU0805	Project Work	0	4	4
Total			**5**	**26**	**31**

COURSES OFFERED BY OTHER DEPARTMENTS OF GRI

XI. PHYSICAL SCIENCES

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17AMMU0101/17AGBU0101	Elementary Mathematics / Introductory Biology *	2 (1+1) / 2 (2+0)		2
2	17ACSU0301	Agri- Informatics	2	1	3
3	17AMMU0302	Statistical Methods	1	1	2
		Total	**5**	**2**	**7**

*R: Remedial Course

XII. BIOLOGICAL SCIENCES (Biochemistry/Physiology/Microbiology)

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17ACPU0101	Fundamentals of Crop Physiology	1	1	2
2	17APBU0202	Agricultural Microbiology	1	1	2
3	17AGMU0203	Fundamentals of Plant Biochemistry and Biotechnology	2	1	3
4	17AFSU0604	Principles of Food Science & Nutrition	2	0	2
		Total	**6**	**3**	**9**

XIII. LANGUAGES

S. No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1.	17AGLU0101	Comprehension & Communication Skills in English (Gradial course)	1	1	2
2.	17AGLU0202	Communication Skills and Personality Development	1	1	2
		Total	**2**	**2**	**4**

XIV. GANDHIAN THOUGHT

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1.	17GTPU0101	Gandhi's Life, Thought and Work / Human Values & Ethics/	2	0	2
2.	17SHSU0102	Shanti Sena**	0	1	1
		Total	**2**	**1**	**3**

XV. OTHER COURSES

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1.	17NSSU0101/ 17APEU0101	NSS/Physical Education & Yoga Practices	0	1	1
2.	17NSSU0202/ 17APEU0202	NSS/Physical Education & Yoga Practices	0	1	1
		Total	**0**	**2**	**2**

XVI. SKILL DEVELOPMENT & ENTREPRENEURSHIP

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17SDEU0801	Skill Development and Entrepreneurship-I	0	10	10
2	17SDEU0802	Skill Development and Entrepreneurship-II	0	10	10
		Total	**0**	**20**	**20**

XVII. ELECTIVE COURSES

S.No	Subject Code	Name of the Course	Credit		
			Theory	Practical	Total
1	17ELEU0401	Elective -I	2	1	3
2	17ELEU0502	Elective-II	2	1	3
3	17ELEU0603	Elective-III	2	1	3
		Total	**6**	**3**	**9**

DISCIPLINE-WISE SUMMARY OF CREDIT HOURS

S.No	Name of the Discipline	Credit		
		Theory	Practical	Total
1	Agronomy	11	13	24
2	Soil Science & Agricultural Chemistry	9	4	13
3	Genetics & Plant Breeding	7	6	13
4	Agricultural Entomology	8	4	12
5	Plant Pathology	7	3	10
6	Horticulture	5	5	10
7	Agricultural Engineering	4	4	8
8	Animal Sciences	3	1	4
9	Agricultural Economics	8	3	11
10	Agricultural Extension And Communication	5	26	31
11	Physical Sciences	5	2	7
12	Biological Sciences (Biochemistry/Physiology/Microbiology)	6	3	9
13	Languages	2	3	5
14	Gandhian Thought / Shanti Sena	2	1	3
15	Other Courses	0	2	2
16	Skill Development and Entrepreneurship	0	20	20
17	Elective Courses	6	3	9
	Total	**88**	**103**	**191**

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

S.No	Name of the Discipline	Credit		
		Theory	Practical	Total
1	Agribusiness Management	2	1	3
2	Agrochemicals	2	1	3
3	Commercial Plant Breeding	1	2	3
4	Landscaping	2	1	3
5	Food Safety and Standards	2	1	3
6	Biopesticides&Biofertilizers	2	1	3
7	Protected Cultivation	2	1	3
8	Micro propagation Technologies	1	2	3
9	Hi-tech. Horticulture	2	1	3
10	Weed Management	2	1	3
11	System Simulation and Agro-advisory	2	1	3
12	Agricultural Journalism	2	1	3

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.No	Name of the Discipline	Credit		
		Theory	Practical	Total
1	Production Technology for Bioagents and Biofertilizer	0	10	10
2	Seed Production and Technology	0	10	10
3	Mushroom Cultivation Technology	0	10	10
4	Soil, Plant, Water and Seed Testing	0	10	10
5	Commercial Beekeeping	0	10	10
6	Poultry Production Technology	0	10	10
7	Commercial Horticulture	0	10	10
8	Floriculture and Landscaping	0	10	10
9	Food Processing	0	10	10
10	Agriculture Waste Management	0	10	10
11	Organic Production Technology	0	10	10
12	Commercial Sericulture	0	10	10

I SEMESTER
17AGRU0101 FUNDAMENTALS OF AGRONOMY 4 (3+1)

Objectives:

- To impart knowledge on the basics of Agronomy from sowing up to harvest
- To train and inculcate irrigation and weed management techniques including handling of tools and implements used for various field operations.

Learning outcomes:

1. Students can learn about basic aspects of Agronomy from sowing upto harvest including various tools and implements used for field operations
2. Students aware about the irrigation principles , methods of irrigation and its application in field crops
3. Students can learn about the basics of weed management in field crops

Theory

Unit I : **Introduction**: Definition of Agronomy- Scope and its importance- Role of an Agronomist- Branches of agriculture- Tillage and Tilth- Objective of Tillage- Types of tillage- Modern concept of Tillage- Tools and implements and machineries for different agricultural operations.

Unit II : **Seeds and Sowing:** Factors affecting germination- Seed rate and seed treatment- Nursery methods and transplanting- Methods of sowing- Plant population and geometry- Growth and development of crops- Factors affecting growth and development- Crop rotation and its principles- Adaptation and distribution of crops- Harvesting, threshing, drying and storage.

Unit III : **Manures and Fertilizers:** Crop nutrition- Basic, primary, secondary and micro nutrients needed for crop growth- Nutrient use efficiency- slow release fertilizers- Neem coated urea, Sulphur coated urea, Coaltar coated urea- Methods of application of fertilizers- Basal dressing, top dressing- Foliar application of fertilizers- Fertigation – Integrated Nutrient Management(INM).

Unit IV : **Irrigation**: Water resources- Soil-Plant-Water relationship, crop water requirement- Water use efficiency- Irrigation- Scheduling and methods of irrigation- Surface, sub surface and pressurized irrigation- Flooding, border irrigation, Check basin irrigation, Furrow irrigation, Sprinkler irrigation, Drip irrigation- Suitability of crops- Merits and demerits of each irrigation systems.

Unit V : **Weed Management-** Weeds- Importance and classification of weeds- crop weed competition- concepts of weed management- principles and methods

of weed management- Cultural, mechanical, chemical and biological methods of weed control- merits and demerits of each methods- Herbicides- definition and classification – Selectivity and resistance- Allelopathy- time and methods of herbicide application- herbicide residue management-IWM.

Practical

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

Theory Schedule:

1. Agriculture- Definition- Importance and scope- Branches of Agriculture-
2. Development of scientific Agriculture- National and International Agricultural Research Institutes
3. Agronomy- Definition- meaning and scope- Role of an agronomist -Agro-climatic zone of India and Tamil Nadu.
4. Tillage and Tilth- Objectives of tillage- Types of tillage- Modern concepts of Tillage
5. Tools and implements and machineries for different Agricultural operations
6. Factors affecting crop production – climatic – edaphic – biotic – physiographic and socio economic factors
7. Seeds and sowing- seed rate- Nursery methods and transplanting.
8. Sowing methods- Broadcasting, Dibbling- Line sowing, sowing/planting on ridges- sowing by seed drill- merits and demerits
9. Crop stand establishment- Planting geometry- Thinning and gap filling and other intercultural operations
10. Crop rotation- Definition and its principles – advantages of crop rotation
11. Adaptation and distribution of crops- Major crops of India and Tamil Nadu
12. Harvesting- Methods of harvesting- assessment of crop maturity- physiological maturity and harvest maturity- Symptoms of harvesting- Threshing , cleaning and drying-Post harvest processing
13. Crop nutrition- Basic, primary, secondary and micro nutrients needed for crop growth-
14. Manures and fertilizers- Definition- organic manures- Bulky and concentrated organic manures
15. Fertilizers- Definition- Types of fertilizers-Straight, complex and compound fertilizers- - Nitrogenous, Phosphatic and Potassic fertilizers- fertilizer mixtures
16. Fertilizer / Nutrient use efficiency- slow release fertilizers- Neem coated urea, sulphur coated urea, Coal tar coated urea- preparation and its advantages

17. Methods of application of fertilizers- Basal application, top dressing- Broadcasting, placement of fertilizers-
18. Foliar application of fertilizers- Water soluble fertilizers- Fertigation
19. Bio- fertilizers- Nitrogen fixing bacteria- Rhizobium, Azospirillum, Azolla, Blue Green Algae(BGA)- Phosphorous solubilizing bacteria- Phosphobacteria- VAM
20. Water resources- Soil-Plant-water relationship, crop water requirement- water use efficiency – methods for minimizing wastage of water through percolation, evaporation and seepage
21. Irrigation- Definition- Methods of irrigation- surface, sub surface and pressurized irrigation methods- surface irrigation methods viz., flooding, furrow, border strip, check basin and other irrigation methods
22. Modern techniques of irrigation- Pressurized Irrigation-Drip and sprinkler irrigation methods- suitability of crops- Merits and demerits of each system of irrigation-
23. Weeds- Definition-Importance and classification of weeds- crop weed competition-
24. Harmful and beneficial effects of weed- Critical period of weed competition
25. Methods of weed control- Preventive, Eradication and control methods
26. Principles of weed management- Cultural methods of weed management, mechanical methods of weed management- merits and demerits
27. Biological methods of weed management- Bio herbicides- Aquatic weeds and its management- Parasitic weeds and its management
28. Chemical weed control- Herbicides- definition- Classification of herbicides- Selective and non-selective herbicides- contact and translocated herbicides
29. Methods of herbicide application- Soil, foliar and herbigation- Time of application of herbicides- Pre sowing incorporation, Pre emergence and Post emergence spray
30. Herbicide nozzles- Fan type, cone type and spot application –Herbicide mixtures and herbicide residues management

Practical schedule:

1. Field visit to wet land, irrigated dry and dry farming
2. Identification of principal crops, manures and fertilizers
3. Identification of Agro chemicals and their usage
4. Identification of green manures and green leaf manures
5. Study of tools and implements and machineries and acquiring skill in the use of various agricultural tools and implements
6. Practicing Nursery preparation – sowing and transplanting methods
7. Practicing seed treatment techniques
8. Practicing various methods of irrigation
9. Practicing different methods of fertilizer application
10. Practicing weeding in wet land and garden land
11. Working out seed rate and fertilizer requirement for important crops
12. Practicing harvesting and processing of important crops
13. ESE Practical Examinations.

References:

Text books

1. Balasubramaniyan, P and S.P.Palaniappan, 2002. *Principles and practices of Agronomy*. Agro bios(India), Jodhpur
2. Dahama, A.K. 1996. *Organic farming for Sustainable Agriculture*. Ago botanical publishers (India), Bikaner
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4. ICAR, 1996. *Hand book of Agriculture.* Indian Council of Agriculture Research, New Delhi
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7. Singh, S.S. 1998. *Principles and practices of Agronomy*. Kalyani publishers, New Delhi
8. Thakur, C.1980. *Scientific Crop Production*. Vol.I Metropolitan Book Co. Pvt., Ltd., New Delhi
9. Sivanappan, R.K and Karaigowder, 1997. *Irrigation and Drainage*. Popular Book Depot, Chennai.

E- References:

1. http:/icar.res.in
2. www.webcast.gov.in
3. www.icar.org.in/nasm.html

I SEMESTER

17SACU0101 FUNDAMENTALS OF SOIL SCIENCE 3 (2+1)

Objectives:

- To impart the basics of soil with relevant to its origin, classification, physical, chemical and biological properties.
- To enrich knowledge on organic matter and its fate after application to soil.

Learning Outcomes:

- Understanding the Soil forming rocks and minerals, soil forming processes.
- Studying the physical and chemical properties of soils.
- Studying about soil organic matter, soil pollution and mitigation.

Theory

Unit I : **Soil forming rocks and Minerals:** History and development of Soil Science and its branches. Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: Origin of earth-Soil forming rocks and minerals-origin-classification. Weathering of rocks and minerals-physical, chemical and biological weathering.

Unit II : **Soil forming processes:** Soil formation-Factors of soil formation-Soil forming processes-Profile development-Definition of soil- Soil composition-Types of soils found in India and Tamil Nadu - Soil taxonomy.

Unit III : **Physical Properties of Soils:** Physical properties of soils-texture-mechanical components and structure, density and porosity, soil colour, soil air, composition, gaseous exchange, soil temperature - sources-amount and flow of heat in soil;, soil water-measurement-soil and water relationship moisture constants-soil water movement. Soil consistency and plasticity;. Significance of physical properties in relation to plant growth.

Unit IV : **Chemical properties of Soils:** Chemical properties of soils- Chemical composition-Soil reaction-pH, soil acidity and alkalinity -Buffering capacity of soils- 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 - Organic colloids-Colloids in relation to fertility of soil and their effect on plant growth.

Unit V : **Soil Organic matter and their Turn over:** Soil Organic matter - sources- chemical composition-decomposition- properties and its influence on soil properties; role and functions of organic matter in soil-

humus formation- humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; soil-nutrient availability-factors influencing the availability; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

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

Theory Schedule:

1. History and development of Soil Science and its branches.
2. Soil as a natural body, Pedological and edaphological concepts of soil;
3. Soil genesis: Origin of earth
4. Soil forming rocks and minerals-origin-classification.
5. Weathering of rocks and minerals-physical, chemical and biological weathering.
6. Soil formation-Factors of soil formation
7. Soil forming processes-Profile development
8. Definition of soil- Soil composition
9. Types of soils found in India and Tamil Nadu
10. Soil taxonomy
11. Physical properties of soils-texture-mechanical components and structure,
12. Density and porosity, soil colour,
13. Soil air, composition, gaseous exchange,
14. Soil temperature - sources- amount and flow of heat in soil;
15. Soil water-measurement-soil and water relationship moisture constants-soil water movement.
16. Soil consistency and plasticity;. Significance of physical properties in relation to plant growth.
17. Chemical properties of soils- Chemical composition
18. Soil reaction-pH, soil acidity and alkalinity
19. Buffering capacity of soils- effect of pH on nutrient availability;
20. Soil colloids-Inorganic and organic - silicate clays: constitution and properties;
21. Sources of charge; ion exchange, cation exchange capacity, base saturation
22. Organic colloids-Colloids in relation to fertility of soil and their effect on plant growth.
23. Soil Organic matter - sources- chemical composition-decomposition-
24. Soil Organic matter - properties and its influence on soil properties;
25. Role and functions of organic matter in soil-

26. Humus formation- humic substances - nature and properties;
27. Soil organisms: macro and micro organisms, their beneficial and harmful effects;
28. Soil-nutrient availability-factors influencing the availability;
29. Soil pollution - behaviour of pesticides and inorganic contaminants,
30. Prevention and mitigation of soil pollution.

Practical Schedule:

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 bulk and particle density and porosity in soil.
5. Determination of soil moisture content.
6. Determination of soil texture by feel method.
7. Determination of soil texture by Bouyoucos method.
8. Capillary rise phenomenon of water in soil column and water movement in soil.
9. Determination of soil pH and electrical conductivity.
10. Determination of cation exchange capacity of soil.
11. Study of soil map.
12. Determination of soil colour.
13. Demonstration of heat transfer in soil.
14. Estimation of organic matter content of soil.
15. ESE Practical Examination.

References:

Text books

1. Biswas, T.D. and Mukherjee, S.K. 1997. *Text book of Soil Science*. Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Brady, N.C. 1995. *The Nature and Properties of Soils*. Prentice Hall of India Pvt. Ltd., New Delhi
3. Daji, A.J. 1970. *A Text Book of Soil Science*. Asia Publishing House, Madras
4. Dhanasekaran, K., Poonkodi, P., Singaravel, R and.Raghupathy, B 2003, *Fundamentals of Soil Science*. Om Sakthi Pathippagam, Chidambaram
5. Dilip Kumar Das. 1997. *Introductory Soil Science*. Kalyani Publishers, Ludhiana
6. Donahue, R.L., Miller, T.W. and Shickluna, J.C. 1987. *Soils – An introduction to Soils and Plant Growth*. Prentice Hall of India (P) Ltd., New Delhi
7. Kolay, A.K. 1993. *Basic concepts of Soil Science*. Wiley Eastern Limited, 4835/24 Ansari Road, Daryaganj, New Delhi
8. Rai, M.M. 1998. *Principles of Soil Science*. MacMillan India Limited, New Delhi
9. Sahai, V.N. 2001. *Fundamentals of Soil*, Kalyani Publishers, Ludhiana
10. Sehgal, J. 1997. *Pedology-Concepts and applications*. Kalyani Publishers, Ludhiana
11. Sekhon, G.S. Eds., 2002. *Fundamentals of Soil Science*. Indian Society of Soil Science, IARI, New Delhi.

E- References:

1. agritech.tnau.ac.in
2. www.fao.org/ soils- portal
3. http.//nrcs.usda.gov

I SEMESTER
17PBGU0101 FUNDAMENTALS OF GENETICS 3 (2+1)

Objective:

- The aim of this course is to understand the basic concepts of genetics, principles and their application, ultra structure of cell and cell organelles

Learning Outcome:

- Basic principles of inheritance and modern concepts of genetics will be exposed to student

Theory

Unit I : **History of Genetics**, pre Mendelian concepts of heredity, Mendel work, Principles of heredity, Lethal genes, Pleiotropy with examples; phenocopy , penetrance and expressivity . Dominance relationships, Epistatic interactions with example. Probablity and chi –squares

Unit II : **Multiple alleles** – characteristics and features ,Pleiotropism and Pseudoalles ,study of blood group, Multiple factor hypothesis ,Linkage and its Crossing over mechanisms, Chromosome mapping, Qualitative and Quantitative traits, Polygenes and Continuous variation, Sex determination and Sex linkage , Sex limited and Sex influenced traits , Cytoplasmic inheritance

Unit III : **Architecture of Chromosome**, Chromonemata, chromosome matrix, Chromomers, Centromere, secondary constriction and telomere: Special type of chromosomes, Cell cycle and cell division mitosis and meiosis

Unit IV : **Structural and Numerical variations** in chromosome and their implications, use of haploids, diploids and double haploids in genetics. Mutation, classification, methods of including mutations &CIB technique, Mutagenic agents and induction of mutation, Genetic code

Unit V : **Nature, Structure & Replication of genetic material** .Protein synthesis, Transcription and Translational mechanism of genetic material. Gene concept: Gene structure, Functions and regulation.Lac and Trp operns.

Practical

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

Theory Schedule:

1. History of Genetics, Pre Mendelian concepts of heredity
2. Mendel's Laws - Principle of dominance- Principle of unit characters exceptions to Mendel's Laws
3. Monohybrid and dihybrid ratios - modifications of F2 ratio in monohybrid and dihybrid crosses and lethal factors
4. Pleiotropy, phenocopy penetrance (complete penetrance and incomplete penetrance) and expressivity (uniform expressivity and variable expressivity)
5. Gene interaction - their types ,Probability and chi-square
6. Multiple alleles (Blood groups in human beings, fur / coat colour in rabbits and self incompatibility alleles in plants) – characteristic features of multiple alleles – pseudo-alleles.
7. Linkage- definition- estimation of linkage- types of linkage
8. Crossing over – mechanism of crossing over – types of crossing over – factors effecting crossing over
9. Chromosome mapping – two-point and three-point test cross – cytological maps and genetic maps
10. Qualitative and quantitative characters – definition – monogenic and polygenic inheritance and their differences – multiple factor hypothesis
11. Sex determination – various mechanisms of sex determination – genic balance theory of sex determination in *Drosophila melanogaster* – sex linked and Sex influenced traits
12. Cytoplasmic inheritance – definition – chloroplast inheritance – mitochondrial inheritance - characteristic features of features of cytoplasmic inheritance
13. Cell - differences between prokaryotic and eukaryotic cell ; Ultra structure of cell and cell organelles and their functions.
14. Study of chromosome - structure - morphology, composition of chromosome — euchromatin and heterochromatin – karyotype and ideogram
15. Special type of chromosomes – lamp brush chromosomes, salivary gland chromosomes, supernumerary chromosomes, iso chromosomes and sex chromosomes
16. Cell division - Mitosis and meiosis
17. Mitosis – definition – process of mitosis – mitotic cycle – significance in plant breeding
18. Meiosis – definition – process – differences between mitosis and meiosis – significance in plant breeding
19. Structural chromosomal aberrations – deletions, duplications , inversions , translocations
20. Numerical chromosomal aberrations – terminology – classification – euploidy and aneuploidy – kinds of polyploidy – autopolyploid, allopolyploids and segmental allopolyploids
21. Numerical chromosomal aberrations – polyploidy and evolution of crop species – wheat, cotton, tobacco, *Triticale*, *Brassica* etc.
22. Mutations - definition – brief history –classification of mutations – characteristic features of mutations

23. Mutations – physical and chemical mutagens, Methods of inducing mutations and C *l* B technique
24. Genetic code – properties of genetic code – central dogma
25. Deoxyribo Nucleic Acid (DNA) and its structure – Watson and Crick model – functions and types of DNA
26. Modes of DNA replication – semi-conservative DNA replication – experimental proof
27. RNA and its structure function and types –messenger RNA (mRNA), ribosomal RNA (rRNA) and transfer RNA (tRNA)) – differences between DNA and RNA
28. Protein synthesis – transcription and translation
29. Gene structure – function - expression and differential gene activation – Operon concept – Lac Operon – Trp operons.

Practical Schedule:

1. Use of microscope and Study of cell organelles
2. Principles of killing and fixing; preparation of stains and preservatives
3. Fixing and observing the mitotic phases in root tips of onion / *Aloe sp*
4. Fixing and observing the meiotic phases in the inflorescence in maize / sorghum
5. Principles of dominance, recessive, back cross, test cross, incomplete dominance, co dominance and lethal factor; Chi square test
6. Study of genetic ratios –Monohybrid - incomplete dominance and test cross ratios
7. Study of dihybrid ratios with dominance, with incomplete dominance and test cross
8. Study of Simple interaction of genes-comb character in fowls; Dominant epistasis, Recessive epistasis, Duplicate and additive epistasis, Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis
9. Multiple alleles and polygenic inheritance
10. Estimation of linkage with F_2 and test cross data; Coupling and repulsion
11. Problems on two point test cross, three point test cross – drawing genetic maps
12. Study on Sex linked inheritance in Drosophila
13. Study of models on DNA and RNA structures
14. ESE Practical Examination

References:

Text books

1. Gupta P.K.2004. *Cytology, Genetics and evolution*. Rastogi Publications, Meerut. (Hindi Edition)
2. Kaushik, M.P.2003. *A text Book of Modern Botany*. Prakash publications, Muzaffar nagar(UP)
3. Klug, W.W and Cummings, M.R.2005. *Concepts of genetics*. Pearson Education (Singapore) pvt. Ltd., Indian branch. Pratap Ganj.New Delhi.
4. Singh, B.D. 2001. *Genetics*. Kalyani Publishing House, New Delhi.
5. Strickberger, M.W.2001. *Genetics*. Prentice Hall of India. Pvt. Ltd., New Delhi.
6. Shekhawat, A.S.and Tripathi, B.K., 2009. *A practical manual on Element of Genetics*. Publish by College of Agriculture, Bikaner.

E- References:

1. www.nmsu.edu
2. www.biology200.gsu.edu

I SEMESTER

17HORU0101 FUNDAMENTALS OF HORTICULTURE 2 (1+1)

Objectives:

- To learn about the importance, branches, layout of an orchard, special horticulture techniques for horticultural crops.
- To learn about the sexual and asexual Propagation techniques.

Learning Outcome:

- After completion of this course, the students will acquire basic knowledge about the fundamental aspects of horticulture. The students in turn will find it easier to undergo other horticultural courses in the following semesters.

Theory

Unit I	:	**Basic concepts of Horticulture:** Horticulture - Its definition and branches, importance and scope. Horticultural and botanical classification. Climate and soil for horticultural crops.
Unit II	:	**Propagation Methods and Structures:** Plant propagation-methods and propagating structures. Seed dormancy, Seed germination, principles of orchard establishment.
Unit III	:	**Training and Pruning:** Principles and methods of training and pruning, juvenility and flower bud differentiation, unfruitfulness.
Unit IV	:	**Pollination:** Pollination, Pollinizers and Pollinators. Fertilization and Parthenocarpy. Medicinal and Aromatic plants.
Unit V	:	**Growth regulators:** Importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

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

Theory Schedule:

1. Horticulture - Its definition.
2. Branches of Horticulture.
3. Importance and Scope of horticulture.
4. Horticultural and botanical classification.
5. Climate and soil for horticultural crops.

6. Plant propagation-methods and propagating structures.
7. Seed dormancy, Seed germination.
8. Principles of orchard establishment.
9. Principles and methods of training.
10. Principles and methods of pruning.
11. Juvenility and flower bud differentiation, Unfruitfulness.
12. Pollination, Pollinizers and Pollinators, Fertilization and Parthenocarpy.
13. Medicinal and Aromatic plants.
14. Importance of plant bio-regulators in horticulture.
15. Irrigation – methods.
16. Fertilizer application in horticultural crops.

Practical Schedule:

1. Identification of horticultural crops.
2. Acquiring knowledge about Layout and planting of an orchard
3. Acquiring knowledge and identification of garden tools.
4. Practising Preparation of seed bed/ nursery bed
5. Practising preparation of potting mixture.
6. Practising sexual methods of propagation.
7. Acquiring knowledge about uses of plant parts used in Vegetative propagation.
8. Practising asexual propagation by different methods of Cutting and Layering.
9. Practising asexual propagation by different methods of Budding and Grafting.
10. Learning about the micropropagation techniques.
11. Practising training and pruning of fruit trees.
12. Fertilizer application in different crops.
13. Visits to commercial nurseries/orchard.
14. End semester practical examination.

References:

Text books

1. Adams C.R., K.H. Bradford, M.P. Early. 1996. *Principles of Horticulture*. CBS Publishers and Distributors, New Delhi.
2. Christopher, E.P. 2001. *Introductory Horticulture*. Biotech Books, New Delhi.
3. Edmond J.B., A.M. Musser and F.S. Andrews. 1975. *Fundamentals of Horticulture*. Tata McGraw Hill Publishing Co., New Delhi.
4. Hartman. H.T. and D.E. Kester. 1976. *Plant Propagation – Principles and Practices*. Prentice Hall of India Ltd., New Delhi.
5. Janic, J.W.H., 1988. *Horticultural Science.* Freeman and Co., San Francisco.
6. Jitendra Singh. 2011. *Basic Horticulture*. Kalyani Publishers, New Delhi.
7. Kumar, N. 1997.*Introduction to Horticulture*.Rajalakshmi Publication, Nagercoil
8. Chadha,K.L.(ICAR), 2002. *Hand book of Horticulture* . ICAR, NewDelhi
9. K.V.Peter, 2009. *Basics Horticulture*. New India Publishing Agency
10. Kausal Kumar Misra and Rajesh Kumar, 2014. *Fundamentals of Horticulture*. Biotech Books.

E- References:

1. http://aggie-horticulture,tamu.edu/propagation/propagation.html
2. http://www/britannica.com/
3. http://www.horticulture.com.au/export/hmac.asp
4. http://www.horticultureworld.net/hort-india.htm
5. http://www.fao.org/

Journals:

1. Indian Horticulture
2. Acta Horticulture
3. Indian Journal of Horticulturae
4. Scientia Horticulture
5. Journal of Horticulture Sciences and Biotechnology

I SEMESTER
17ACPU0101 FUNDAMENTALS OF CROP PHYSIOLOGY 2 (1+1)

Objective:

- To expose the students to the basic concepts and underlying application of Crop Physiology.

Learning Outcome:

- The students will learn about the basic concepts and application of crop physiology.

Theory

Unit I : **Introduction** - importance of crop physiology in agriculture. Water relations - role and its significance - diffusion - imbibition - osmosis and plasmolysis. Absorption and translocation of water and solutes. Transpiration - steward's theory of stomatal mechanism - guttation.

Unit II : **Mineral nutrition** - mechanism of nutrient uptake - physiological role - nutritional and physiological disorders and their correction - foliar nutrition. Photosynthesis - light reaction - red drop - Emerson's enhancement effect - dark reaction - different pathways - factors influencing photosynthesis.

Unit III : **Photorespiration**. Respiration - mechanism - energy budgeting - respiratory quotient - factors affecting respiration. Flowering - photoperiodism - role of phytochrome - regulation of flowering in crops - vernalization. Growth - factors influencing growth - growth analysis.

Unit IV : **Plant Growth regulators** - classification - physiological role - practical applications. Components of source and sink - yield components - Harvest index.

Unit V : **Role of environment in Crop physiology** - water stress - temperature stress - light and salt stresses - physiological changes - alleviations. Global warming - physiological effects. Abscission and senescence - types - causes - physiological and biochemical changes - regulations.

Practical

Measurement of plant water status by different methods. Estimation of stomatal index and stomatal frequency. Measurement of leaf area by different methods. Measurement of root pressure and rate of transpiration Estimation of chlorophyll stability index and RWC to screen genotypes for drought tolerance. Separation of photosynthetic pigments through paper chromatography Determination of photosynthetic efficiency in crop plants. Estimation of soluble protein content in crops to assess the photosynthetic rate in crop plants. Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA). Rapid tissue tests for: A) Nitrogen (b) Phosphorus (c) Potassium (d) Calcium (e) Iron.

Theory Schedules:

1. Introduction - importance of crop physiology in agriculture. Water relations in plants - role and its significance - diffusion – imbibitions.
2. Osmosis and plasmolysis. Absorption and translocation of water and solutes.
3. Transpiration - steward's theory of stomatal mechanism - guttation.
4. Mineral nutrition - mechanism of nutrient uptake - physiological role - nutritional and physiological disorders and their correction - foliar nutrition.
5. Photosynthesis - light reaction - red drop - Emerson's enhancement effect
6. Dark reaction - different pathways - factors influencing photosynthesis. .
7. Photorespiration. Respiration - mechanism - energy budgeting - respiratory quotient - factors affecting respiration.
8. Flowering - photoperiodism - role of phytochrome - regulation of flowering in crops - vernalization.
9. Vernalization. Growth - factors influencing growth - growth analysis.
10. Plant growth regulators - classification - physiological role - practical applications
11. Components of source and sink - yield components - Harvest index.
12. Role of environment in crop physiology - water stress - temperature stress
13. Light and salt stresses - physiological changes - alleviations. Global warming - physiological effects.
14. Abscission and senescence - types - causes - physiological and biochemical changes - regulations.

Practical Schedule:

1. Measurement of plant water status by different methods.
2. Estimation of stomatal index and stomatal frequency.
3. Measurement of leaf area by different methods.
4. Measurement of root pressure and rate of transpiration
5. Estimation of chlorophyll stability index and RWC to screen genotypes for drought tolerance.
6. Separation of photosynthetic pigments through paper chromatography
7. Determination of photosynthetic efficiency in crop plants.
8. Estimation of soluble protein content in crops to assess the photosynthetic rate in crop plants.
9. Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA).
10. Rapid tissue tests for: A) Nitrogen (b) Phosphorus (c) Potassium (d) Calcium (e) Iron

11- 13. Field visit for foliar diagnosis.

15. ESE Practical Examination

References:

Text books

1. Arvind Kumar and Purohit, S.S., 1996. *Plant Physiology*. Agrobotanical Publishers, India.
2. Bidwell, R.G.S.1974. *Plant Physiology*. Macmillan Publishing Co., Inc. New York. Collier Macmillan Publishers, London.
3. Jain, V.K., 1996. *Fundamentals of Plant Physiology*. S.Chand and Company Limited, New Delhi.
4. Kramer, P.J., 1969. *Plant and soil water relationships, a modern synthesis.* McGraw Hill Book Company, New York.
5. Nickell, L.G., 1981. *Plant Growth Regulators* : Agricultural Uses. Springer - Verlag, New York, Heidelberg, Berlin.
6. Pandey, S.N. and B.K.Sinha, 1972. *Plant Physiology*. 3rd Edition-Vikas Publishing House Private Limited, New Delhi.

I SEMESTER

17AEXU0101 RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY 2

(2+0)

Objectives:

1. To impart an idea on Rural Social situation to the students in view of learning the rural settings.
2. To offer the importance of Educational Psychology for understanding Agricultural Extension.

Learning Outcomes:

- The students can learn the Rural Social situation, their Structure and Function for effective Agricultural Extension.
- The students may be motivated towards learning, personality and good behavior.

Theory

Unit I : **Introduction:** Sociology and Rural Sociology- Meaning, Definition and Scope- Significance of Rural sociology in Agricultural Extension - Social Ecology - Rural Society-Characteristics, Differences between Rural and Urban societies.

Unit II : **Social Groups**: Classification, Characteristics, Formation and organization of groups – Role of social groups in Agricultural Extension - Social Stratification: meaning, forms, class system and cast systems - Culture -concept: their role in Agricultural Extension.

Unit III : **Social Institution**- Meaning, types and importance in Agricultural Extension - Social Change and Development. Educational Psychology: meaning, scope and importance in Agricultural Extension.

Unit IV : **Behaviour**: Cognitive, Affective, Psychomotor domain, Personality, Learning- Learning, learning experience and learning situation – meaning and definition – Elements of learning situation and its characteristics – Steps in Extension teaching.

Unit V : **Motivation**- Meaning and types, Theories of Motivation, Intelligence - Meaning, types, factors and importance in Agricultural Extension.

Theory Schedule:

1. Introduction: Sociology - Meaning, Definition and Scope.
2. Rural Sociology - Meaning, Definition and Scope.
3. Significance of Rural Sociology in Agricultural Extension and Social Ecology
4. Rural Society – Characteristics, Differences between Rural and Urban Societies.
5. Social Groups: Classification and Characteristics.
6. Formation and Organization of Groups.
7. Role of Social Groups in Agricultural Extension.
8. Social Stratification: Meaning and Forms.

9. Class System and Cast Systems.
10. Culture Concept: Their Role in Agricultural Extension.
11. Social Institution – Meaning, Types and Importance in Agricultural Extension
12. Social Change & Development
13. Educational Psychology: meaning, scope and importance in Agricultural Extension.
14. Behaviour: Cognitive, Affective, Psychomotor domain, Personality
15. Learning- Learning, learning experience.
16. Learning situation – meaning and definition
17. Elements of learning situation and its characteristics.
18. Steps in extension teaching.
19. Motivation- meaning and types.
20. Theories of Motivation
21. Intelligence - meaning, types, factors and importance in Agricultural Extension.

References:

Text books

1. Annamalai,R.(1998). *Extension Education and Programme Planning***.** Palaniappa Printers, Tirunelveli.
2. Dahama,O.P and O.P.Bhatnagar.(2008).*Education and Communication for Development*, Oxford & IBH Publishing Co., Ltd., New Delhi.
3. Ray, G.L.(2006*). Extension Communication and Management***.** Naya Prakash, Kolkata.
4. Reddy, A.A. (2001*). Extension Education*. Shree Laxmi Press, Bapatla
5. Tripathi, N.K. (2000). *Rural Sociology and Psychology in Extension Education.*
6. Supe, S.V. (1983). *An Introduction to Extension Education*. Oxford & IBM Publishing Co. Pvt. Ltd., New Delhi.
7. Chitamber, J.B. (1997). *Introducing Rural Sociology***,** Weily Eastern Ltd., New Delhi.
8. Mangal, S.K. (2000). *Educational Psychology*, Prakash Brothers, Ludhiana.

I SEMESTER

17AGLU0101 COMPREHENSION & COMMUNICATION SKILLS IN ENGLISH

2 (1+1)

Objective:

- To impart students on communication skills and to be well talented on vocabularies and grammatical knowledge

Learning Outcome:

- The students are well equipped on Communication skills, grammatical knowledge and handling of interviews.

Theory

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

Unit II : **Reading Comprehension**, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. (Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations.)

Unit III : **Functional grammar**: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis.

Unit IV : **Direct and Indirect Narration**. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing.

Unit V : **The Style: Importance of Professional writing**. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical

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

Theory Schedule:

Lecture 1-4	**:**War Minus Shooting
Lecture 5-7	**:**A Dilemma
Lecture 8-10	**:** You and Your English
Lecture 11-12	**:** Grammar Components
Lecture 13-15	**:** L/S/R/W Skills

Practical Schedule:

Practical 1-3	**:** Listening Practice (Intensive & Extensive)
Practical 4-5	**:** Speaking Practice (Oral Communication/ stress / intonation)
Practical 6	**:** Model Conversation Practice
Practical 7-9	**:** Reading Practice (Skimming & Scanning)
Practical 10	**:** Presentation Skill practice (Handout preparation)
Practical 11-13	**:** Writing Practice (note-taking/ precise writing / abstract/article writing
Practical 14	**:** Curriculum Vitae / Group discussion
Practical 15	**:** Mock interview Practice
Practical 16	**:** End Semester Examination

References:

Text books

1. Greebaum Sidney, *Oxford English Grammar,* New Delhi, Oxford University Press.Peregoy,2009.
   Sahaneya Wandy, et.al., *IELTS, Preparation and Practice,* Oxford University Press. 2005.

I SEMESTER
REMEDIAL COURSE
17AGBU0101 INTRODUCTORY BIOLOGY 2 (1+1)

Objectives:

- To induce the basics botany among the beginners of Agricultural Programme
- To impart students on classification, Morphology of flowering plants and characteristic features

Learning Outcome:

- Students will gain knowledge on basic botany and its role in agriculture

Theory

Unit I : **Introduction to the living world**. Diversity and characteristic features of plant, animal and microbes.

Unit II : **Origin and Evolution of life**. Theories supported for the evolution of life. Eugenics: positive and negative structure, cell division.

Unit III : **Classification of Flowering plants**. Natural and artificial systems. ICBN principles and recommendation.

Unit IV : **Morphology of Flowering plants**. Rose, stem leaf, flower and fruits. Seed morphology and germination.

Unit V : **Characteristics features** and economic important of the following families. Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

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

Theory Schedule:

1. Introduction to the living world
2. Diversity and characteristics of life
3. Origin of life, Evolution
4. Eugenics
5. Binomial nomenclature
6. Classification
7. Cell
8. Cell division
9. Morphology of flowering plants

10. Morphology of flowering plants
11. Seed and seed germination
12. Plant systematic- Brassicaceae, Fabaceae
13. Plant systematic- Poaceae.
14. Role of animals in agriculture

Practical Schedule:

1. Morphology of flowering plants – Root, Stem
2. Morphology of flowering plants – leaf and their medications
3. Inflorescence
4. Flower and fruits
5. Cell, tissues
6. Cell division
7. Internal structure of Root, Stem
8. Internal structure of leaf
9. Study of specimens and slides.
10. Study of specimens and slides.
11. Description of plants – Brassicaceae
12. Description of plants – Fabaceae
13. Description of plants – Poaceae

References:

Text books

1. Sharma, O.P.2013. *Plant Taxonomy*, McGraw Hill education Pvt Ltd., New Delhi
2. Pandey, S.W and Sinha , B.K. *Plant Physiology* , Narosa Publishing House, New Delhi
3. Verma, P.S and Agarwal , V.K. *Cell biology, Genetics and Molecular Biology* , *Evolution and Ecology* , S.Chand and company , New Delhi.

I SEMESTER
REMEDIAL COURSE
17AMMU0101 ELEMENTARY MATHEMATICS 2 (2+0)

Objectives:

- To offer Basic Mathematics for the students coming from Non Mathematics stream
- To create confidence to solve the problems relevant to Agricultural Sciences

Learning Outcome:

- The students have gained knowledge on basic mathematics and how to solve problems relevant to agricultural sciences.

Unit I : **Matrices and Determinants:** Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3^{rd} order, Properties of determinants up to 3^{rd} order and their evaluation**.**

Unit II : **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 III : **Circle:** Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.

Unit IV : **Differential Calculus :** Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n, e^x, sin x & cos x from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions 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 V : **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).

Theory Schedule:

1. Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication,
2. Transpose
3. Inverse up to 3^{rd} order
4. Properties of determinants up to 3^{rd} order and their
5. Evaluation**.**
6. 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
7. Slope-intercept form of equation of line, Slope-point form of equation of line,
8. Two point form of equation of line, Intercept form of equation of line,
9. Normal form of equation of line, General form of equation of line,
10. Point of intersection of two st. lines
11. Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines
12. Area of triangle and quadrilateral.
13. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points,
14. Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2,y_2),
15. Tangent and Normal to a given circle at given point (Simple problems)
16. Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2= a^2$.
17. Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity
18. Differentiation of x^n , e^x, sin x & cos x from first principle, Derivatives of sum, difference, product and quotient of two functions,
19. Differentiation of functions of functions (Simple problem based on it),
20. Logarithmic differentiation (Simple problem based on it),
21. Differentiation by substitution method and simple problems based on it,
22. Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form y=f (x) (Simple problems based on it).
23. Integral Calculus : Integration of simple functions,
24. Integration of Product of two functions,
25. Integration by substitution method,
26. Definite Integral (simple problems based on it),
27. Area under simple well-known curves (simple problems based on it).

References:

Text books

1. Manickavasagam Pillai T.K., T.Natarajan and K.S. Ganapathy. *Algebra, Vol. II*, S.Viswanathan Printers, 2006
2. Manickavasagam Pillai T.K., T.Natarajan, *Analytical Geometry – Part I, Two Dimensions*, S.Viswanathan Printers, 2011
3. Manickavasagam Pillai T.K., T.Natarajan, *Calculus, Vol. I & II*. S.Viswanathan Printers, 2014

I SEMESTER
REMEDIAL COURSE
17AGRU0102 AGRICULTURAL HERITAGE 1 (1+0)

Objectives:

To enable the student to

1. Understand the importance of Agricultural heritage
2. Know about the value of Indigenous knowledge in agriculture
3. Familiarize the students about current scenario of Indian Agriculture

Learning Outcome:

- The students have gained the basic knowledge about agricultural history of India.
- They have been familiarized with the indigenous knowledge and present scenario of Indian agriculture.

Theory

Unit I : **Agricultural heritage**- Introduction, definition of agricultural heritage- Need and importance of Agricultural heritage- Historical facts- Relevance of heritage to present day Agriculture.

Unit II : **Ancient agricultural practices**- Past and present status of agriculture- Vedic civilization- Agriculture and Kaudilya's Artha sasthra- Agriculture in sangam literature- Tholkappium, Thirukkural and Avvaiyar.

Unit III : **Journey of Indian agriculture** and its development from past to modern era- History of agriculture- Development of agriculture in World and India- Important International Institutions for Agricultural research .

Unit IV : **Indigenous Traditional Knowledge** (ITK)**:** Plant production and Plant protection through Indigenous traditional knowledge- Crop voyage in India and World- Agricultural scope-Importance of Agriculture- Branches of Agriculture- Agricultural resources available in India.

Unit V : **Classifications of crops**- Major crops of India and Tamil Nadu- National Agriculture setup in India- Current scenario of Indian agriculture- Indian Agricultural concerns and future prospects

Theory Schedule:

1. Introduction to Indian agricultural heritage- Definition- heritage and Agricultural heritage-Need and importance of studying Agricultural heritage-Historical facts.
2. Ancient agricultural practices- development of human culture- Paleolithic stage(Old stone age)-Mesolithic period- Chalcolithic culture (Bronze age)- Iron age
3. Agriculture and allied activities in ancient India and Tamil Nadu- The vedic civilization- Pastoralism- crops cultivated in vedic period- role of women in agriculture during vedic period- Agriculture and Kaudilya's Artha –sastra
4. Agriculture in sangam literature of Tamil Nadu- Tholkappium- land classification, seasons, cultivated crops and importance of Agriculture- Irrigation- agricultural tools and implements, seeds, crop rotation, threshing and marketing .
5. Sangam literature of Tamil Nadu –Thirukkural and importance of agriculture- sowing, manuring, irrigation, weeding and care of crops- Avvaiyar- Aathisoodi, Kondraiventhan and Nalvazhi.
6. Journey of Indian agriculture and its development from past to modern era- History of agriculture- Development of scientific agriculture in World- advances in agriculture in 19^{th} Century
7. Development of scientific agriculture in India- 1880 to 1962 and till date- National Institutions for Agricultural research- Important International Institutions for Agricultural research
8. Plant production and Plant protection through Indigenous traditional knowledge
9. Crop voyage in India and World
10. Agricultural scope-Importance of Agriculture- Branches of Agriculture- Agricultural resources available in India
11. Major crops of India and Tamil Nadu – Classifications of crops- Based on origin, life cycle, place of occurrence, economic/commercial classification and Agronomic classifications
12. National Agriculture setup in India- Current scenario of Indian agriculture
13. Indian Agricultural concerns and future prospects

References:

Text books

1. Gopal Chandra De, 1997.*Fundamentals of Agronomy*.Oxford and IBH publishing Co.Pvt.Ltd., New Delhi
2. ICAR, 1996. *Hand book of Agriculture*. Indian Council of Agriculture Research, New Delhi
3. Reddy , S.R. 1999. *Principles of Agronomy*. Kalyani Publishers, New Delhi.
4. Sankaran , S and V.T.Subbiah Mudaliar, 1997. *Principles of Agronomy*. The Bangalore Printing and Publishing Company ltd., Bangalore
5. Singh, S.S. 1998. *Principles and Practices of Agronomy*. Kalyani publishers, New Delhi
6. Sivanappan, R.K and Karaigowder, 1997. *Irrigation and Drainage*. Popular Book Depot, Chennai.

E- References:

1. http:/icar.res.in
2. www.webcast.gov.in
3. www.icar.org.in/nasm.html

I SEMESTER
NON-GRADIAL COURSE
17GTPU0001 GANDHI'S LIFE, THOUGHT AND WORK 2 (2+0)

Objectives:

To enable students to understand and appreciate the principles and practices of Gandhi and their relevance in the contemporary times.

- To develop character and attitude to follow Gandhian values and responsibilities in their personal and social life.

Specific Objectives of Learning:

This will make the students:

1. To understand the life of Gandhiji in-depth.
2. To get introduced to the relevant Gandhian philosophies.
3. To apply the Gandhian concepts in the relevant context.
4. To envision the Gandhian socio-economic, political and cultural ideas.
5. To get educated on Gandhian lines in a multi-dimensional way.

Learning Outcome:

- The students have learnt the Gandhiji's life in depth and his philosophies
- The students have learnt the socio economic, cultural and political concepts of Ghandhiji in a multidimensional way.

Theory

Unit I : **Life of Gandhi in brief**: Early life in India – London Phase – South African Adventure – Struggle for total freedom in India – Martyrdom

Unit II : **Concepts of Gandhi's Philosophy**, Truth and Nonviolence, Ends and Means, Rights and Duties, Simple Living and High Thinking

Unit III : **Gandhi's concepts** and their applications: Sarvodaya, Satyagraha, Santi Sena Constructive Work

Unit IV : **Gandhian Vision of Society**: Self and society – Communal harmony, removal of untouchability and Equality of sexes – Politics: Decentralization of power, Gram Swaraj (Panchayati Raj) and good governance – Economics of Swadeshi, Trusteeship, Bread Labour and Self-employment.

Unit V : **Gandhian Dimensions of Education**: Basic Education, Adult Education, Pluralism – Multilingualism, Religions and interfaith relations- Health; Diet, Nature Cure, Education on Health, Sanitation and Hygiene.

Theory Schedule:

1. Life of Gandhi in brief:
2. Early life in India
1. London Phase
2. South African Adventure
3. Struggle for total freedom in India
4. Martyrdom
5. Concepts of Gandhi's Philosophy
6. Truth and Nonviolence
7. Ends and Means, Rights and Duties
8. Simple Living and High Thinking
9. Gandhi's concepts and their applications: Sarvodaya, Satyagraha,
10. Santhi Sena , Constructive Work
11. Gandhian Vision of Society
12. Self and society
13. Communal harmony, removal of untouchability
14. Equality of sexes
15. Politics:Decentralization of power,
16. Gram Swaraj (Panchayati Raj) and good governance
17. Economics of Swadeshi, Trusteeship
18. Bread Labour and Self-employment
19. Gandhian Dimensions of Education: Basic Education
20. Adult Education,
21. Pluralism – Multilingualism
22. Religions and interfaith relations- Health; Diet,
23. Nature Cure, Education on Health,
24. Sanitation and Hygiene.

References:

Text books

1. M.K. Gandhi: (1983), *An Autobiography or the Story of My Experiments with Truth,* Navajivan Publishing House, Ahmadabad.
2. M.K. Gandhi: (1951), *Satyagraha in South Africa*: Navajivan Publishing House, Ahmadabad.
3. M.K. Gandhi: (1983), *Constructive Programme" Its Meaning and Place*. Navajivan Publishing House, Ahmadabad.
4. M.K. Gandhi: (1948) *Key to Health*, Navajivan Publishing House, Ahmadabad.
5. M.K. Gandhi: (1949), *Diet and Diet Reform*, Navajivan Publishing House, Ahmadabad.
6. M.K. Gandhi: *Basic Education*, Navajivan Publishing House, Ahmadabad.

7. M.K. Gandhi: (2004), *Village Industries*, Navajivan Publishing House, Ahmadabad.
8. M.K. Gandhi: (1962), *Hind Swaraj, Navajivan Publishing House*, Ahmadabad.
9. M.K. Gandhi: (2004), *Trusteeship*, Navajivan Publishing House, Ahmadabad.
10. M.K. Gandhi: (2001), *India of my Dreams*, Navajivan Publishing House, Ahmadabad.
11. M.K. Gandhi: *Self Restraint Vs. Self Indulgence*, Navajivan Publishing House, Ahmadabad.
12. K.Arunachalam: Gandhi: (1985), *The Peace Maker*, Gandhi Samarak Nidhi, Madurai.
13. R.K. Prabhu & UR Rao. *The Mind of Mahatma Gandhi*, Navajivan Publishing House.

I SEMESTER
NON-GRADIAL COURSE
17SHSU0001 SHANTI SENA 1 (0+1)

Objectives:

1. To introduce the Concept of Shanti Sena (Peace Brigades) to the students
2. To give exposure and training to students in the skills needed for Shanti Sena

Learning Outcome:

1. This will enable the students to comprehend the concept of Shanti Sena and alternative defence in their social life
2. This will shape them to be peace makers in the context of growing violent conflicts.

Theory

Unit I : **Shanti Sena**: Meaning and conceptual frame work – historical development.

Unit II : **Shanti Sena in India and abroad**: Contributions of Mahatma Gandhiji, Khan Abdul Ghaffar Khan, Vinoba Bhave and Jeyaprakash Narayan.

Unit III : **Organisation and functions of Shanti Sena**: Shanti Kendras, All India Shanti Sena Mandal; Peaceful resolution of conflicts, Peace Making, Alternative to Defense and Violence.

Unit IV : **Experiments in Modern times**: World Peace Brigade, Peace Brigade International, U.N. Peace Keeping Force, Truth and Reconciliation Commission and Experiments of Gandhigram Rural Institute.

Unit V : **Skills and Training for Shanti Sena**: Skills of First Aid and Skills for disaster management, Peace Making Skills (Conflict Resolution and Counseling) and Transforming oneself into a Shanti Saink.

References:

Text books

1. Vinoba Bhave (1961), *Shanti Sena,* Akhil Bharat Sarva Seva Sangh Prakashan, Varanasi.
2. K.Arunachalam (1985), *Gandhi – The Peace Maker,* Gandhi Smarak Nidhi, Madurai.
3. Suresh Ram, *Vinoba and his Mission*, Sarva Seva Sangh Prakashan, Varanasi.
4. Narayana Desai, (1972), *Towards Non-Violent Revolution*, Sarva Seva Sangh Prakashan, Varanasi.
5. Naraya Desai, (1963), *A Hand Book for Shanti Sainiks*, Sarva Seva Sangh Prakashan, Varanasi.
6. Naraya Desai, (1962), *Shanti Sena in India*, Sarva Seva Sangh Prakashan, Varanasi.
7. Dr.N.Radhakrishnan, (1989), *Gandhi and Youth*: The Shanti Sena of GRI, Gandhigram Rural Institute, Gandhigram.

8. Dr.N.Radhakrishnan, (1997), *Gandhian Nonviolence: A Trainer's Manual*, Gandhi Smiriti and Darshan Samiti, New Delhi.

I SEMESTER
NON-GRADIAL COURSE
17NSSU0001 NATIONAL SERVICE SCHEME 1 (0+1)

Objectives:

- To impart knowledge for students on cooperation, developing leadership among them and inculcating knowledge on helping others

Learning Outcome:

- The students have learnt leadership qualities and able to work in an cooperative environment
- They have emerged as an youngest citizens to do various welfare activities for the society

Practicals:

Course aims at evoking social consciousness among students through various activities *viz.,* working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.
Following activities are to be taken up under the NSS course:

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
- Understanding youth
- Community 34obilization
- Social harmony and national integration
- Volunteerism and shramdan
- Citizenship, constitution and human rights
- Family and society
- Importance and role of youth leadership
- Life competencies
- Youth development programmes
- Health, hygiene and sanitation
- Youth health, lifestyle, HIV AIDS and first aid
- Youth and yoga
- Vocational skill development
- Issues related environment
- Disaster management
- Entrepreneurship development
- Formulation of production oriented project
- Documentation and data reporting
- Resource mobilization
- Additional life skills

Activities directed by the Central and State Government All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

National Service Scheme I

Introduction and basic components of NSS

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, NSS volunteers' awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, 35obilizat guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community 35obilization

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of 35obilization involving youth-adult partnership

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights

Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

Concept of family, community (PRIs and other community based 35obilization35) and society

National Service Scheme II

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led 36obilization36

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

National Service Scheme III

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

National Service Scheme IV

Youth and crime

Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring in preventing crime and awareness for juvenile justice

Civil/Self defense

Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource 37obilization

Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

References:

Text books

1. *National Service Scheme Manual*, 1997. Department of Youth Affairs and Sports, Ministry of Human Resource Development, Government of India.
2. Supe, S.V. 1995, *Extension Education*, Sterling Publications, Madras
3. Advi Reddy, 1996, *Extension Education* , Babatal Publications, Hyderabad
4. Narayanasamy N, M.P.Boraian and R. Ramesh. 1997. *Participatory Rural Appraisal*, GRU, Gandhigram

I SEMESTER
NON-GRADIAL COURSE
17SPOU0001/17YOGU0001 PHYSICAL EDUCATION AND YOGA PRACTICES
1 (0+1)

Objectives:

- To indulge students on various games and to develop their talents and interest.
- To educate students on physical fitness, yoga and health consciousness.

Learning Outcome:

- The students will get motivated towards any type of games and its regulations
- The students will get educated towards physical fitness and health awareness

Practicals:

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
3. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
4. Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
5. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
6. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
9. Teaching of some of Asanas – demonstration, practice, correction and practice
10. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation with teaching of rules of the game
11. Teaching – Meaning, Scope and importance of Physical Education
12. Teaching – Definition, Type of Tournaments
13. Teaching – Physical Fitness and Health Education
14. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

Note:

1. Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants)
2. The games mentioned in the practical may be inter changed depending on the season and facilities.

References:

Text books

1. *Track and Field* by C.Thirunarayanan and S. Harihara Sharma
2. *Track and Field* by Mariyyah
3. *Essentials of Exercise Physiology* by Larry G.Shaver
4. *Organization of Physical Education* by J.P. Thomas
5. *Methods in Physical Education* by S. Harihara Sharma
6. *Principles of Physical Education* by R.C. Sathiyanesan
7. *The Complete Book of First Aid* by John Handerson
8. *The Official Rules book of Basketball, Football, Hockey, Volley ball, Kabbadi Federations of India.*

.II SEMESTER

17APBU0201 FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY 3 (2+1)

Objectives:

- To offer the basics of plant biochemistry.
- To teach the basic concepts and applications of biotechnology

Learning Outcome:

- The students will learn about the fundamentals of biochemistry and use of biotechnological tools in crop improvements and their functions.

Theory

Unit I : **Importance of Biochemistry**. Properties of water, pH and Buffer. Carbohydrate: importance and classification. Structure of Monosaccharides, Reducing and oxidizing properties of monosaccharides, Mutarotations; Structures of Disacchaarides and poly saccharides. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain.

Unit II : **Lipid: Importance and classification**; Structures and properties of fatty acids; storage lipids and membrane lipids. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids. Proteins: Importance of proteins and classification. Structure of proteins. Properties and reactions of proteins.Structural organization of proteins Amino acids - classification and structure. Essential amino acids, properties of amino acids.

Unit III : **Enzymes – classification and nomenclature**. Mechanism of enzyme action. Factors affecting enzyme action. Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure.

Unit IV : **History and concepts of plant biotechnology**, morphogenesis-organogenesis and embryogenesis, tissue culture techniques-callus and suspension cultures, Micro-propagation methods; shoot tip and meristem tip culture, anther and pollen culture, ovule and embryo culture and protoplast culture. Somatic hybridization and Cybrids, Invitrogermplasm conservation – Cryopreservation.

Unit V : **Recombinant DNA methods** :Physical (Gene gun Method) , chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; PCR techniques and its applications ; RFLP, RAPD ,SSR; Marker assisted breeding in crop improvement.

Practical

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

Theory Schedule:

1. Introduction to Biochemistry , Properties of Water, pH and Buffer
2. Carbohydrates - Importance and Classification
3. Structure of monosaccharides ,Disaccharides, Oligosaccharides and Polysaccharides
4. Physical properties of carbohydrates - Mutarotation, optical activity, isomerism
5. Carbohydrate metabolism - Glycolysis - Reactions and bioenergetics
6. TCA cycle - Reactions and Bioenergetics , Glyoxylate cycle
7. Respiration - Electron Transport Chain
8. Lipids – Importance and Classification , Storage lipids , Structural lipids
9. Beta-oxidation of Fatty acids and Bioenergetics
10. Biosynthesis of Fattyacids and Triacylglycerol
11. Fatty acids – Structure and Properties
12. Protein -structure , Importance and Classification
13. Amino acids - Classification and Structure , Properties
14. Enzymes - Properties, Classification and Mechanism of enzyme action.
15. Factors affecting enzyme activity and Enzyme inhibition - Allosteric enzymes
16. Nucleosides, Nucleotides and Structure of DNA
17. Structure, Types and Functions of RNA
18. Concepts of Plant Biotechnology
19. History of Plant Tissue Culture: Scope and Importance
20. Regeneration methods - Totipotency , Morphogenesis, Organogenesis and Embryogenesis
21. Micropropagation Methods
22. Culture types - Callus culture and Cell suspension culture; Shoot tip and Meristem tip culture
23. Anther and Pollen culture; Ovule and Embryo culture
24. Protoplast isolation and fusion- Somaclonal variation-Synthetic seeds
25. *Invitro*germplasm conservation - Cryo-preservation
26. Recombinant DNA Methods : Physical (Gene gun Method) , chemical (PEG Method)
27. Direct gene transfer methods in plants: *Agrobacterium* mediated method
28. Transgenic plants and their applications
29. DNA markers - Hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP
30. Marker assisted breeding in crop improvement.

Practical Schedule:

1. Preparation of standard solutions and buffer solutions
2. Determination of pH.
3. Qualitative test of carbohydrates
4. Estimation of total sugars
5. Estimation of proteins – Lowry' method
6. Estimation of total free amino acids
7. TLC separation and Identification
8. Laboratory organization and sterilization techniques
9. Preparation of stock solutions for MS medium
10. Meristem tip culture, Shoot tip culture
11. Anther culture , Embryo culture
12. Plant Genomic DNA isolation
13. Agarose gel electrophoresis
14. ESE Practical Examination

References:

Text books

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6. Malacinski, M. and D. Friefelder. 2003. *Essentials of molecular biology*. IV Ed.Jones and Bartlett publishers, Boston
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II SEMESTER
17AGBU0202 AGRICULTURAL MICROBIOLOGY 2 (1+1)

Objectives:

- To impart in depth information on soil and agricultural microbiology
- To make the students understand the role of microbes in agriculture
- To give an overview on plant microbe interaction. To understand infection process and control measures
- To know the importance of Biofertilizers and Biopesticides

Learning Outcomes:

- The students will get acquainted on soil and microbes roll in agriculture
- They may get an overall knowledge on importance of biofertilizers, biopesticides and control measures

Theory

Unit I : **Introduction**: Microbial World: Prokaryotic and Eukaryotic microbes. Bacteria: Cell structures

Unit II : **Chemo Autotrophy**: Photo autotrophy, Growth. 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 : **Biological Nitrogen Fixation**: Symbiotic, Associative and Asymbiotic. Azolla, Blue Green Algae and *Mycorrhizae*, Rhizosphere and Phyllosphere.

Unit V : **Microbes in Human welfare**: Silage production, Biofertilizer, Biopesticides, Biofuel production and Biodegradation of agro waste.

Practical

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

Theory Schedule:

1. Introduction, Microbial World: Prokaryotic and Eukaryotic microbes
2. Bacteria: cell structures
3. Autotrophy, Photo autotrophy, Growth
4. Genetics: Genetic recombination
5. Transformation, conjugation and transduction
6. Plasmids and transposon
7. Role of microbes in Soil fertility and crop production
8. Carbon, Nitrogen Cycles
9. Phosphorus and Sulphur cycles.
10. Biological Nitrogen Fixation- Symbiotic
11. BNF: Associative and Asymbiotic Azolla, Blue Green Algae
12. Mycorrhiza, Rhizosphere and Phyllosphere
13. Microbes in human welfare: Silage production, Biofertilizer
14. Biopesticides, Biofuel production
15. Biodegradation of agro waste

Practical Schedule:

1. Introduction to microbiology laboratory and its equipments
2. Microscope: parts, principles of microscopy, resolving power, numerical aperture
3. Micrometry: measurement of the cells
4. Nutritional media and their preparation
5. Sterilization techniques: Autoclave, Hot air oven
6. Isolation and enumeration of microbial population in soil- Bacteria, fungi and actinomycets
7. Purification and preservation of microbial cultures
8. Isolation of Rhizobium from legume root nodule
9. Authentification Techniques of *Rhizobium*
10. Isolation of *Azotobacter* from soil
11. Isolation of *Azospirillum* from soil
12. Isolation of BGA
13. Gram staining and microscopic examination of microbes
14. ESE Practical Examination

References:

Text books

1. Jamaluddin et al 2013 *Microbes and Sustainable Plant Productivity*, Scientific Publishers, Jodhpur, India
2. SubbaRao, N.S. 1997. *Biofertilizers in Agriculture and Forestry*, III Ed., Oxford & IBH Publishing Co.Pvt.Ltd., New Delhi
3. SubbaRao, N.S. 1995. *Soil Microorganisms and Plant Growth*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

4. Martin Alexander 1983. *Introduction to Soil Microbiology*. Wiley Eastern Ltd., New Delhi
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4. https://www.microbes.info/resource-topic/agricultural-microbiology

II SEMESTER

17AENU0201 FUNDAMENTALS OF ENTOMOLOGY 4 (3+1)

Objectives:

- To acquaint the students with external morphology of the insect, basic aspects of anatomy of different systems and identification of insects up to family level with hands-on experience.
- To familiarize the students with concept of IPM, insecticide classification and their formulations and recent methods of pest control.

Learning Outcome:

1 Know about arthropods and especially insects with their morphological features
2 Identify insects of economic importance and acquire working skills for collecting, mounting, and preserving insects
3 Know about pesticide classification and their formulations and maintenance of pesticide appliances

Theory

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

Unit 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.

Unit III : **Categories of pests.** Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control importance, hazards and limitations. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids.Symptoms of poisoning, first aid and antidotes.

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

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

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Theory Schedule:

1. History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom
2. Classification of phylum Arthropodaupto classes
3. Relationship of class Insecta with other classes of Arthropoda
4. Morphology: Structure and functions of insect cuticle
5. Moulting process in insects
6. Body segmentation. Structure of Head, thorax and abdomen
7. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus
8. Structure of male and female genital organ
9. Metamorphosis and diapause in insects
10. Types of larvae and pupae
11. Structure and functions of Digestive system
12. Structure and functions of Circulatory system
13. Structure and functions of Excretory system
14. Structure and functions of Respiratory system

15. Structure and functions of Nervous,secretary (Endocrine)
16. Structure and functions of Reproductive system
17. Types of reproduction in insects
18. Major sensory organs like simple and compound eyes, chemoreceptor
19. Insect Ecology: Introduction, Environment and its components
20. Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents
21. Effect of biotic factors – food competition, natural and environmental resistance
22. Categories of pests
23. Concept of IPM, Practices, scope and limitations of IPM
24. Classification of insecticides, toxicity of insecticides and formulations of insecticides
25. Chemical control importance, hazards and limitations
26. Recent methods of pest control, repellents, anti feedants, hormones, attractants, gamma radiation
27. Insecticides Act 1968- Important provisions
28. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes
29. Systematics: Taxonomy –importance, history and development and binomial nomenclature
30. Definitions of Biotype, Sub-species, Species, Genus, Family and Order
31. Classification of class Insecta upto Orders
32. Basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae
33. Dictyoptera: Mantidae, Blattidae
34. Odonata; Isoptera: Termitidae; Thysanoptera:Thripidae
35. Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae
36. Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae
37. Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae
38. Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae

Practical Schedule:

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 and their families of agricultural importance
9. Study of characters of orders Hemiptera, Lepidoptera, Neuroptera and their families of agricultural importance
10. Study of characters of orders Coleoptera, Hymenoptera, Diptera and their families of agricultural importance
11. Insecticides and their formulations
12. Pesticide appliances and their maintenance
13. Sampling techniques for estimation of insect population and damage
14. ESE Practical Examination

References:

Text books

1. Borror, D.J., D.M. Delong and C.A. Triple Horn. 1976. *An Introduction to the Study of Insects (IV Edition)*. Holt, Rinehart and Winston, New York, 852 p.
2. Chapman, R.F. 1981. *The Insects: Structure and Function.* Edward Arnold (Pub.) Ltd., London. 919 p.
3. Nayar, K.K., T.N. Ananthakrishnan and B.V. David. 1976. *General and Applied Entomology*, Tata McGraw Hill Publishing Company Limited, New Delhi, 589 p.
4. Pedigo, L.P. 1999. *Entomology and Pest Management. III Edition*. Prentice Hall, New Jersey, USA, 691 p.
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6. Saxena, S.C. 1992. *Biology of Insects*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 366 p.
7. Selvanarayanan, V. and S. Arivudainambi. 2004. *Introductory Entomology*, Manivasagar Padhippagam, Chennai. 262 p.

II SEMESTER

17APPU0201 FUNDAMENTALS OF PLANT PATHOLOGY 4 (3+1)

Objective:

- To facilitate the students to learn and understand the plant disease causing agents, their properties and management practices of crop plants

Learning Outcome:

1. Understanding the Development and History of plant pathology
2. Understanding Terms, Concepts and Classification of plant Diseases
3. Understanding the important disease causing agents and their basic symptoms
4. Understanding the principles of plant disease management

Theory

Unit I : **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 II : **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 III : **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 IV : **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.) Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens.

Unit V : **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**.**

Theory Schedule:

1 Introduction: Importance of plant diseases,
2 Scope and objectives of Plant Pathology.
3 History of Plant Pathology with special reference to Indian work.
4 Terms and concepts in Plant Pathology.
5 Pathogenesis. Causes / factors affecting disease development
6 Disease triangle and tetrahedron and classification of plant diseases.
7 Important plant pathogenic organisms,
8 Different groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa,
9 Phanerogamic parasites and nematodes with examples of diseases caused by them.
10 Diseases and symptoms due to abiotic causes.
11 Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus,
12 Reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature,
13 Classification of fungi. Key to divisions, sub-divisions, orders and classes.
14 Bacteria and mollicutes: general morphological characters.
15 Basic methods of classification and reproduction.
16 *Viruses*: nature, structure, replication and transmission.
17 Study of phanerogamic plant parasites.
18 *Nematodes:* General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera, Meloidogyne*, *Anguina, Radopholus*etc.)
19 Growth and reproduction of plant pathogens.
20 Liberation / dispersal and survival of plant pathogens.
21 Types of parasitism and variability in plant pathogens.
22 Pathogenesis. Role of enzymes, toxins and growth regulators in disease development
23 Defense mechanism in plants**.**
24 Epidemiology: Factors affecting disease development.
25 Principles and methods of plant disease management.
26 Nature, chemical combination,
27 Classification, mode of action and formulations of fungicides and antibiotics.

Practical Schedule:

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

References:

Text books

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2. Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 1996, 1989. *Introductory Mycology, 4th Edn.,* Wiley Eastern Ltd., New Delhi.
3. Mehrotra, R.S.1990. *Plant Pathology*, Wiley Eastern Ltd., New Delhi.
4. Dasgupta, M.K. 1988. *Principles of Plant Pathology*. Allied Publishers Pvt. Ltd., Bangalore.
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7. Prakasam.V., V.Valluvaparidasan, T. Raguchander and K. Prabakar. 1997. *Field Crop Disease*s. AE Publication, Coimbatore.

II SEMESTER

17AGEU0201 SOIL AND WATER CONSERVATION ENGINEERING 2 (1+1)

Objectives:

1. To understand the different types of erosion and its control measures
2. To learn Suitable soil conservation measures under different land slopes
3. To identify suitable vegetative species to control soil erosion as well as wind erosion

Learning Outcome:

1. The students can learn different types of erosion due to water and wind.
2. The students can learn different types of gully control structures and its suitability.
3. The students can learn to estimate soil loss by using USLE.
   The students can learn the control methods of soil erosion.

Theory

Unit I : **Introduction to Soil and Water Conservation** – History of soil erosion, Soil Conservation Programmes in India- Causes of soil erosion; Definition and Agents of soil erosion; Types of erosion – Raindrop, Sheet, Rill, Gully and Stream channel erosion.

Unit II : **Gully classification**; Gully control methods – Vegetative control method - sod flume, sod check, shrub check, trees and shrubs ; Temporary gully control structures – brush dam , loose rock dam, plank or slab dam and log and pole dams; Permanent gully control structures – drop spill way, chute spill way and drop inlet spill way.

Unit III : **Soil loss estimation** by Universal soil loss equation - Application of USLE – Assessment of erosion hazard; Measurement of soil loss – Runoff plots - Multi slot divisor and Coshocton wheel silt sampler.

Unit IV : **Principles of Erosion control** – Land capability classification -Contour farming, Contour bunding and Graded bunding, Broad-base ridge type terrace, Bench terrace; Vegetated water ways- Functions, location and design.

Unit V : **Wind erosion** – causes of wind erosion - different phases of soil movement - Types of soil movement; Control of wind erosion – cultivated crops, field and contour stripping, wind- break, shelter belt, tillage practices and formation and stabilization of sand dunes.

Practical

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

Theory Schedule:

1. Soil erosion- definition and agents of soil erosion; causes of soil erosion
2. Types of erosion and factors affecting erosion
3. Gully classification and vegetative control method
4. Temporary gully control structures
5. Permanent gully control structures
6. Soil loss estimation by ULSE
7. Application of ULSE and assessment of erosion hazard
8. Erosion control methods – Land use capability classification
9. Contour farming, contour bunding and graded bunding
10. Terracing – broad base ridge type terrace and bench terracing
11. Vegetated water ways – functions, location
12. Wind erosion- definition, causes of wind erosion
13. Different phases of soil movement and types of soil movement.
14. Permanent wind erosion control methods.
15. Sand dunes – stabilization, suitable tree species.

Practical Schedule:

1. Visit to Institute of Indian Soil and Water Conservation Research Centre, Ooty- for studying soil and water conservation programmes its development and Status
2. Estimation of soil loss by using Universal soil loss equation
3. Estimation of peak run off rate by using Rational method
4. Draw and indicate components of temporary gully control structures
5. Draw and indicate components of permanent gully contour structures
6. Draw and indicate components of contour bund and graded bund
7. Draw and indicate components of bench terraces and broad base ridge type terraces
8. Design of Vegetated water ways
9. Draw different types of Strip cropping
10. Practice on simple leveling
11. Practice on compound leveling
12. Enter the levels by using Rise and Fall method
13. Enter the levels by using height of collimation method
14. Calculate the area of a given field by using chain survey
15. Preparation of Contour maps.
16. ESE Practical Examination

References:

Text books

1. Singhal, O.P. 1998. *Agricultural Engineering*, Aman Publishing house, Meerut.
2. Dr.Bimal Chandra Mil. 1995. *Introduction to Soil and Water Conservation Engineering*, Kalyani Publishers, Calcutta.
3. Saini, G.S. 1996. *A Textbook of Soil and Water Conservation*, Amman Publishing house, Meerut.
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5. Murthy, V.V.N and Madan K. Jha. 2009. *Land and Water Management Engineering*, Kalyani Publishing, New Delhi.

II SEMESTER

17AGRU0203 INTRODUCTION TO FORESTRY 2 (1+1)

Objectives:

- To acquire knowledge on the basic aspect of Forestry
- To conceptualize the importance of forests and Agro forestry system
- To learn about techniques of tree planting and its management

Learning outcome:

1. Students can learn about the basic aspects of Forestry
2. Students can understand the importance of forests and Agro forestry system
3. Students learn about techniques of tree planting and its management

Theory

Unit I : **Introduction**: Definitions of basic terms- Forest, Forestry- Role and Functions of Forests- Forest classification- Social forestry, Farm forestry, Agro forestry, Community forestry, Industrial forestry and Urban forestry – Forest Influences- Scope of forestry- Types of forest in World, India and Tamil Nadu. Salient features of National Forest Policies**.**

Unit II : **Forest Regeneration**: Objectives- Natural regeneration and artificial regeneration - **Natural** regeneration from seed and vegetative parts, coppicing, pollarding, root suckers. **Artificial** regeneration-Man made plantations- Factors determining Regeneration. Nursery Technique – Forest Plantation-. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.

Unit III : **Forest Mensuration**: Objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; -Measurement of Tree Diameter, Tree Height, Age and Growth rate and Tree stand .

Unit IV : **Agroforestry**: Concept, Definitions, Importance, benefits, limitations - Criteria of selection of trees in Agroforestry- Classification of different agro forestry systems prevalent in the country, Shifting cultivation, Taungya, Alley cropping, Wind breaks and Shelter belts, Home gardens- Criteria for selection of AF Trees.

Unit V : **Silviculture-** Definition, Objectives- Plant classification – Crown, Stem, Roots Locality, Plant succession- Cultivation practices for importance trees**.** Silviculture practices for important fast growing tree species of the region. TBO's, MPTS and NFTS- Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias.

Practical

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

Theory Schedule:

1. Definitions of Basic terms in Forestry - Forestry, Forest- Role and Functions and Scope of forestry
2. Classification of forest- Social forestry, Community forestry, Extension forestry, Farm forestry, Industrial forestry and Urban forestry.
3. Types of forest in India and Tamil Nadu
4. National Forest Policies including Agro forestry policies
5. Forest regeneration- Natural and Artificial Regeneration methods- seed and vegetative parts
6. Artificial regeneration- man made plantations -coppicing, pollarding, root suckers choice between natural, essential preliminary considerations.
7. Nursery management practices in forestry
8. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning
9. Forest mensuration- Objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement.
10. 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
11. Agroforestry: concept Definitions, importance, benefits, limitations -criteria of selection of trees in Agroforestry,
12. Classification of different agro forestry systems prevalent in the country, shifting cultivation, Taungya, Alley cropping, Wind breaks and Shelter belts, Home gardens.
13. Silviculture- Definition- Objectives- Cultivation practices for important trees- TBO 's, MPTS and NFTS-
14. Silvicultural practices for Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias.

Practical Schedule:

1. Identification of tree-species.
2. Identification and description of seeds and seedlings of important silviculturetree species
3. Identifying plus trees – characters – marking Collection of seed, seed purity – seed viability
4. Seed treatment – seed germination percentage – seed rate calculation
5. Nursery area selection – criteria for nursery – Nursery layout
6. Nursery methods for important silviculture tree species – Mother bed – raised bed and sunken bed
7. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees.
8. Height measurement of standing trees by shadow method, single pole method and hypsometer.
9. Volume measurement of logs using various formulae.
10. Study on nitrogen fixing trees and multipurpose trees
11. Forest plantations and their management.
12. Visits of nearby Agro forestry plantations
13. Visits of nearby forest based industries.
14. ESE Practical Examinations

References:

Text books

1. Luna, R. K. (1998). *Plantation Foresting in India*, International Book Distributors, Dehradun.
2. FAO. (1991). *Agroforestry in Asia and Pacific*, RAPA Publications, Bangkok.
3. Nair, PKR (2008). *An Introduction to Agro forestry*, Sprinage (P) Ltd. New Delhi.
4. David M.Smith. (1989). *The Practice of Silviculture*, EBD Educational Pvt. Ltd., Dehradun.
5. Srivastava, M.B.1997. *Introduction to Forestry*. Vikas publishing Pvt.Ltd., New Delhi.
6. Chundawat, B.S., and S.K.Gautam, 2005. Text Book of Agro-forestry. Oxford and IBH Publishing company Pvt. Ltd., New Delhi.
7. Khannan, L.S. 2000. *Principles and practices of Silviculture*. KhannaBhandu, Dehra Dun.
8. Lal, J.B. 2002. *India's forest – Myth and Reality*. Natraj Publishers. Dehra Dun.
9. Ramaprakash. 2002. *Forest Management*. IBH publishers, Dehra Dun.

II SEMESTER
17AECU0201 FUNDAMENTALS OF AGRICULTURAL ECONOMICS 2 (2+0)

Objective:

- This course aims to introduce the basic principles of economics including the problem of economic decision - making, laws of economics, production economics and macroeconomic concepts.

Learning Outcome:

- The students have been educated towards the principles, laws, production and macroeconomic concepts.

Theory

Unit I : **Introduction and Basics:** 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. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

Unit II : **Economic Laws:** Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply.

Unit III : **Production Economics:** Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: concepts, short run and long run cost curves. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit IV : **Market:** Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.

Unit V : **Macroeconomics:** National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems:

Theory Schedule:

1	Introduction and Basics**:** Economics: Meaning and scope, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis.
2	Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior
3	Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Concepts of economy and its functions
4	Economic Systems - important features of capitalistic, socialistic and mixed economies, elements of economic planning
5	Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development
6	Agricultural planning and development in the country.
7	Economic Laws: Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle
8	utility theory; law of diminishing marginal utility, equi-marginal utility principle
9	Consumer's equilibrium and derivation of demand curve, concept of consumer surplus
10	Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity
11	Supply: Stock v/s supply, law of supply, schedule, supply curve,
12	Determinants of supply, elasticity of supply
13	Production Economics: Production: process, creation of utility, factors of production, input output relationship

14 Laws of returns: Law of variable proportions and law of returns to scale
15 Cost: concepts, short run and long run cost curves
16 Distribution theory: meaning, factor market and pricing of factors of production.
17 Concepts of rent, wage, interest and profit
18 Market: Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets
19 Price determination under perfect competition
20 Short run and long run equilibrium of firm and industry
21 Shut down and break even points
22 Macroeconomics: National income: Meaning and importance, circular flow
23 Concepts of national income accounting and approaches to measurement, difficulties in measurement
24 Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control
25 Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of 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
27 Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure
28 Tax: meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems and GST

References:

Text books

1. Ahuja, H.L. 2001. *A Text Book of Modern Economics*, Sultan Chand and sons Co.Ltd., New Delhi.
2. Dewett, K.K. 2001. *Modern Economic Theory*, Syamlal Charitable Trust, New Delhi.
3. Diwvedi, D.N. 2000. *Principles of Economics*, Vikas Pub. House Pvt. Ltd., New Delhi.
4. Samuelson, P.A. 1998. *Economics*, McGraw Hill Kogakuisha Ltd., New Delhi.
5. Sankaran, S. 2000. *Principles of Economics*, Progressive Corporation Pvt. Ltd., Madras.
6. Sen, K.K. 2000. *An Introduction to Economics*, Sultan Chand and Sons Co. Ltd., New Delhi.
7. Seth, M.L. 2000. *Principles of Economics*, Lakshmi Narain Agarwal Co., Agra.

II SEMESTER
17AEXU0201 FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION 3 (2+1)

Objectives:

- To impart students on knowledge about basic extension, education and extension efforts in India
- To develop the concepts of rural development, leadership and transfer of technology concepts
- To impart students on knowledge about various ICT applications in TOT, communication strategies, innovation and adapter categories

Learning Outcome:

- The students will be familiarized with various agricultural developmental programmes, their pro-active initiatives and will be motivated towards better communication skill.

Theory

Unit I : **Education**: Meaning, definition and 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.

Unit II : **Extension efforts in India**: Pre-independence Era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment) and Post-independence Era (Etawah Pilot Project, Nilokheri Experiment, various Extension/ Agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP. New trends in agricultural extension: Privatization of extension, Cyber extension/ E-extension, Market-led extension, Farmer-led extension, Expert systems.

Unit III : **Rural Development:** Concept, meaning, definition; various rural development programmes launched by Govt. of India. **Community Development** - meaning, definition, concept and principles, Philosophy of Community Development.

Unit IV : **Rural Leadership:** Concept and definition, Types of leaders in rural context; 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.

Unit V : **Extension teaching methods:** Meaning, classification- individual, group and mass contact methods, ICT Applications in TOT (New and Social

Media) - Media mix strategies; **Communication** - meaning and definition; Principles and Functions of Communication, models and barriers to communication. **Agricultural journalism**; Diffusion and Adoption of innovation; Concept and meaning, Process and stages of adoption, Adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Theory Schedule:

1. Education: Meaning, definition & Types.
2. Extension Education- meaning, definition, scope
3. Process, objectives and principles of Extension Education
4. Extension Programme planning-meaning, process, principles
5. Steps in Programme Development Extension systems in India.
6. Extension efforts in India: Pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment)
7. Post-independence era (Etawah Pilot Project, Nilokheri Experiment)
8. Various Extension and Agriculture Development Programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP)
9. Various Extension and Agriculture Development Programmes launched by ICAR/Govt.of India ORP, ND, NATP, NAIP
10. Privatization of extension, Cyber extension/ E-extension.
11. Market-led extension, Farmer-led extension, Expert systems.
12. Rural Development: Concept, meaning, definition.
13. Various rural development programmes launched by Govt. of India (NREGA, NOAPS)
14. Various Rural Development Programmes launched by Govt.of India (NMBS, NFBS)
15. Community Development- meaning, definition, concept & principles.
16. Philosophy of Community Development.
17. Rural Leadership: Concept and definition, Types of leaders in rural context.
18. Extension Administration: meaning and concept, principles and functions.
19. Monitoring and Evaluation: Concept and definition, Monitoring and Evaluation of extension programmes;
20. Transfer of technology: Concept and models,
21. Capacity building of extension personnel.

22. Extension teaching methods: Meaning, classification- individual, group and mass contact methods,
23. ICT Applications in TOT (New and Social Media) - Media mix strategies;
24. Communication - meaning and definition; Principles and Functions of Communication,
25. Models and barriers to communication, Agricultural journalism
26. Diffusion and Adoption of innovation; Concept and meaning, Process and
27. Stages of adoption, Adopter categories.

Practical Schedule:

1. To get acquainted with University extension system
2. Handling and use of Audio Visual Equipment's.
3. Preparation of Extension Literature: Leaflet, booklet, folder,
4. Preparation of Extension Literature: Pamphlet news stories and success stories.
5. Presentation Skill Exercise: Micro teaching, Group Discussion and Debate.
6. Visit to village to understand the problems being encountered by the villagers/ farmers.
7. Study of organization and functioning of DRDA and other development departments at district level.
8. Visit to NGO and KVK- Learning from their experience in rural development.
9. To understand the PRA techniques and their application in village development planning.
10. To conduct Exposure Visit: Community Radio and Television Studio for understanding the process of programme production.
11. To prepare Script for Print and Electronic media.
12. To develop script for radio and television.
13. ESE Practical Examination

References:

Text books

1. Annamalai, R.1993. *Extension Education and Programme Planning*. Palaniappa Printers
2. Chaubey, B.K. *et.al.*1999. *Extension Education*. Aman Publishing House, Meerut
3. Dahama O. P and O.P. Bhatnagar. 1996. *Education and Communication for Development,*Oxford & IBH Publishing Co., Ltd., New Delhi. Pvt. Ltd., New Delhi
4. Reddy, A.A. 1980. *Extension Education*. Shree Laxmi Press, Bapatla.
5. Ahuja, B.N. 1997. Theory and Practice of Journalism, Surjeet Publications, New Delhi.
6. Benor Daniel, Q. James Harrison and Baxter Michael. 1984. *Agricultural Extension – The Training and Visit System*, A World Bank Publication, Washington, USA.
7. Dipak de, Basavaprabhu Jirli. 2010. *A Handbook of Extension Education*, Agrobios, India.
8. Katar Singh. 1999. *Rural Development – Principles, Policies and Management,* Sage Publications India Pvt. Ltd., New Delhi.

9. Kelsey, L.D and C.C. Hearne. 1967. *Cooperative Extension Work*, Cornell University Press, New York.
10. Manoharan Muthiah, P. and R. Arunachalam. 2003. *Agricultural Extension*, Himalaya Publishing House, Mumbai.
11. Narayanasamy, N. 2009. *Participatory Rural Appraisal Principles, Methods and Application*, Sage Publications India Pvt. Ltd., New Delhi.
12. Pandey, B.K. 2005. *Rural Development*, ISHA Books, New Delhi.
13. Pandey, V.C. 2003. *Information Communication Technology and Education* (The Changing World ICT Governance), Isha Publishers.
14. Ray, G.L. 1999. *Extension Communication and Management*, Naya Prokash, 206, Bidhan Sarani, Calcutta.
15. Reddy Adivi, A. 1993. *Extension Education*, Shree Lakshmi Press, Bapatla, Andhra Pradesh.
16. Rishipal. 2011. *Training and Development Methods*, S.Chand and Co. Ltd., New Delhi.
17. Rogers, E.M. 1995. *Diffusion of Innovations*, The Free Press, New York.
18. Sagar Mondal and Ray, G.L. 2007. *Text book of Rural Development*, Kalyani Publishers, New Delhi.
19. Sandhu, A.S. 1996. *Agricultural Communication: Process and Methods*, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
20. Sandhu, A.S. 1996. *Extension Programme Planning*, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
21. Sanjay Prakash Sharma. 2006. *Panchayat Raj,* Vista International Publishing House, New Delhi.
22. Singh, A.K. 2012. *Agricultural Extension,* Agrobios, New Delhi.
23. Sivasudevaro, B and Rajannikanthu, G. 2007. *Rural Development and Entrepreneurship Development,* The Associated Publications, Ambala.
24. Supe, S.V. 1997. *An Introduction to Extension Education*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Web Resources:

1. rural.nic.in
2. www.panchayat .gov.in
3. wcd.nic.in
4. moud.nic.in
5. mhupa.gov.in
6. www.i4d.com
7. www.panasia.org
8. www.joe.org

II SEMESTER
17AGLU0202 COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT 2 (1+1)

Objectives:

1. To develop inter-personal skills and be an effective communicator.
2. To develop professionals with idealistic practical and problem-solving skills.
3. To construct attitude, skill and understand it influence on behaviour.

Learning Outcome:

- The students will be familiarized with various communication skills.
- They will develop as a better professionals with inter personal skills.
- They will develop problem solving skills and their influence on behaviour and will emerge as a better personalities.

Theory

Unit I : **Communication Skills**: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication;

Unit II : **Listening and note taking**, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

Unit III : **Reading and comprehension** of general and technical articles, precise writing, summarizing, abstracting;

Unit IV : **Individual and group presentations**, impromptu presentation, public speaking; Group discussion.

Unit V : **Organizing seminars** and conferences.

Practical

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

Theory Schedule :

Lecture 1-3	**:**	What is communication (Definition/ Basics/ features/ Role of Language in communication/ verbal, non- verbal communication)
Lecture 4	**:**	Listening & note taking
Lecture 5-7	**:**	Writing Skill (Field diary/ lab record/ indexing/ foot notes/ bibliography)

Lecture 8	**:**	Precise writing/ abstracting/ summarizing
Lecture 9 – 10	**:**	Presentation Skill (Speaking) (Individual & Group)
Lecture 11	**:**	Public Speaking
Lecture 12	**:**	Group discussion
Lecture 13	**:**	Organizing seminars/ Conferences

Practical Schedule:

Practical 1-2	**:**	Listening Practice/ Writing Practice (note taking)
Practical 3	**:**	Speaking Practice (Self-Introduction/ Narration)
Practical 4-6	**:**	Writing Practice (Field diary/ lab record/ indexing)
Practical 7	**:**	Reading Comprehension (General & Technical Articles)
Practical 8-9	**:**	Precise Writing/ Summarizing/ Abstracting
Practical 10	**:**	Presentation (Individual & Group)
Practical 11	**:**	Seminar Presentation/ Group Discussion
Practical 12	**:**	Meeting/ Seminars/ Conferences & Workshop Organizing (Mock)
Practical 13	**:**	ESE Practical Examination

Practical

1. A study of Listening and note taking
2. A study of writing skills,
3. A study of oral presentation skills.
4. A study of field diary and lab record.
5. A study of indexing, footnote.
6. A study of bibliographic procedures.
7. A study of reading and comprehension of general and technical articles.
8. A study of precise writing, summarizing, abstracting.
9. A study of individual and group presentations.

References:

Text books

1. Krishna Mohan and Meera Banerjee 1990. *Developing communication skills*, Macmillam India Ltd. New Delhi.
2. AIR CMDE P.C. Sharma. 2008. *Communication skills and Personality Development,* NiraliPrakashan, Arihant Printers, Pune.

II SEMESTER
NON-GRADIAL COURSE
17NSSU0001 NATIONAL SERVICE SCHEME 1 (0+1)

Objectives:

- To impart knowledge for students on cooperation, developing leadership among them and inculcating knowledge on helping others

Learning Outcome:

- The students have learnt leadership qualities and able to work in an cooperative environment
- They have emerged as an youngest citizens to do various welfare activities for the society

Practicals:

Course aims at evoking social consciousness among students through various activities *viz.,* working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.
Following activities are to be taken up under the NSS course:

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
- Understanding youth
- Community 65obilization
- Social harmony and national integration
- Volunteerism and shramdan
- Citizenship, constitution and human rights
- Family and society
- Importance and role of youth leadership
- Life competencies
- Youth development programmes
- Health, hygiene and sanitation
- Youth health, lifestyle, HIV AIDS and first aid
- Youth and yoga
- Vocational skill development
- Issues related environment
- Disaster management
- Entrepreneurship development
- Formulation of production oriented project
- Documentation and data reporting
- Resource mobilization
- Additional life skills

Activities directed by the Central and State Government All the activities related to the National Service Scheme course is distributed under four different courses viz.,

National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

National Service Scheme I

Introduction and basic components of NSS

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, NSS volunteers' awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, 66obilizat guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community 66obilization

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of 66obilization involving youth-adult partnership

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights

Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

Concept of family, community (PRIs and other community based 66obilization66) and society

National Service Scheme II

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led 67obilization67

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

National Service Scheme III

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

National Service Scheme IV

Youth and crime

Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring in preventing crime and awareness for juvenile justice

Civil/Self defense

Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource 67obilization

Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

References:

Text books

1. *National Service Scheme Manual*, 1997. Department of Youth Affairs and Sports, Ministry of Human Resource Development, Government of India.
2. Supe, S.V. 1995, *Extension Education*, Sterling Publications, Madras
3. Advi Reddy, 1996, *Extension Education* , Babatal Publications, Hyderabad
4. Narayanasamy N, M.P.Boraian and R. Ramesh. 1997. *Participatory Rural Appraisal*, GRU, Gandhigram

II SEMESTER
NON-GRADIAL COURSE
17SPOU 0001/17YOGU0001 PHYSICAL EDUCATION AND YOGA PRACTICES 1 (0+1)

Objectives:

- To indulge students on various games and to develop their talents and interest.
- To educate students on physical fitness, yoga and health consciousness.

Learning Outcome:

- The students will get motivated towards any type of games and its regulations
- The students will get educated towards physical fitness and health awareness

Practicals:

1. Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation
2. Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game.
3. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation.
4. Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game.
5. Teaching of different track events – demonstration practice of the skills and correction.
6. Teaching of different field events – demonstration practice of the skills and correction.
7. Teaching of different asanas – demonstration practice and correction.
8. Teaching of weight training – demonstration practice and correction.
9. Teaching of circuit training – demonstration practice and correction.
10. Teaching of calisthenics – demonstration practice and correction.

Note:

1. Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants)
2. The games mentioned in the practical may be inter changed depending on the season and facilities.

References:

Text books

1. *Track and Field* by C.Thirunarayanan and S. Harihara Sharma
2. *Track and Field* by Mariyyah
3. *Essentials of Exercise Physiology* by Larry G.Shaver
4. *Organization of Physical Education* by J.P. Thomas
5. *Methods in Physical Education* by S. Harihara Sharma
6. *Principles of Physical Education* by R.C. Sathiyanesan
7. *The Complete Book of First Aid* by John Handerson
8. *The Official Rules book of Basketball, Football, Hockey, Volley ball, Kabbadi Federations of India.*

III SEMESTER

17AGRU0304 CROP PRODUCTION TECHNOLOGY – I 2 (1+1)

Objective:

The aim of this course is to know about the importance and cultivation aspects of Cereals, millets, pulses, oilseeds and fodder crops raised under *kharif* season

Learning outcome:

1. Students can learn about the Crop classification and cultivation practices of various crops grown under *kharif* season
2. Students can gain practical knowledge on raising of nursery and recording bio-metric observation and working of cost of cultivation for various crops

Theory

Unit I : **Cereals:** Rice, Maize – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest)and Yield.

Unit II : **Millets:** Major millets- Sorghum, Pearl millet (Cumbu) and Finger millet (Ragi)Minor millets- Fox tail millet (Tenai), Little millet (Samai), Kodo millet (Varagu), Barn yard millet (Kudiraivali) and Proso millet (Pani varagu): Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.

Unit III : **Pulses:** Pigeon pea (Red gram), Black gram (Urd bean), Green gram (Mung bean) and Cowpea : Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices(from land preparation to harvest) and Yield.

Unit IV : **Oil Seeds:** Groundnut, Sesame (Gingelly), and Castor- Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices(from land preparation to harvest) and Yield.

Unit V : **Fibre and Fodder crops:** Cotton and Jute- Forage crops- Definition-classification of fodder crops- Fodder sorghum , Fodder cumbu, Cumbu-Napier grass, Fodder cowpea, Cluster bean, Desmanthus , Stylo and Siratro- Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield

Practical

Rice nursery preparation, transplanting of rice, sowing of maize, pigeon pea, mung bean, groundnut and cotton- Effect of seed size on germination and seedling vigour of *kharif* season crops, effect of sowing depth on germination of *kharif* crops- Identification of weeds in *kharif* season crops- Top dressing and foliar feeding of nutrients – Study of yield contributing characters and yield calculation of *kharif* season crops- study of crop varieties and important agronomic experiments at experimental farm- study of forage experiments, morphological description of *kharif* crops- Visit to research centres of related crops.

Theory Schedule:

1. Importance and area , production and productivity of major kharif Cereals and millets of India and Tamil Nadu
2. Importance and area , production and productivity of major kharif Pulses, Oil seeds, Cotton and forage crops of India and Tamil Nadu
3. Rice – Origin, distribution-economic importance- varieties- soil and climatic requirements
4. Rice- Nursery management- main field and other cultural practices and yield
5. Rice- Special type of rice cultivation SRI- Trangenic rice- Hybrid rice
6. Maize- Origin, distribution-economic importance- varieties- soil and climatic requirements
7. Maize – Cultural practices such as seeds and sowing, manuring, weed management , harvest and yield
8. Sorghum and Cumbu- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as seeds and sowing, manuring, weed management , harvest and yield
9. Ragi- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as nursery, seeds and sowing, manuring, weed management , harvest and yield
10. Redgram and Blackgram- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
11. Green gram and cowpea- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
12. Groundnut- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
13. Sesame and Castor- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
14. Cotton and Jute: Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield

15. Fodder sorghum, Fodder cumbu, Cumbu-Napier grass, fodder cowpea, Desmanthus, siratro and stylo- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield.

Practical Schedule:

1. Identification of *kharif* Cereals, millets, pulses, Cotton and forage crops in the crop cafeteria
2. Practicing various nursery types and main field preparation for rice crop
3. Practicing nursery and main field preparation for *kharif* millets, pulses and Oilseeds
4. Acquiring skill in different seed treatment techniques in important field crops
5. Estimation of plant population per unit area for important field crops
6. Acquiring skill in field preparation , sowing, and manuring of crops under pure and inter cropping situations for Cereals and millets
7. Acquiring skill in field preparation , sowing, and manuring of crops under pure and inter cropping situations for pulses , Oil seeds and Cotton
8. Acquiring skill in using seed drill for sowing operations
9. Acquiring skill in foliar nutrition for important *kharif* field crops
10. Observation on growth parameters of cereals and millets
11. Observation on growth parameters of Pulses , Oilseeds and Cotton
12. Study of yield parameters and estimation of yield in important field crops
13. Working out cost and returns of important Cereals, millets, Pulses, Oil seeds, Cotton and Oil seeds
14. ESE Practical Examinations

References:

Text books

1. Ahlawat, I.P.S., Om prakash and G.S.Saini, 1998. *Scientific Crop production in India.* Rama publishing House, Meerut
2. Chidda singh, 1997. *Modern Techniques of raising Field crops*. Oxford and IBH publishing Co. Pvt.Ltd., New Delhi.
3. Singh, S.S. 1997. *Crop Management under Irrigated and Rainfed conditions*. Kalyani publishers , New Delhi.

E- References:

1. ww.crida.org
2. www.cgiar.org
3. www.tnau.ac.in/agriportal

III SEMESTER

17PBGU0302 FUNDAMENTALS OF PLANT BREEDING 3 (2+1)

Objective:

- The aim of this course to expose the students to basic and applied principles of plant breeding, mode of reproduction, breeding methods for plant breeding

Learning Outcome:

- The plant breeding methodologies and applications employed for self, cross and vegetatively propagated crops will be exposed.

Theory

Unit I : **History and objective of plant breeding**, Mode of pollination Mode of reproduction and apomixes, self incompatibility and male sterility. Centre of origin /diversity, Domestication, Acclimation and Introduction, Plant genetic resources

Unit II : **Heritability and genetic advance**, Genetic basis and breeding methods in self pollinated crops, Pure line Selection, Mass Selection, Hybridization, Pedigree method, bulk pedigree method, Mass pedigree method, SSD, Backcross method and Multilines

Unit III : **Genetic structure** of a population in cross pollinated crop and Hardy Weinberg law, Heterosis and Inbreeding depression Hybrids and Development of Inbred, Ear to row method, Modified Ear to Row , Recurrent Selection , Composite and Synthetic varieties

Unit IV : **Breeding methods** in asexually propagated crops, Clonal selection and hybridization, Wide hybridization, Polyploidy and their applications, Mutation breeding: mutation types, mutagens breeding procedure, applications.

Unit V : **Breeding for biotic and abiotic stress resistance**. Introduction to markers – Morphological – Biochemical- DNA markers, uses of marker assisted selection. Participatory plant breeding, Intellectural Property Rights, Plant Breeders and Farmer's Right

Practical

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

Theory Schedule:

1. Objectives and role of plant breeding - historical perspective- activities in Plant breeding
2. Mode of Pollination -self – cross - mechanism of pollination
3. Modes of reproduction – sexual – asexual - self and cross fertilization – significance of pollination
4. Self incompatibility – classifications – mechanisms – application – measures to overcome and limitations
5. Male sterility – introduction – classification – CMS, GMS, CGMS, TGMS, PGMS -inheritance and applications
6. Centers of origin – contribution of Vavilov, Harlan, Zhukovosky – law of homologous series
7. Plant genetic resources – importance – germplasm – types – activities – gene erosion - gene bank – collection - conservation – types of conservation – agencies – quarantine
8. Germplasm: evaluation – use of descriptors, documentation, utilization; Agencies – national and international; germplasm exchange – quarantine
9. Plant introduction as a breeding method – types of introduction – objectives – quarantine - acclimatization – achievements - merits and demerits
10. Basic biometrics-nature and significance of qualitative and quantitative variation phenotypic, genotypic and environmental-heritability and genetic advance
11. Genetic basis of self pollinated crops – Vilmorin principle of progeny selection - Johannsen's pure line theory
12. Breeding methods for self pollinated crops without involving artificial hybridization: Pure line selection – procedure – merits and demerits – achievements; Mass selection in self pollinated crops – procedure - types – comparison of mass and pureline selection – achievements
13. Hybridization and selection – objectives types – choice of parents – steps in hybridization - kinds of emasculation.
14. Pedigree breeding – procedure – mass pedigree – merits – demerits – achievements; Bulk breeding – procedure – merits – demerits – achievements.
15. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – procedure – application – merits and demerits
16. Back cross method - prerequisites and its application in transferring resistant genes - merits and demerits

17. Multilines, multiblends and population improvement approach in self - pollinated crops
18. Genetic structure of a population in cross pollinated crop – Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement.
19. Heterosis breeding – theories - genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression – development of inbred- -types of hybrids – achievements – merits and demerits – hybrid variety – merits and demerits
20. Breeding methods followed in cross pollinated crops - Ear to row method, Modified Ear to Row , Recurrent Selection – types – merits and demerits
21. Development of inbred lines and hybrids
22. Composites and synthetics - steps in development of Composites and synthetics– achievements – merits and demerits.
23. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits
24. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization
25. Polyploidy breeding – classification – applications
26. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations
27. Breeding for Biotic stress and Abiotic stress
28. Introduction to markers – morphological – biochemical- DNA markers – uses of marker assisted selection - major genes – merits – demerits – achievements
29. Participatory plant breeding ,Intellectural Property Rights, Plant breeders' right, Farmers right

Practical Schedule:

1. Breeder's Kit and its Components
2. Germplasm Collection, Preservation and Conservation
3. Study of pollination mechanism, emasculation and hybridization methods in Cereals
4. Study of pollination mechanism, emasculation and hybridization methods in Pulses
5. Study of pollination mechanism, emasculation and hybridization methods in Oilseeds
6. Study of pollination mechanism, emasculation and hybridization methods in Forage and Fibre crops
7. Problems in population genetics: Hardy –Weinberg Law
8. Pollination and Reproduction in Plants
9. Pollen Morphology
10. Different types Male Sterility and their role
11. Handling Segregating populations
12. Estimation of Heritability , Genetic advances and Heterosis
13. Evaluating advanced breeding lines – Yield Evaluation Trials
14. ESE Practical Examination

References:

Text books

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

E-References:

1. http://www.edugreen.teri.res.in/explore/bio/breed.htm

2. http://cuke.hort.ncsu.edu/gpb/

3. http://www.stumbleupon.com/tag/plant-breeding

4. http://www.iaea.org/

III SEMESTER

17HORU0302 PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES 2 (1+1)

Objectives:

1. To learn about the nursery practices, planting , maturity indices, harvesting techniques, grading, packaging, storage and seed production techniques of vegetable crops.
2. To learn about the production technology of spice crops

Learning Outcome:

- The course will provide knowledge on cultivation practices, yield & quality improvement of vegetables and spice crops.

Theory

Importance of vegetables & spices in human nutrition and national economy- kitchen gardening- brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices.

Unit I : **Solanaceous vegetables:** Tomato, Brinjal, Chilli, and Capsicum.

Unit II : **Cucurbitaceous and leguminaceous vegetables:** Cucumber, Melons, Gourds, Pumpkin. French bean, and Peas.

Unit III : **Cole crops and Bulb crops:** Cabbage, Cauliflower, Knol-khol. Bulb crops - Onion, and Garlic.

Unit IV : **Root crops & Tuber crops and leafy vegetables:** Root crops -Carrot, Raddish, Beetroot. Tuber crops- Potato. Leafy vegetables -Amaranth, Palak, and Perennial vegetables.

Unit V : **Major spice crops:** Pepper, Cardamom, Turmeric, and Ginger.

Practical

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

Theory Schedule:

1. Importance of vegetables & spices in human nutrition and national economy.
2. Kitchen garden.
3. Production technology of Tomato.
4. Production technology of Brinjal.
5. Production technology of Chilli and Capsicum.
6. Production technology of Cucumber and Melons.
7. Production technology of Gourds-Bottle gourd, Ridge gourd and Snake gourd.
8. Production technology of Pumpkin.
9. Production technology of French bean and Peas.
10. Production technology of Cole crops Cabbage.
11. Production technology of Cauliflower and Knol-khol.
12. Production technology of Bulb crops Onion and Garlic.
13. Production technology of Root crops such as Carrot, Raddish and Beetroot.
14. Production technology of Tuber crops such as Potato.
15. Production technology of Leafy vegetables Amaranth, Palak and Perennial vegetables
16. Production technology of pepper and Cardamom.
17. Production technology of Ginger and Turmeric.

Practical Schedule:

1. Identification of vegetables & spice crops.
2. Identification of seeds of different vegetable crops.
3. Calculation of seed requirement for important vegetable crops.
4. Raising vegetable seedlings in nursery bed and portrays.
5. Direct seed Sowing/ transplanting of vegetables in main field.
6. Study of morphological characters of different vegetables & spices.
7. Identification of organic manures and chemical fertilizers.
8. Fertilizers applications in vegetables.
9. Maturity indices of vegetables.
10. Grading and packaging of vegetables.
11. Calculating cost of production of important vegetables and spice crops.
12. Visit to vegetable field.
13. Visiting local market & Uzhavar santhai.
14. End Semester Practical examination.

References:

Text books

1. Bose, T.K. 1986. *Vegetable Growing in India*. Naya Praskash Publication, Calcutta.
2. Das, P.C., *Vegetable Crops of India. Kalyani Publication*, New Delhi.
3. Shanmugavelu, K.G. 1989. *Production Technology of Vegetable Crops*. Oxford India Publication, New Delhi.

4. Singh, S.P. 1989. *Production Technology of Vegetable Crops*. Universal Publication centre, Karnal.
5. Veeraraghavathatham, D., M. Jawaharlal and Seemanthini Ramadas. 1996. *A Guide on Vegetable Culture*. A.E. Publications, Coimbatore
6. Thamburaj. S. and N.Singh 2004. *Vegetables, Tuber Crops and Spices*. ICAR.
Vishnu Swarup, 2006. *Vegetable science and technology in India.* Kalyani publishers, New Delhi.

E – References

1. http://www.informaworld.com/smpp/title~db=all~content=g904622674
2. http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html
3. http://attra.ncat.org/attra-pub/manures.html
4. http://ucanr.org/freepubs/docs/8129.pdf
5. http://www.sus-veg-thai.de/

Journals

1. Indian Journal of Horticulture.
2. Indian Journal of Vegetable sciences.
3. Indian Horticulture.
4. International Journal of Vegetable Science.
5. Scientia Horticulture.

III SEMESTER

17AECU0302 AGRICULTURAL FINANCE AND CO-OPERATION 3 (2+1)

Objectives:

1. To teach about agricultural finance, credits and banking
2. To teach about cooperation

Learning Outcome:

1. To learn about agriculture finance, credits and cooperatives.
2. To learn about cooperation, entrepreneurship development.

Theory

Unit I : **Agricultural Finance:** Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Recent developments in agricultural credit. Credit analysis and cost of Credit.

Unit II : **4 R's and 3 C's of credits:** Sources of agricultural finance: Institutional and Non-institutional sources: Commercial banks, RRBs and Co-operatives- social control and nationalization of commercial banks. Micro financing including KCC. Lead bank scheme - Crop loans systems Scale of finance and unit cost.

Unit III : **Banking:** An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India.

Unit IV : **Co-operation:** Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, Farmers' service cooperative societies, Processing cooperatives, Farming cooperatives, Cooperative warehousing Role of ICA, NCUI, NCDC, NAFED.

Unit V : **Entrepreneurship Development:** Concept of Entrepreneurship – Entrepreneur and Entrepreneurship – definition, meaning, characteristics of ideal entrepreneurs – Types of entrepreneurs. Training programmes for entrepreneurship development. Basic guidelines for preparation of project reports – Bank norms – SWOT analysis.

Preparation and analysis of financial statements –Income Statement and Balance Sheet.

Practical

Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural produces and its value added products. Seminar on selected topics.

Theory Schedule:

1. Agricultural credit: meaning, definition, need, classification.
2. Credit analysis.
3. Sources of agricultural finance: institutional and non-institutional sources,
4. Commercial banks, social control and nationalization of commercial banks
5. Micro financing including KCC.
6. Lead bank scheme, RRBs
7. Crop loan systems.
8. Scale of finance and unit cost.
9. An introduction to higher financing institutions – RBI, NABARD,
10. ADB, IMF, world bank,
11. Insurance and Credit Guarantee Corporation of India.
12. Cost of credit.
13. Recent development in agricultural credit.
14. Preparation and analysis of financial statements
15. Balance Sheet and Income Statement.
16. Entrepreneur and Entrepreneurship : Concepts, meaning and qualities of Entrepreneurs.
17. Basic guidelines for preparation of project reports- Bank norms
18. SWOT analysis.
19. Meaning, brief history of cooperative development in India
20. Objectives, principles of cooperation
21. Significance of cooperatives in Indian agriculture.
22. Agricultural Cooperation in India- Credit, marketing, consumer and multi-purpose cooperatives
23. Farmers' service cooperative societies
24. Processing cooperatives
25. Farming cooperatives
26. Cooperative warehousing
27. Role of ICA, NCUI, NCDC, NAFED

Practical Schedule:

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 to acquire firsthand knowledge of their management, schemes and procedures.
6. Visit to a cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures.
7. Estimation of credit requirement of farm business – A case study.
8. Preparation and analysis of balance sheet – A case study.
9. Preparation and analysis of income statement – A case study.
10. Appraisal of a loan proposal – A case study.
11. Techno-economic parameters for preparation of projects.
12. Preparation of Bankable projects for various agricultural products and its value added products.
13. Seminar on selected topics.
14. End Semester Practical Examinations

References:

Text books

1. Ghosal, S.N., *Agricultural Financing in India*, Asia Publishing House, Bombay, 1996
2. Johi, S.S. and C.V. Moore., *Essentials of Farm Financial Management, Today and Tommorow's* .Printers and Publishers, New Delhi, 1970
3. John, J. Hamptron., *Financial Decision Making: Concepts, Problems and Cases*, Prentice-Hall of India, New Delhi, 1983
4. Subba Reddy, S., P.Raghu Ram., P. Sastry, T.V.N and Bhavani Devi, I. 2010. *Agricultural Economics*. Oxford & IBH Publishing Company private Ltd., NewDelhi, 2010.
5. William, G. Murray and Nelson Aarson, G., *Agricultural Finance*, The Iowa State University Press, Ames, Iowa, 1960.

III SEMESTER

17AGEU0302 FARM MACHINERY AND POWER 2 (1+1)

Objectives:

1. To understand the operation and maintenance of Tractor, Power tiller, Sprayer, Reaper and Multi crop thresher.
2. To identify suitable implements for tillage, sowing, plant protection operations for different crop and soil conditions.

Learning Outcome:

1. The students can get practical knowledge in operation and maintenance of tractor, power tillage, sprayer, reaper and multi crop thresher.
2. The students can learn in selection of suitable farm equipment for tillage to harvest based on field and crop conditions.
3. The students can able to estimate the cost of farm equipment operation, coverage and power requirements

Theory

Unit I : **Status of Farm power in India**: Sources of Farm power- man, animal, electrical, mechanical; IC engines – Working principle and different components of IC engines.

Unit II : **Comparison of Two stroke and Four stroke cycle engines**; Different systems of IC engines – air cleaning, cooling, lubrication, fuel supply and combustion system.

Unit III : **Tractor types**: Power transmission system – clutch, gear box, differential and final drive; Hydraulic control system; cost estimation – Fixed cost and Variable cost.

Unit IV : **Tillage** – Objectives, classification; Primary tillage implements – Mould board plough, disc plough, chisel plough; Secondary tillage implements – cultivator, disc harrows; sowing machinery – Happy seed drill, Broad based bed furrow cum seed planter, Calibration of seed drill; Transplanter - self propelled Rice transplanter.

Unit V :

Sprayers: Compressed lever operated knap sack sprayer, power sprayer; Duster – hand rotary type; Paddy reaper and Multi crop thresher – its components, functions and specification.

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 seedcum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter Familiarization with different types of sprayers and dusters Familiarization with different intercultivation equipment, Familiarization with harvesting and threshing machinery.

Theory Schedule:

1. Status of farm power in India and sources of farm power – merits and demerits
2. IC engine – Components and working principle of four stroke diesel engine
3. Working principle of two stroke petrol engine.
4. Comparison of two stroke and four stroke cycle engine
5. Air cleaning, cooling and lubrication system
6. Fuel supply and combustion system
7. Tractor – types and its components
8. Power transmission system
9. Hydraulic control system – Three point linkage
10. Cost estimation of tractor operation
11. Tillage – Objectives; Primary tillage implements
12. Secondary tillage implements
13. Sowing and transplanting machineries
14. Paddy reaper – functions and components
15. Multi crop thresher – functions and components.

Practical Schedule:

1. Study of air cleaning and cooling system of an IC engine
2. Study of lubrication and fuel supply system of an IC engine
3. Study of combustion system of am IC engine
4. Study of clutch and gear system of a tractor
5. Study of differential and find drive system of a tractor
6. Study of hydraulic control system of a tractor
7. Learning of tractor driving
8. Learning of power tiller driving.
9. Familiarization of primary tillage implements
10. Familiarization of secondary tillage implements
11. Familiarization of seed drills
12. Calibration of seed drill
13. Familiarization of sprayers & dusters
14. Familiarization of paddy reaper

15. Familiarization of multi crop thresher
16. ESE Practical Examination

References:

Text books

1. Nakra .C.P 2006, *Farm Machinery and Equipment*; Dhanapat Rai Publishing Company (P) Ltd, New Delhi.
2. Bindra, O.S. and Harcharan Singh, 1971. *Pesticide Application Equipment.* Oxford and IBH Pub Co., New Delhi.
3. Srivastava, A.C., 1990. *Elements of Farm Machinery*. Oxford and IBH Pub. Co, New Delhi
4. Jagadishwar Sahay, 2004. *Elements of Agricultural Engineering*. Standard Publishers Distributors, New Delhi. – 4th Edition.

III SEMESTER
17SACU0302 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT
3 (2+1)

Objectives:

1. To teach the basics of environmental studies, environmental pollution and its effects.
2. To teach about disasters and management.

Learning Outcome:

1. To learn about ecosystems, pollution and other problems related to environment To learn about disasters and its management

Theory

Unit I : **Introduction to Environmental Science and Ecology:** Environmental Science **-** definition, scope and importance; Ecosystems - Structure and function of an ecosystem. Energy flow in the ecosystem. Ecological succession. Food chains -food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit II : **Natural Resources and biodiversity:** Natural Resources: Renewable and non-renewable resources. Status, degradation, over exploitation, management and conservation of Land resources, Water resources, forest resources, Mineral resources and Energy resources. Biodiversity – definition and types. Hot-spots of biodiversity. Threats to biodiversity: Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit III : **Environmental Pollution:** Environmental Pollution: definition, cause, effects and control measures of soil, water, air pollution. Green House effect - Global warming and Climate change - Impact on agriculture and other natural resources. Environmental protection-National and state level organizations. Global treaties – Conventions. Legislation to protect the environment.

Unit IV : **Disaster and Impact Assessment:** Definition, introduction to natural and manmade disaster, Levels of disasters, History on natural disasters in India, Disaster phenomena and events (global national and regional), Concept of risk, hazard, and vulnerability.) -Severity, extent of damage on agricultural production systems, economic losses

affecting livelihood, social and economic perspective. Disaster preparedness for crops, livestock and fisheries, hazard and risk reduction strategies. Role of IT, remote sensing, GIS and GPS in disaster preparedness. weather forecasting and early warning systems, flood forecasting agricultural drought monitoring and forecasting.

Unit V : **Disaster Risk Reduction and policies for Disaster Management:** Contingency Planning for Disaster Risk Reduction: agronomic, engineering other non-engineering interventions for drought, flood, cyclone and heat/cold waves, agro- met advisories, crop advisories, community nursery, contingent seed bank, mini-kit availability, strategies for fisheries management in flood prone areas, livestock shelters, feed and fodder banks, mass vaccination of livestock, etc

Disaster Management Act and Policies in India, Organizational structure for disaster management at national, state and district levels, Existing schemes and government policies to tackle agricultural disasters. Insurance and loan schemes: criteria and constraints of crop/animal insurance and credit guarantee schemes.

Practical

Environmental sampling and preservation - Biodiversity assessment in Agricultural systemWater quality analysis: pH, EC and TDS, Acidity, Alkalinity, Water hardness, DO and BOD, COD, *E.coli,* Assessment of Air pollution: Suspended Particulate Matter (SPM) - Assessment of heavy metal pollution in soil – Field Visits: Contaminated site, Common Effluent Treatment Plant - Agro meteorology on weather forecasting and predictions through modelling - RS-GIS for disaster management - Impact assessment of Earth quake / flood / Tsunami affected areas - Visit to flood /Tsunami / Earth quake affected areas

Theory Schedule:

1. Environmental Science **-** definition, scope and importance;
2. Ecosystems - Structure and function of an ecosystem.
3. Energy flow in the ecosystem. Ecological succession.
4. Food chains -food webs and ecological pyramids.
5. Forest, grassland and desert ecosystems
6. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries.
7. Natural and Energy resources: Land, Water, Air, Forest, Minerals, Perpetual, Renewable and Non-renewable
8. Present Status of Natural and Energy resources, Resource Extraction, Degradation and Sustainable Management and Conservation.
9. Biodiversity: Types, National and Global Status, importance, Hotspots and Threats
10. Conservation of Biodiversity: *In-situ andEx-situ* - Biosphere Reserves - National parks, Wildlife Sanctuaries, Botanical Garden, etc..
11. Soil, water and air pollution

12. Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources
13. National and state level organizations.
14. Global treaties – Conventions.
15. Legislation to protect the environment.
16. Definition, Introduction to natural and manmade disaster, Levels of disasters, History on natural disasters in India, Disaster phenomena and events (global national and regional), Concept of risk, hazard, and vulnerability.)
17. Hydro meteorological Disasters:Floods and flash floods: General characteristics, causes, nature and frequency of flooding, flood plains, flood hydrographs, river and coastal floods, lake outburst, cloud burst; Droughts: Causes, classification – agricultural, hydrological and meteorological droughts; drought frequency and intensity.
18. Hydro meteorological Disasters:Cyclones and Tsunami: Structure and nature of cyclones and tsunamis, characteristics, factors, hazard potential; Frost, heat and cold waves: cause, intensity and extent of frost, heat and cold waves and its impact on agricultural crops.
19. Geological disasters Landslides: causes, susceptibility to landslides and slope failures; Earthquake – Causes, magnitude and intensity
20. Manmade Disasters: chemical hazards, nuclear hazards, forest fire, oil spill and road accidents
21. Severity, extent of disaster damage on agricultural production systems, economic losses affecting livelihood, social and economic perspective
22. Severity, extent of disaster damage on livestock/Fish/Poultry: Mortality, morbidity, health, reproduction yield, feed and fodder availability;
23. Severity, extent of disaster damage on Soil, Water and Irrigation Infrastructure. Soil erosion, water availability, accessibility and quality. Siltation, damage to canal network, tube wells, open wells, dug wells, channels, ponds etc.
24. Strategies for disaster management planning, priority setting for preparedness strategies in agricultural production system, livestock and fisheries, formulation of a disaster risk reduction plan.
25. Role of IT, remote sensing, GIS and GPS in disaster preparedness.
26. Weather forecasting and early warning systems, flood forecasting agricultural drought monitoring and forecasting.
27. Understating resilience, linking vulnerability reduction and disaster recovery, disaster response and post-disaster recovery.
28. Nature and type of immediate response, disaster management plans, key response functions logistic, recovery rehabilitation reconstruction.
29. Contingency Planning for Disaster Risk Reduction: agronomic, engineering other non-engineering interventions for drought, flood, cyclone and heat/cold waves, agro-met advisories, crop advisories, community nursery, contingent seed bank, mini-kit availability.
30. Strategies for fisheries management in flood prone areas, livestock shelters, feed and fodder banks, mass vaccination of livestock, etc
31. Disaster Management Act and Policies in India, Organizational structure for disaster management at national, state and district levels.

32. Existing schemes and government policies to tackle agricultural disasters. Insurance and loan schemes: criteria and constrains of crop/animal insurance and credit guarantee schemes.

Practical Schedule:

1. Environmental sampling and preservation
2. Biodiversity assessment in Agricultural system
3. Water quality analysis: pH, EC and TDS
4. Estimation of Acidity, Alkalinity
5. Estimation of water hardness
6. Estimation of DO and BOD in water samples
7. Estimation of COD in water samples
8. Enumeration of *E.coli* in water sample
9. Assessment of Suspended Particulate Matter (SPM)
10. Assessment of heavy metal pollution in soil
11. Visit to Contaminated site
12. Visit to Common Effluent Treatment system
13. Agro meteorology on weather forecasting and predictions through modelling
14. RS-GIS for disaster management
15. Impact assessment of Earth quake/ flood/Tsunami affected areas
16. Visit to flood/Tsunami/ Earth quake affected areas
17. ESE Practical examination

References:

Text books

1. Tyler Miller and Scot Spoolman. 2009. *Living in the Environment* (*Concepts, Connections, and Solutions).* Brooks/cole, Cengage learning publication, Belmont, USA
2. P.D. Sharma, 2009, *Ecology and Environment*, Rastogi Publications, Meerat, India
3. De. A.K., 2010. *Environmental chemistry*. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp
4. DharChakrabarti. P.G., 2011. *Disaster management & climate change - India's risk managementpolicy frameworks and key challenges*. Published by Centre for Social Markets (India), Banaalore. 36 pp.
5. *Proceedings of 2nd India disaster management congress*, New Delhi. Organized by National Institute of Disaster Management, New Delhi

III SEMESTER
17ACSU0301 AGRI-INFORMATICS 3 (2+1)

Objectives:

- To understand the fundamental concept of computer and Internet
- To develop applications using MS Word, MS Excel and MS Powerpoint
- To enable the students to understand the use of ICT for Agriculture activities

Learning Outcome:

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

- Learn the basic concept of Computer and Internet
- Create document in MS Word
- Do the Statistical Calculations and draw the chart using MS Excel
- Design Presentation using MS Powerpoint
- Apply ICT for Agriculture activities

Theory

Unit I : **Computer and Internet concepts:** Computer: Definition- Anatomy of a Computer- Generations of a Computer - Introduction to Input and Output Devices -Operating System: Features and Functions-Types of Operating System - Types of programming languages- Computer Networks- Introduction-Applications and Types- Internet: Concepts and Applications - Browsing the Internet- Electronic Mail (E-Mail).

Unit II : **MS-Word:** MS-Word: Introduction-Features – Creation and Save of Document - Document editing and formatting a document-Page setup and Print Preview- Table creation- Mail Merge and its importance-Brainstorming Session.

Unit III : **MS-Excel:** MS-Excel :Introduction - Advantages & applications - Organization of workbook - Editing and Saving a spreadsheet - Designing different types of Charts –Built-in functions and its applications-Brainstorming Session.

Unit IV : **MS-Power Point and MS-Access: MS-Power Point:** Introduction – Creating presentation - saving and close presentation- Changing Layout - Changing Designs – Custom Animation - Slide transition-Applying Animation effects-Inserting table, charts, pictures in presentation- **MS-Access:** Database Concepts- Creating and Editing Database-Brainstorming Session - RDBMS-Introduction-Advantages and Applications- Agricultural Projects.

Unit V : **ICT in Agriculture:** ICT in Agriculture- Introduction and Scope - Role of communications in ICT- Practices of ICT - Mobile

Communications: Farmer Call Centre-SMS Broadcast Service- Web Communications: Agricultural web sites and portals -Web Conferencing- Knowledge management, Information kiosks - Video and Tele conference, Kissan call centres-Expert systems on agriculture- Multimedia: Concepts- Self learning CDs on package of practices, diseases and pest management.

Practical

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

Theory Schedule:

1. Computer: Definition- Anatomy of a Computer- Generations of a Computer
2. Introduction to Input and Output Devices
3. Operating System: Features and Functions-Types of Operating System
4. Types of programming languages
5. Computer Networks- Introduction-Applications and Types
6. Internet: Concepts and Applications-Browsing the Internet- Electronic Mail (E-Mail).
7. MS-Word: Introduction-Features – Creation and Save of Document
8. Document editing and formatting a document- Page setup and Print Preview- Table creation
9. Mail Merge and its importance
10. Brainstorming Session-MS Word
11. MS-Excel :Introduction - Advantages & applications
12. Organization of workbook - Editing and Saving a spreadsheet
13. Designing different types of Charts
14. Built-in functions and its applications
15. Brainstorming Session-MS Excel
16. Introduction about power point – Creating presentation - saving and close presentation
17. Changing Layout - Changing Designs – Custom Animation - Slide transition
18. Applying Animation effects- Inserting table, charts, pictures in presentation
19. MS-Access: Database Concepts, Creating and Editing Database
20. Brainstorming Session – MSAccess

21. RDBMS-Introduction-Advantages and Applications, Agricultural Projects
22. ICT in Agriculture- Introduction and Scope - Role of communications in ICT
23. Practices of ICT-Mobile Communications: Farmer Call Centre
24. SMS Broadcast Service- Web Communications: Agricultural web sites and portals
25. Web Conferencing, Knowledge management, Information kiosks
26. Video and Tele conference, Kissan call centres
27. Expert systems on agriculture- Multimedia: Concepts
28. Self learning CDs on package of practices, diseases and pest management

Practical Schedule:

1. Practice of MS-DOS Commands
2. Working with Windows Operating System
3. MS Word- Prepare a document over selected plants, Prepare report using table.
4. Share the information using mail merge.
5. MS Excel- Prepare Profit and Loss Analysis and Exhibit it using various charts
6. Conduct presentation over earned experiences and draw conclusion
7. Create and Maintain data base for different plants.
8. Surf the Internet and Create Mail-ID
9. Send the above created files (Document, Worksheet, PowerPoint) using Mail-ID
10. Practise with DSSAT Model
11. DSSAT Model-Real time applications
12. Working with DSSAT Model
13. ESE Practical Examination

References
Text books

1. Alexis Leon and Mathews Leon. 2008. *Introduction to Computers*. Leon Techworld
2. Andrew S.Tanenbaum , 2013 *Computer Networks,* 5/e, PHI Private Ltd.
3. Deitel. 2009. *Internet and world wide web- How to program*, 4/e, Pearson Prentice Hall
4. Saravanan and Shanthi. 2002. *Computer Concepts, Windows & MS Office*, Vikas Publishing House
5. Willem Zijp, 1994.*Improving the Transfer and Use of Agricultural Information - A Guide to Information Technology*, World Bank Publications,.
6. Saravanan.R and C.Kathiresan, 2011. *Information & Communication Technology for Agriculture and Rural Development*, New India Pub. Agency,

III SEMESTER
17AMMU0302 STATISTICAL METHODS 2 (1+1)

Objectives:

1. To enable students to understand basic concepts and terms and uses of Statistics in agricultural data analysis.
2. To develop skills among the students to analyze data using appropriate Statistical tools.

Learning Outcome:

Upon completion of the course, the students will be able to:

1. Be familiar with basic concepts and terms
2. Solve problems using appropriate statistical measures
3. Create and interpret visual representation of statistical data.
4. Make valid decisions applying statistical methods.

Theory

Unit I : **Introduction to Statistics** and its Applications in Agriculture, Types of data and frequency distribution. Graphical and diagrammatic Representation of data, Measures of Central value & Dispersion.

Unit II : **Definition of Correlation**, Scatter Diagram, Karl Pearson's Coefficient of Correlation and its interpretation and Liner Regression Equations.

Unit III : **Definition of Probability**, Addition and Multiplication Theorems (without proof). Simple Problems based on Probability; Introduction to Theoretical Distributions – Binomial & Poisson Distributions and simple problems.

Unit IV : **Introduction to sampling** – Sampling versus complete enumeration, simple random sampling with and without replacement, use of random number tables and lottery method for selection of random samples; Determination of sample size.

Unit V : **Introduction to Test of Significance**, Parametric and Non-parametric Tests, Chi-Square Test for Independence of Attributes in 2 x 2 contingency table; Introduction of analysis variance, Analysis of Variance in one way and two way classifications; Design of experiments.

Practical

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

Theory Schedule:

1. Introduction to Agricultural Statistics and its applications.
2. Sources of data, Secondary and Primary sources
3. Classification and tabulation of data;
4. Frequency distribution; Diagrammatic and Graphical representation
5. of statistical data
6. Sampling – meaning, advantages, concept of parameter and statistics,
7. Sample size, sampling error, sampling frame, Types of samples
8. Probability and Non-Probability samples
   Introduction of probability and its applications –Theoretical
9. Distributions – Binomial and Normal Distributions
10. Measures of central tendency
11. Measures of Dispersion: Measures – Mean, Median, Mode and Range and Standard deviation.
12. Theory of correlation and regression.
13. Definition, uses, types and correlation
14. Regression Lines – Properties of regression coefficients.
15. Test of attributes, small and large sample tests.
16. Analysis of variance – one-way and two-way classification.
17. Non-parametric and Distribution Free Tests
18. Chi-Square test and Contingency coefficient

Practical Schedule:

1. Graphical Representation of Data – Diagrams, Frequency curves and Polygons.
2. Measures of Central Tendency – Means, Geometric mean, Median and Mode.
3. Measures of dispersion – Range, Standard deviation and Coefficient of variation
4. Measures of Skewness & Kurtosis and Moments.
5. Correlation & Regression analysis – Computation of correlation coefficient and determination of regression equations.
6. Test of significance – Parametric tests – Small and Large sample tests and Test of significance attributes.
7. Chi-square test – Independence of attributes for 2x2 contingency table.

8. Analysis of variance One-way and Two-way classification.
9. Selection of random sample – Using lottery method and Table of random numbers.
17. Design of experiments – Completely randomized design, Randomized block design and Latin Square design.
18. ESE Practical Examination

References:
Text books

1. Sampath Kumar V.S. 1997 .*Bio-Statistics*, Manomaniam Sundaranar University Publication, Tirunelveli,.
2. Gurumani, N., 2004. *An Introduction to Bio-Statistics*, Chennai, MJP Publication,
3. Arora P.N, Malhan P.K, 1996.*Bio-Statistics*, Himalaya Publishing House, New Delhi,.
4. Vijayalakshmi G and Sivapragasam C. 2009. *Research Methods: Tips and Techniques*, MJP Publishers Chennai,
5. Gupta, S.P. 1992. *Statistical Methods*, Sultan and Chand Publishers, New Delhi
6. Gupta, C.B. 1992. *An Introduction to Statistical Methods*, Vikas Publishers, New Delhi,
7. Krishnanswamy, O.R, 2002. *Methodology of Research in Social Sciences*, Himalaya Publishing House, Bombay,

III SEMESTER

17LPMU0301 LIVESTOCK AND POULTRY MANAGEMENT 4 (3+1)

Objectives:

1. The General objective of this course is to establish basic knowledge of how to manage and operate livestock and poultry farms.
2. This course is designed to impart basic technical knowledge and skills required to successfully run livestock farm enterprise by developing competencies concerning the selection and breeding of livestock, management of animals of different physiological status, feeding, housing and health care.
3. To impart scientific knowledge and skills required to run broiler and layer chicken farm successfully.

Learning Outcome:

- The students have learned about basic knowledge on how to manage and operate livestock and poultry farms
- The students will get acquainted on selection and breeding of livestock and their management aspects
- The students will gain knowledge and skills required to run broiler and layer chicken farm successfully

Theory

Unit I : **Dairy Cattle**: Introduction - Meaning of commonly used terms - Origin and domestication of livestock - Livestock census – Role of livestock in Indian economy - Milk production and availability. Cattle breeds – Indigenous breeds – Red Sindhi, Sahiwal, Gir, Kangayam – Exotic breeds – Holstein Friesian, Jersey, Brown Swiss. Breeds of buffalo – Murrah – Surti – Nili - Ravi – Selection of dairy cattle. Male and Female reproductive system – Oestrous cycle - Signs of heat. Care of calf at birth - Heifer management - Management of pregnant animals. Housing - Selection of site for the farm buildings - Types of animal housing – Conventional barn – Loose housing - construction details of cattle shed. Classification of feeds – Nutrients and their function. Digestive system of ruminants – Digestion of feed - Common ailments – Bloat – Carbohydrate engorgement – Diarrhoea – Indigestion. Common diseases – Mastitis - Foot and Mouth disease – Anthrax – Black quarter – Endoparasites – Ectoparasites.

Unit II : **Sheep**: Introduction – Zoological classification – Advantages of sheep farming – breeds classification – Indigenous breeds – Hissardale, chokla, Nali, Nellore, Mandya – Breeds of Tamil Nadu – Mecheri, Madras red, Ramnad White, Trichy black, Kilakarsal, Vembur – Exotic breeds – Merino, Rambouillet, Dorest- Suffolk – South Down – Breeding – Selection of breeding stocks - Reproduction in sheep – Breeding system –

Breeding policy for improving mutton and wool production — Feeding – Nutrient requirements – Feed resources – Pasture management – Flushing – Feeding of pregnant and lactating ewes – Housing of sheep – Common diseases – Sheep pox – Blue tongue – PPR – Anthrax – Hemorrhagic septicemia – Foot root – Pregnancy toxemia.

Unit III : **Goat**: Introduction – Meaning of commonly used terms – Advantages of goat farming – Breeds – Indigenous breeds – Jamunapari – Tellicherry – Barbari – Exotic breeds – Saanen –Toggenberg – Nubian – Breeding – Selection of breeding animal – Reproduction - Mating systems – Feeding – Feeding habits of goat – Nutrient requirement – Stall fed system of goat rearing – Control of ecto and endo parasites – Common complaints – Carbohydrate engorgement – HCN poisoning – Tetanus.

Unit IV : **Swine**: Advantages and disadvantages of pig farming – Utility – Breeds – Large White Yorkshire – Middle White Yorkshire – Landrace – Berkshire – Breeding – Selection of breeding stocks – Reproduction - symptoms of heat – Care of pregnant sows – Management at the time of furrowing – Weaning – Feeding – Creep feeding – Starter ration – Grower ration – Finisher ration – quantity to be feed – Housing of pigs - Common diseases – Swine fever – Swine pox – Foot and mouth disease – Swine erysipelas – Brucellosis.

Unit V : **Poultry**: Advantages of poultry farming – Role of egg and chicken meat in human nutrition – Parts of a fowl – Classification of poultry – American – English – Asiatic – Mediterranean classes – Management – Chick – Grower – Layer – Broiler – Housing – Location – Housing requirements – Construction details – Deep litter system – Cage system – Feeding – Nutrient requirement for different classes of chicken – Feed formulation – Common diseases – Ranikhet disease – Infectious bursal disease – Coccidiosis – Vaccination – Dressing of bird for table purpose.

Practical

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

Theory Schedule:

1. Introduction to dairying, advantages of dairying and role of dairying in Indian Economy.
2. Exploring origin and domestication of livestock, Livestock census, milk production and availability.
3. Meaning of commonly used terms, Zoological classification of bovine and name the parts of dairy cow.
4. Classification of breeds of cattle and distinguishing characteristics and production performance of breeds of cattle- Red Sindhi, Sahiwal, Gir and Kangayam, Jersey, Holstein Friesian and Brown Swiss.
5. Distinguishing characteristics and production performance of buffalo breeds – Murrah, Surti and Nili-Ravi and Selection of dairy cattle .
6. Basic anatomy and physiology of reproductive system of bull and cow
7. Changes in female reproductive system during different phase of oestrous cycle and Signs of heat in cows and buffaloes
8. Management of calf, heifer and pregnant cows.
9. Selection of site for the farm buildings and Construction of cow shed
10. Classification of feeds Nutrients and their function
11. Organs of digestive system and digestion of feed
12. Common ailments of cow – Bloat, Carbohydrate engorgement, Diarrhoea and Indigestion
13. Common diseases of cow – Mastitis, Foot and Mouth disease, Anthrax and Black quarter
14. Introduction to sheep farming, meaning of commonly used terms, Zoological classification and advantages of sheep farming and classification of sheep breed
15. Distribution, characteristics and production performance of indigenous breeds – Hissardale, chokla, Nali, Nellore and Mandya,
16. Distribution, characteristics and production performance of breeds of Tamil Nadu – Mecheri, Madras red, Ramnad White, Trichy black, Kilakarsal, Vembur
17. Distribution, characteristics and production performance of exotic breeds – Merino, Rambouillet, Dorest, Suffolk and South Down
18. Sheep Breeding – Selection of breeding stocks, Reproduction in sheep, sheep breeding systems and breeding policy for improving mutton and wool production.
19. Feeding of sheep – Nutrient requirements for different class of sheep, Feed resources, Pasture management, Flushing, Feeding of pregnant and lactating ewes.
20. Housing of sheep – space requirement, construction details of shed and yard
21. Cause, mode of transmission, clinical signs, treatment, prevention and control of common viral diseases viz. sheep pox, blue tongue and PPR.
22. Cause, mode of transmission, clinical signs, treatment, prevention and control of common bacterial diseases viz. anthrax, hemorrhagic septicemia and foot root and metabolic disease pregnancy toxemia.

23. Introduction, meaning of commonly used terms and advantages of goat farming.
24. Distribution, characteristics and production performance of indigenous goat breeds – Jamunapari, Tellicherry and Barbari.
25. Distribution, characteristics and production performance of breeds of exotic breeds – Saanen, Toggenberg Anglo Nubian and Boer.
26. Goat Breeding – Selection of breeding stocks, reproduction in goat, goat breeding systems and breeding policy for improving meat and milk production.
27. Feeding of goat – feeding habits of goat, dry matter requirements for different class of goat, Feeding schedule, feeding of different classes of goat
28. Stall fed system of goat rearing
29. Cause, mode of transmission, clinical signs, treatment, prevention and control of Common complaints – Carbohydrate engorgement, HCN poisoning and tetanus.
30. Introduction to swine farming, meaning of commonly used terms, advantages and disadvantages of pig farming
31. Breeds pig – Large White Yorkshire, Middle White Yorkshire, Landrace, Berkshire and Duroc.
32. Breeding of pigs – Selection of breeding stocks, reproduction in pigs, symptoms of heat, care of pregnant sows and management at the time of and farrowing.
33. Systems of swine rearing.
34. Management of piglets from birth to weaning.
35. Feeding of pigs– creep feed, starter ration, grower ration, finisher ration and quantity to be feed
36. Housing of pigs – space requirement, pen and yard accommodation construction details.
37. Cause, mode of transmission, clinical signs, treatment, prevention and control of common viral diseases viz. swine fever, swine pox, foot and mouth disease.
38. Cause, mode of transmission, clinical signs, treatment, prevention and control of common bacterial diseases viz. swine erysipelas and brucellosis.
39. Introduction to poultry farming, meaning of commonly used terms, advantages of poultry farming, role of egg and chicken meat in human nutrition.
40. Parts of a fowl, classification of poultry breeds on the basis of origin and utility Characteristics of American, English, Asiatic and Mediterranean classes of chicken.
41. Broiler production and management
42. Management of layer chicks.
43. Management of growers and layer chicken

44. Housing – location, housing requirements and construction details deep litter house and cage system.
45. Feeding of chicken – nutrient requirement for different classes of chicken feed ingredients and feed formulation.
46. General measures to control outbreak of diseases in a poultry farm and vaccination schedule for broiler and layer chicken.
47. Cause, mode of transmission and clinical signs of common diseases – Ranikhet disease, infectious bursal disease and coccidiosis.
48. Slaughtering of chicken for table purpose.

Practical Schedule:

1. Familiarizing with of body parts of farm animals
2. Identification of breeds of Livestock
3. Disbudding and Castration
4. Dentition and ageing
5. Recording of temperature, pulse and respiration
6. Identification of feeds and fodder
7. Preparation of plans for animal housing
8. Preparation of dairy farm projects for obtaining bank loan
9. Preparation of project for a sheep unit
10. Preparation of project for a goat unit
11. Preparation of project for a broiler chicken unit
12. Preparation of project for a layer chicken unit
13. Visit to commercial sheep, goat, piggery, rabbitry and poultry farm
14. ESE Practical Examination

References:

Text books

1. ICAR, 2013. *Hand book of Animal Husbandry, 4th Ed.*ICAR Publication, Pusa, New Delhi.
2. Banerjee, G.C., 2006. *Text book of Animal Husbandry 8th Ed.*Oxford and IBH Publishing Company Ltd., New Delhi.
3. Jagadish Prasad, 2002. *Principles and practices of Dairy Farm Management, 3rd Ed.* Kalyani Publishers, Ludhiana.
4. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. *Livestock Production Management, 4th* Ed.Kalyani Publishers, New Delhi.

5. Ranjhan, S.K., and N.N.Pathak, 2003. *Text book on buffalo production, 4 Ed.* Vikas Publishing House Pvt. Ltd., New Delhi.
6. Panda, B. and S.C.Mohapatra. 1989. *Poultry Production*. ICAR Publications, New Delhi.
7. C.P.Peacock, 1996. *Improving Goat Production in the Tropics:* A Manual for Development Workers, Oxafam.

IV SEMESTER
17AGRU0405 INTRODUCTORY AGRO-METEOROLOGY AND CLIMATE CHANGE 2 (1+1)

Objectives:

1. The general objective is to know about basic aspects and general principles of climate and weather w.r.t agriculture and allied areas
2. To facilitate the students on the climate change and its significance

Learning outcome:

1. Students can learn about climate, weather and its effect on crop production
2. Students can enrich knowledge on weather aberrations, weather forecasting and climate change and its effect on crop production
3. Students gain knowledge on handling of Agro- meteorological equipments and recording of data and presentation.

Theory

Unit I : **Introduction:** Agricultural Meteorology- Definition of Meteorology – Agro-climatology- Weather and Climate-Factors affecting weather and climate- Scope of Agricultural Meteorology-Co-ordinates of India and Tamil Nadu- Earth atmosphere – its composition, extent and structure.

Unit II : **Atmospheric pressure and precipitation:** Atmospheric weather variables- Atmospheric pressure , its variation with height- Clouds-classification and characteristics- Rainfall (Precipitation)- Types of precipitation such as rain, snow, sleet and hail-Hydrological cycle-Monsoon- mechanism and importance in agriculture – Monsoons of India-onset and withdrawal and effect on crop production- Isohytes- Artificial rain making.

Unit III : **Solar radiation and Temperature:** Solar radiation- Light and heat energy- Intensity , quality, day length and direction of light- effect on crop production, measurement- Nature and properties of solar radiation- solar constant-depletion of solar radiation, Short wave, long wave and thermal radiation, Albedo-Temperature effect on crop growth, cardinal temperature, diurnal and seasonal variations- Isotherrn- Soil temperature and effect on crop growth.

Unit IV : **Atmospheric humidity and Wind:** Atmospheric humidity- concept of saturation, vapour pressure, process of condensation, formation of dew, fog , mist, frost and cloud- Wind-Types of wind, daily and seasonal variation of wind speed, cyclone, anti cyclone, land breeze and sea breeze- Evaporation- Transpiration, evapotranspiration(ET)- Potential evapotranspiration (PET)- Definition and their importance in Agricultural production.

Unit V : **Weather aberrations, Forecasting and Climate change:** Weather hazards- drought, floods, frost, tropical cyclones and extreme weather conditions such as heat wave and cold wave- modifications of crop micro climate, climatic normal's for crop and livestock production- weather forecasting- types of weather forecast and their uses- climate change, climatic variability-global warming, causes of climatic change and its impact on regional and national Agriculture.

Practical

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

Theory Schedule:

1. Meteorology- Agricultural Meteorology- Definition, their importance and scope in crop production
2. Climate and Weather- Factors affecting climate and weather - macro climate, meso climate and micro climate-Definitions and their importance- Different climates of India and Tamil Nadu and their characterization
3. Co-ordinates of India and Tamil Nadu- Atmosphere-composition of atmosphere- Vertical layers of atmosphere based on temperature difference – Lapse rate
4. Atmospheric pressure, diurnal and seasonal variation- Pressure systems of the world- causes for variation- Isobar- Low, depression, tornado and hurricane
5. Precipitation(Rainfall)- Forms of precipitation such as rain, snow, sleet and hail- Hydrological cycle-Isohyte – Monsoon- different monsoons of India- Onset and withdrawal and effect on crop production-Artificial rain making
6. Solar radiation –Light and heat energy- Intensity, quality, day length and direction of light and effect on crop production- Measurement of solar radiation

7. Nature and properties of solar radiation- solar constant, short wave, long wave and thermal radiation, albedo
8. Temperature- factors affecting temperature- Diurnal and seasonal variation in air temperature- Isotherm-Heat unit and its use- Heat and cold injuries- Soil temperature and its effect on crop growth
9. Atmospheric humidity- Types-Vapour pressure, process of condensation- formation of dew, fog, mist, frost and cloud- Diurnal variation in relative humidity and its effect on crop production
10. Wind systems of the world- Inter Tropical Convergence Zones (ITCZ)- Wind speed in different seasons- Cyclone and anti cyclone- land breeze and sea breeze.
11. Evaporation- Transpiration, evapotranspiration(ET)- Potential evapotranspiration (PET)-Definition and their importance in Agricultural production
12. Weather hazards- drought, floods, frost, tropical cyclones and extreme weather conditions such as cold wave and heat wave- Climatic normals for crop and livestock production
13. Weather forecasting- Types, importance , agro advisory services- synoptic charts- Crop weather calendar
14. Climate change, climate variability- Global warming- Definition and causes of climate change including ENSO
15. Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal eco-system

Practical schedule:

1. Site selection, Layout and classification of Agro-meteorological observatory
2. An Introduction to School of Agriculture & Animal sciences meteorological observatory
3. Measurement of maximum and minimum temperature
4. Measurement of solar radiation and sunshine hours
5. Measurement of rainfall and humidity
6. Measurement of wind direction and wind velocity
7. Measurement of evaporation
8. Mapping of Arid and semi arid regions of India
9. Rainfall analysis and Crop planning
10. Acquiring skill in land shaping methods for in-situ soil moisture conservation
11. Drawing synoptic charts
12. Preparation of Crop weather calendars
13. ESE Practical Examinations

References

Text books

1. Gopalaswamy, N.1994. *Agricultural Meteorology*. Rawat publications, Jaipur
2. Harbal singh, M.1974. *Agricultural Meteorology*, Punjab Agricultural University, Ludhiana.
3. Krishnamurthy, U.R.1995. *Practical manual on Agricultural Meteorology*. Kalyani Publishers, Ludhiana
4. Mavi, H.S. 1994. *Introduction to Agro meteorology*. Oxford and IBH publishing co., New delhi.
5. Prasad rao, G.S.L.H.V.2005. *Agricultural Meteorology*, Kerala Agricultural University press, Thrissur

E- References

- www.tawn.tnau.ac.in
- www.usbr.gov/pn/agri.met
- www.imd.gov.in

IV SEMESTER

17AGRU0406 FARMING SYSTEM AND SUSTAINABLE AGRICULTURE 1 (1+0)

Objective:

- To facilitate the students to learn and understand the basic concepts of farming systems and cropping systems in Agriculture.

Learning Outcome:

- The Students can learn about Importnce, basic concept, benefits of Farming System and cropping system.
- The students can learn about LEISA, Conservation agriculture ,IFS and their significance in crop production

Theory

Unit I : **Farming system**: Definition-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** : Definition- Cropping pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping system.

Unit III : **Sustainable agriculture:** Definition, importance, concept,significance and its impact on agriculture. Economic and ecological aspects- Indicators of sustainability, adaptation and mitigation.

Unit IV : **LEISA**:. High External Input Agriculture(HEIA), Low External Input Agriculture(LEIA) and Low External Input Sustainable Agriculture (LEISA) and its techniques for sustainability. Conservation agriculture- Definition and strategies

Unit V : **Integrated Farming System**- Definition, objectives and characteristics, components of IFS and its advantages. Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques.

Theory Schedule:

1. Farming System-scope, importance, and concept
2. Types and systems of farming system
3. Factors affecting types of farming, Farming system components and their maintenance
4. Cropping system and pattern, multiple cropping system,
5. Efficient cropping system and their evaluation of Allied enterprises and their importance
6. Tools for determining production and efficiencies in cropping and farming system
7. Sustainable agriculture- Definition, importance, concept,significance and its impact on agriculture.
8. Economic and ecological aspects- Indicators of sustainability, adaptation and mitigation.
9. Problems and its impact on agriculture, indicators of sustainability adaptation and mitigation.
10. LEISA- High External Input Agriculture(HEIA), Low External Input Agriculture(LEIA) and Low External Input Sustainable Agriculture (LEISA) and its techniques for sustainability
11. Conservation agriculture strategies in agriculture,
12. Integrated farming system-Definition, objectives and characteristics, components of IFS.
13. Advantages of Integrated farming system.
14. IFS model for different agro-climatic zones, resource use efficiency and optimization techniques. Wet land , Garden land and Dry land IFS

References:

Text books

1. Auberach, R. (1993): *Farming with Nature : Sustainable Agriculture and Biodiversity,* New Ground, Autumn;pp. 24-26.
2. Chaterjee, B.N. And S.Maiti. 1993. *Cropping system – Theory and Practice.* Oxford and IBH publishing Co.Pvt. Ltd., New Delhi.
3. Palaniappan, SP and K. Sivaraman.1996. *Cropping systems in the Tropics – Principles and Management.* New Age International (P) Ltd., Publishers, New Delhi.
4. Jayanthi.C. *et.al,* 2002. *Integrated farming system – A path to Sustainable Agriculture*. TNAU Publication No.14/2002.
5. Rangasamy, A., K.Annadarai, P.Subbian and C.Jayanthi.2002. *Farming systems in the Tropics,* Kalyani Publishers.
6. Panda, S.C. 2003. *Cropping and Farming Systems*. Agro bias, Jodhpur.

IV SEMESTER

17AGRU0407 CROP PRODUCTION TECHNOLOGY – II (*Rabi Crops*) 2 (1+1)

Objective:

The aim of this course is to know about the importance and cultivation aspects of Cereals, millets, pulses, oilseeds and fodder crops raised under *rabi* season

Learning outcome:

1. Students can learn about the Crop classification and cultivation practices of various crops grown under *rabi* season
2. Students can gain practical knowledge on cultivation and preservation of fodder including recording bio-metric observation and working of cost of cultivation for various *rabi* crops

Theory

Unit I : **Cereals:** Wheat, Barley and Rye- – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.

Unit II : **Pulses:** Bengal gram (Chick pea), Lentil and Peas: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.

Unit III : **Oil Seeds:** Rape seed and Mustard**,** Sesame (Gingelly) and Sunflower - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.

Unit IV : **Sugar , Medicinal and Aromatic Crops:** Sugarcane and Sugar beet- Medicinal and Aromatic crops- Mentha, Lemon grass and Citronella - Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.

Unit V : **Forage crops and Fodder preservation -** Fodder legumes- Berseem, Lucerne and Oats- Tree fodder crops- Agathi, Subabul and Acacia -Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield- Classification of feed- Green fodder, hay and silage (Preserved fodder)- hay and silage making methods

Practical

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

Theory Schedule:

1. Importance and area , production and productivity of major *rabi* Cereals and Pulses of India and Tamil Nadu
2. Importance and area , production and productivity of major *rabi* Oil seeds (Rapeseed and mustard) sesame, sugar crops and *rabi* forage crops of India and Tamil Nadu
3. Wheat – Origin, distribution-economic importance- varieties- soil and climatic requirements- main field and other cultural practices such as Nutrient management , weed management, Water management, harvest and yield
4. Barley- Origin, distribution-economic importance- varieties- soil and climatic requirements – Cultural practices such as seeds and sowing, manuring, weed management , harvest and yield
5. Chick pea (Bengal gram)- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as seeds and sowing, manuring, weed management , harvest and yield
6. Lentil and peas- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as nursery, seeds and sowing, manuring, weed management , harvest and yield
7. Rape seed and Mustard- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
8. Sesame(Gingelly)- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
9. Sunflower- Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
10. Sugarcane- Origin, distribution-economic importance- varieties- soil and climatic requirements-
11. Sugarcane- Cultural practices such as, seeds and sowing, manuring, weed management , detrashing, propping, harvest and yield and Sugarbeet cultivation
12. Mentha, lemon grass and citronella: Origin, distribution-economic importance- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield
13. Berseem, Lucerne and oats- varieties- soil and climatic requirements- Cultural practices such as, seeds and sowing, manuring, weed management , harvest and yield

14. Cultivation of tree fodder – Agathi, Subabul and Acacia
15. Classification of feed- Green fodder, hay and silage (Preserved fodder)- hay and silage making methods.

Practical Schedule:

1. Identification of rabi Cereals, pulses, Sugarcane and forage crops in the crop cafeteria
2. Practicing land preparation for wheat and Barley crop
3. Practicing main field preparation for rabi pulses and Oilseeds
4. Acquiring skill in different seed treatment techniques in important field crops
5. Estimation of plant population per unit area for important field crops
6. Acquiring skill in field preparation , sowing, and manuring of crops under pure and inter cropping situations for rabi Cereals and Pulses
7. Acquiring skill in field preparation , sowing, and manuring of crops under pure and inter cropping situations for rabi Oil seeds and forage crops
8. Acquiring skill in Sett treatment of Sugarcane
9. Acquiring skill in planting methods for sugarcane crop
10. Observation on growth parameters of rabi cereals and Pulses
11. Observation on growth parameters of rabi Oilseeds and Sugarcane
12. Study of yield parameters and estimation of yield in important rabi field crops
13. Working out cost and returns of important Cereals, Pulses, Oil seeds, Sugarcane and fodder crops
14. ESE Practical Examinations

References:

Text books

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini, 1998. *Scientific Crop production in India.* Rama publishing House, Meerut
2. Chidda Sngh, 1997. *Modern techniques of raising Field crops*. Oxford and IBH publishing Co. Pvt.Ltd., New Delhi.
3. Singh, S.S. 1997. *Crop management under Irrigated and Rainfed conditions*. Kalyani publishers , New Delhi.

E. References:

- www.cgiar.org ,
- www.tnau.ac.in/agriportal

IV SEMESTER

17SACU0403 PROBLEMATIC SOILS AND THEIR MANAGEMENT 2 (2+0)

Objective:

- To teach the matters pertaining to the problematic soils, their reclamation and crop suitability to those soils

Learning Outcome:

1. Studying about soil quality, soil physical and chemical constraints, wastelands and land use classification.
2. Studying irrigation water quality.
3. Studying the application of remote sensing and GIS in problem soil management.

Theory

Unit I : **Soil Quality:** Soil quality and health; Indices of soil quality; Long term effect of application of toxic organic and inorganic wastes viz., fertilizers, pesticides, sewage, industrial effluents on soil properties and crop growth.

Unit II : **Wastelands and land use classification:** Distribution of waste land and problem soils in India. Their categorization based on properties. Problematic soils under different Agro-ecosystems. Land capability and classification, land suitability classification.

Unit III : **Soil physical and chemical problems:** Soil physical constraints - Highly permeable, Impermeable and ill drained soils, Soil crusting, sub soil hardening, fluffy paddy soils- characteristics and their management. Eroded and Compacted soils, Flooded soils, Polluted soils. Soil Chemical problems – Acid soils, Acid sulphate soils, saline soils, sodic soils and saline sodic soils – Geneis, characteristics - Reclamation and management techniques of chemical problem soils.

Unit IV : **Irrigation water quality:** Quality of irrigation waters – water quality parameters - water quality appraisal – effect of poor quality waters on soil and crop growth and management – utilization of saline water in agriculture.

Unit V :

Remote sensing and GIS in problem soil management: Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation of soils through MPTs.

Theory Schedule:

1. Definition and introduction of soil quality and health,
2. Indices of soil quality.
3. Long term effect of application of toxic organic and inorganic wastes viz., fertilizers, pesticides.
4. Long term effect of application of sewage, industrial effluents on soil properties and crop growth
5. Distribution of waste land and problem soils in India. Their categorization based on properties.
6. Problematic soils under different Agro-ecosystems.
7. Land capability and classification
8. Land suitability classification.
9. Soil physical constraints - Highly permeable, Impermeable and ill drained soils - characteristics and their management.
10. Soil crusting, sub soil hardening, fluffy paddy soils- characteristics and their management.
11. Soil erosion – types, causes and effects.
12. Management of soil erosion.
13. Compacted soils
14. Flooded soils
15. Polluted soils.
16. Genesis, characteristics - reclamation and management techniques of acid soils
17. Genesis, characteristics - reclamation and management techniques of acid sulphate soils
18. Genesis, characteristics - Reclamation and management techniques of Saline soils
19. Genesis, characteristics - reclamation and management techniques of sodic soils and saline sodic soils.
20. Quality of irrigation waters
21. Water quality parameters
22. Water quality appraisal
23. Effect of poor quality waters on soil and crop growth and management
24. Utilization of saline water in agriculture.
25. Remote sensing and GIS in diagnosis and management of problem soils.
26. Multipurpose tree species
27. Bio remediation of soils through MPTs.

References:

Text books

1. Buol, S.W., Hole, F.D., McCracken, R.J., (1973). *Soil genesis and classification*. Oxford and IBH publishing Co., New Delhi
2. Sehgal, J.2005. *Pedology concepts and applications*, Kalyani Publishers, New Delhi
3. USDA, 1954. *Diagnosis and improvements of saline and alkali soils (Ed)* L.A.Richards, Handbook No.60. USDA Washington DC.

4. Somani, L.L. and K.L. Totawat, 1993. *Management of salt affected soils and water*
5. Poonkodi, P., Dhanasekaran, K. and Rasavel, M. 2004. *Soil Survey, Taxonomy, Remote Sensing and Problem soils.* Rasi offset Printers, Chidambaram.
6. Paul A.Longley, Mike Goodchild, David J.Maguire and David W.Rhind, 2010. *Geographic Information Systems and Science*, John Wiley and Sons Ltd., Chichester
7. David Dent, Anthony Young, 1981. *Soil Survey and Land Evaluation*. HarperCollins Publishers Ltd. US.

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2. www.fao.org/ soils- portal
3. http.// web soil survey. nrcs.usda.gov
4. www. isric.org

IV SEMESTER
17PBGU0403 PRINCIPLES OF SEED TECHNOLOGY 3 (1+2)

Objective:

- To understand the importance of seed quality and principles involved in seed production

Learning Outcome:

- The Students will gain Knowledge about the various techniques of quality seed production, processing and seed quality enhancement.

Theory

Unit I : **Seed** – Definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, Seed quality: Definition, Characters, different classes of seed.

Unit II : **Foundation and certified seed** production of important cereals, pulses, oilseeds, fodder and vegetables. Seed Certification: phase, procedure, field inspection. Seed act and seed act enforcement, duty and powers of seed inspector, offences and penalties.

Unit III : **Seeds control order 1983**. Detection of genetically modified crops, GM crops and organic seed production. Seed drying, processing and their steps, Seed testing for quality assessment: Grow out test and Electrophoresis, molecular and biochemical test.

Unit IV : **Seed treatment**, its importance, method of application and seed packing. Seed storage: principles, stages and factors affecting seed longevity during storage .Measure for pest and disease control during storage.

Unit V : **Seed Marketing:** Structure and organization, promotional media, Factors affecting seed marketing, Role of WTO in seed marketing. Private and public sectors and their production and marketing strategies.

Practical

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

Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Theory Schedule:

1. Seed – Introduction , definition and importance
2. Seed technology - Introduction , definition and importance
3. Deterioration of crop varieties – causes and maintenance
4. Maintenance of genetic purity during seed production
5. Seed quality
6. Classes of seed
7. Foundation and certified seed production of – Rice ,Wheat, Maize
8. Foundation and certified seed production of –Sorghum, Pearl Millet
9. Foundation and certified seed production of – Gram and Rape seed mustard.
10. Foundation and certified seed production of – Sunflower , Castor
11. Foundation and certified seed production of – Cotton
12. Foundation and certified seed production of - Tomato, Chilli, Bhendi.
13. Foundation and certified seed production of, Onion,Cucurbits.
14. Seed certification phases of certification, procedure for seed certification and field inspection, fields counts.
15. Seed act 1966 and Seed act enforcement,
16. Duties and powers of seed inspectors, offences and penalities
17. Seed control order: Seed control order 1983.
18. Varietal identification
19. Genetically modified crops
20. Seed drying-Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air
21. Seed processing-planning and establishment of seed processing plant; air screen machine and its working principle, different upgrading equipment and their use.
22. Principles of seed treatment
23. Seed storage; stages of seed storage, factors affecting seed longevity storage and conditions required for good storage, general principles of seed storage.
24. Seed marketing- marketing structure, marketing organization.
25. Intellectual Properties Rights, Patenting,WTO,Plant Breeders Rights and Farmer,s Right
26. Pricing policy

Practical Schedule:

1. Seed production fields to study isolation distance, Planting Ratio and Border rows in Cereals
2. Seed production fields to study isolation distance, Planting Ratio and Border rows in Pulses
3. Seed production fields to study isolation distance, Planting Ratio and Border rows in Oilseeds
4. Seed production fields to study isolation distance, Planting Ratio and Border rows in Vegetables

5. Seed Sampling , Mixing and Dividing
6. Purity Analysis
7. Seed germination Test, Tetrazolium Test and Evaluation
8. Seedling Evaluation and Seed Health test
9. Seed Vigour Tests and Evaluation
10. Seed certification – Field Counting procedure and inspection procedure
11. Visit to Seed production farms
12. Visit to Seed testing Laboratories
13. Visit to Seed processing unit
14. ESE Practical Examination

References:

Text books

1. Agarwal, R.L.1991. *Seed Technology*, Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. *Seed Technology*, ICAR, New Delhi.
3. Subir Sen and Nabinanda Ghosh.1999. *Seed Science and Technology*, Kalyani Publishers. New Delhi.
4. Dhirenra Khare and Mohan S. Bhale.2000. *Seed Technology.* Scientific Publishers(India), Jodhpur.
5. A.K. Joshi and B.D. Singh.2005. *Seed Technology*. Kalyani Publishers, New Delhi.
6. Bhaskaran .M *et al.,* 2004. *Principles of seed production*. Scientific Publishers, Ludhiana.

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2. www.seednet.gov.in
3. www.agricoop.nic.in
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1. Seed Science Research (www.jgateplus.com)
2. Seed Science and Technology (www.jgateplus.com)

IV SEMESTER
17HORU0403 PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS 2 (1+1)

Objectives:

1. To learn about the production technology of Tropical, Subtropical, Humid zone, Arid and Temperate fruit crops.
2. To learn about the production technology of Plantation crops.

Learning Outcome:

- The students will learn about latest production technology of Major and minor fruit crops and plantation crops.

Theory

Unit I : **Introduction - Major fruit crops:** Importance and scope of fruit and plantation crop industry in India. Importance of rootstocks. Production technologies for the cultivation of major fruits-Mango, Banana, Citrus.

Unit II : **Tropical and subtropical fruits:** Grape, Guava, Litchi, Papaya and Sapota

Unit III : **Temperate fruits:** Temperate fruits-Apple, Pear, Peach & Walnut and Almond

Unit IV : **Minor fruits-Arid or semiarid zone fruit crops:** Minor fruits- Datepalm, Ber, Pineapple, Pomegranate, Jackfruit and Strawberry

Unit V : **Plantation crops:** Coconut, Arecanut, Cashew, Tea, Coffee and Rubber.

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

Theory Schedule:

1. Importance and scope of fruit and plantation crop industry in India. Importance of rootstocks.
2. Production technology of Mango.
3. Production technology of Banana.
4. Production technology of Citrus.
5. Production technology of Grape.

6. Production technology of Guava and Litchi.
7. Production technology of Papaya and Sapota.
8. Production technology of Apple, Pear and Peach.
9. Production technology of Walnut, Almond.
10. Production technology of Minor fruits- Date, Ber and Pineapple.
11. Production technology of Pomegranate, Jackfruit, Strawberry.
12. Production technology of Arecanut, Cashew.
13. Production technology of Coconut.
14. Production technology of Tea.
15. Production technology of Coffee.
16. Production technology of Rubber.

Practical Schedule:

1. Seed propagation.
2. Scarification and stratification of seeds.
3. Propagation methods for fruits and plantation crops.
4. Description and identification of fruits.
5. Practicing calculation and application of manures and fertilizers.
6. Preparation of plant bio regulators and their applications.
7. Important pests and diseases of fruit crops.
8. Practicing training and pruning methods followed in Tea and Coffee
9. Physiological disorders of Fruit and Plantation crops.
10. Practicing harvesting and postharvest handling of Fruit crops.
11. Visit to state Rubber farm.
12. Visit to papain extraction unit.
13. Visit to commercial orchards.
14. ESE Practical Examination

References:

Text books

1. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. *Scientific Fruit culture*, Suri Associates, Coimbatore.
2. Bose, T.K. 1988. *Fruits of India – Tropical and Sub-tropica*l, Naya Prakash Publications, Calcutta.
3. Gardner, V.R., F.F. Bradford and H.D. Hooker. 1952. *Fundamentals of fruit production.* Mc Graw Hill Book Co., Inc. London.
4. Kumar N, A. Khader P. Rangaswami and Irulappan I. 2000. *Introduction to Spices, Plantation Crops*, Medicinal and Aromatic Plants. Oxford and IBH.
5. Peter, K.V. 2002. *Plantation crops* – National Book Trust of India – New Delhi.
6. Shanmugavelu, K.G. 1990. *Production technology of fruit crops*. Oxford and IBH Publishing Co (P) Ltd., New Delhi.
7. Shanmugavelu, K.G. and V.N. Madhava Rao. 1980. *Spices and plantation crops.* India Book House, New Delhi.
8. Chadha,K.L. (ICAR) 2002, 2001. *Hand book of Horticulture*. ICAR, New Delhi.

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2. www.hort.purdue.edu/newcrop/morton
3. http://www.indianspices.com/
4. http://indiacoffee.org./
5. http://cpcri.nic.in/

Journals

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2. J. of Ameri. Soci. of Hort. Sci.
3. Acta Hort.

IV SEMESTER

17HORU0404 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAP AND LANDSCAPING 2 (1+1)

Objectives:

1. To impart knowledge on the advances made in the production technology of Cut and Loose flowers in India.
2. To impart comprehensive knowledge about the production technology of Medicinal and Aromatic crops.
3. To learn the basic aspects of successful Landscape Design.

Learning Outcome:

- The students will be familiarized on Production technology and comprehensive knowledge on cut and loose flowers, Medicinal and Aromatic crops respectively
- The students will be equipped with basic concepts of Landscape design

Theory

Unit I : **Introduction:** Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of Trees, Shrubs and Climbers.

Unit II : **Protected cultivation – Cut flowers:** Production technology of important cut flowers like Rose, Gerbera, Carnation, Lilium and Orchids under protected conditions.

Unit III :

Production technology of Cut flowers and Loose flowers: Production technology of gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like Marigold and Jasmine under open conditions.

Unit IV : **Production technology of Medicinal plants:** Production technology of important medicinal plants like Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum, Periwinkle, Isabgol

Unit V :

Production technology of Aromatic plants: Mint, Lemongrass, Citronella, Palmarosa, Ocimum, Rose, geranIum, Vetiver. 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 postharvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Theory Schedule:

1. Importance and scope of Ornamental crops, Medicinal and Aromatic plants and landscaping.
2. Principles of landscaping.
3. Landscape uses of Trees and Shrubs.
4. Climbers and Creepers.
5. Production technology of important Cut flowers like Rose, Gerbera under protected conditions.
6. Production technology of Carnation, Lilium and Orchids under protected conditions.
7. Production technology of Gladiolus and Tuberose.
8. Production technology of Chrysanthemum under open conditions.
9. Package of practices for Loose flowers like Marigold and Jasmine under open conditions.
10. Production technology of important medicinal plants like Ashwagandha, Asparagus.
11. Production technology of Aloe, Costus and Cinnamum.
12. Production technology of Periwinkle and Isabgol.
13. Production technology of Aromatic plants like Mint, Lemongrass and Citronella.
14. Production technology of Palmarosa, Ocimum and Rose.
15. Production technology of Geranium and Vetiver.
16. Processing and value addition in Ornamental crops.
17. Processing and value addition in Ornamental crops MAPs.

Practical Schedule:

1. Identification of Ornamental plants.
2. Identification of Medicinal plants and Aromatic Plants.
3. Nursery bed preparation and seed sowing.
4. Training and pruning of Ornamental plants.
5. Planning and layout of garden.
6. Practicing in lawn making methods.
7. Bed preparation and planting of MAP.
8. Protected structures – care and maintenance.
9. Intercultural operations in flowers and MAP.
10. Harvesting and postharvest handling of Cut and Loose flowers.
11. Visit to essential oil extraction unit & Processing of MAP.

12. Visit to commercial flower field.
13. Visit to a medicinal and Aromatic plants farm.
14. End semester practical examination.

References:

Text books

1. Bose, T.K. and P. Yadav. 1989. *Commercial flowers*. Naya Prakash Publications, Calcutta.
2. Kumar, N. 1997. *Introduction to Horticulture.* Rajalakshmi Publication, Nagercoil.
3. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. *Spices, Plantation Crops, Medicinal and Aromatic plants*, Rajalakshmi Publications, Nagercoil
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5. Robert Bentley and Henry Trimen. 2002. *Medicinal plants,* Omsons Publications, New Delhi.
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2. http:// www.intuxford.tripod.com
3. www.nmpb.nic.in
4. www.agrobiosindia.com
5. www.frlht.india.org

Journals

1. Amruth
2. Journal of medicinal and aromatic plants.
3. Journal of Indian Perfumer.

IV SEMESTER
17AGEU0403 RENEWABLE ENERGY AND GREEN TECHNOLOGY 2(1+1)

Objectives:

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio alcohol, biodiesel and bio oil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, 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, introduction of wind energy and their application.

Practical

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

IV SEMESTER

17AECU0403 AGRICULTURAL MARKETING, TRADE AND PRICES 3 (2+1)

Objectives:

- To impart the students on knowledge about the Marketing strategies and their nature.
- To impart the students on knowledge about the Marketing process their functions, Hurdles and the Trade concepts.

Learning Outcome:

- The students have been equipped with better marketing strategies and to handle it in a better way.
- They know better about marketing functions and trade concepts.

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;

Unit III : **Marketing process and functions:** Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel;number of channel levels; marketing channels for different farm products;

Unit IV : **Integration,** efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions-CWC, SWC, FCI, CACP & DMI – their objectives and functions;

Unit V : **Cooperative marketing in India;** Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR

Practical

Plotting and study of demand and supply curves and calculation of elasticity**;** Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

Theory Schedule:

1	Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing
2	Market structure, marketing mix and market segmentation
3	Classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities
4	Nature and determinants of demand and supply of farm products
5	Producer's surplus – meaning and its types
6	Marketable and marketed surplus, factors affecting marketable surplus of agri-commodities
7	Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC
8	Strategies in different stages of PLC
9	Pricing and promotion strategies: pricing considerations and approaches
10	Cost based and competition based pricing

11 Market promotion – advertising, personal selling
12 Sales promotion and publicity – their meaning and merits & demerits
13 Marketing process and functions: Marketing process-concentration, dispersion and equalization
14 Exchange functions – buying and selling
15 Physical functions – storage, transport and processing
16 Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark)
17 Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing
18 Meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products
19 Integration, efficiency, costs and price spread: Meaning, definition and types of market integration
20 Marketing efficiency, marketing costs, margins and price spread
21 Factors affecting cost of marketing; reasons for higher marketing costs of farm commodities, ways of reducing marketing costs
22 Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI
23 CACP & DMI – their objectives and functions
24 Cooperative marketing in India; Types of risk in marketing; speculation & hedging, futures trading
25 Agricultural prices and policy: Meaning and functions of price, administered prices; need for agricultural price policy
26 Trade: Concept of International Trade and its need, theories of absolute and comparative advantage
27 Present status and prospects of international trade in agri-commodities
28 GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR

Practical schedule:

1 Practical 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 behaviour 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
8 Collection of data regarding marketing costs, margins and price spread
9 Visit to market institutions – NAFED
10 Visit to SWC and CWC

11 Visit to cooperative marketing society, etc. to study their organization and functioning
12 Application of principles of comparative advantage of international trade
13 Presentation of report in the class
14 ESE Practical Examination.

References:

Text books

1. Acharya, S.S and Agarwal, N.K.(1992) *Agricultural Marketing in India*, IBH, Publishing Ltd., New Delhi
2. Jhingam,J.L.(1998). *International Economics*, Vrinda Publications, New Delhi.
3. Francis Cherunilam,(2000). *Internatioinal Economics*, Oxford & IBH, New Delhi.

V SEMESTER

17SACU0504 GEOINFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING 2 (1+1)

Objectives:

1. To introduce the concept of precision farming
2. To teach Geoinformatics as a tool for precision farming
3. To teach the basic concepts and applications of nanotechnology in agriculture

Learning outcome:

1. Introducing precision agriculture to the students, geo-informatics and geospatial technologies as a modern tool for precision agriculture and crop growth improvement in agriculture
2. Studying the concepts and applications of remote sensing and image processing in agriculture
3. Understanding the concepts of nanotechnology

Theory

Unit I : **Introduction to precision agriculture:** Precision agriculture- Historical Aspects, Definitions for Precision Farming, Major Components of Precision Farming or Site-specific Farming, Advantages and Constraints to Adoption of Precision Farming, issues and concerns for Indian agriculture.

Unit II : **Remote sensing in agriculture:** Remote sensing concepts and application in agriculture; Image processing and interpretation.

Unit III : **Geo-informatics:** Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Spatial data and their management in GIS ; Global positioning system (GPS), components and its functions.

Unit IV : **Geospatial technologies in agriculture:** Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Variable Rate Technology (VRT), STCR approach for precision agriculture; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs.

Unit V : **Nanotechnology and its applications in agriculture:** Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, application in agriculture- nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

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

Theory Schedule:

1. Precision agriculture- Historical Aspects, Definitions for Precision Farming,
2. Major Components of Precision Farming or Site-specific Farming, Advantages and Constraints to Adoption of Precision Farming, Issues and concerns for Indian agriculture.
3. Remote sensing concepts and application in agriculture
4. Image processing and interpretation.
5. Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture.
6. Spatial data and their management in GIS
7. Global positioning system (GPS), components and its functions.
8. Crop discrimination and Yield monitoring using spatial technologies
9. Soil mapping;
10. Fertilizer recommendation using geospatial technologies; Variable Rate Technology (VRT), STCR approach for precision agriculture
11. Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs
12. Definition of nanotechnology, concepts and techniques.
13. Introduction about nanoscale effects
14. Classification and properties of nano-particles
15. Application in agriculture- nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical Schedule:

1. Introduction to GIS software, spatial data creation and editing.
2. Introduction to image processing software.
3. Visual and digital interpretation of remote sensing images.
4. Generation of spectral profiles of different objects.
5. Supervised and unsupervised classification and acreage estimation.
6. Multispectral remote sensing for soil mapping.
7. Creation of thematic layers of soil fertility based on GIS.
8. Creation of productivity and management zones.

9. Fertilizers recommendations based on VRT technique.
10. Fertilizers recommendations based on STCR technique.
11. Crop stress (biotic/abiotic) monitoring using geospatial technology.
12. Use of GPS for agricultural survey.
13. Formulation, characterization and applications of nanoparticles in agriculture.
14. Projects formulation and execution related to precision farming.
15. ESE Practical Examinations.

References:

Text books

1. Eden, M.J and Pary, J.T., 1986. *Remote Sensing and Tropical Land Management*. Wiley and Sons, London.
2. Paul A.Longley, Mike Goodchild, David J.Maguire and David W.Rhind, 2010. *Geographic Information Systems and Science*, John Wiley and Sons Ltd., Chichester.
3. Poonkodi, P., Dhanasekaran, K. and Rasavel, M. 2004. *Soil Survey, Taxonomy, Remote Sensing and Problem soils*. Rasi offset Printers, Chidambaram.
4. Pradeep. T. 2012. Nano – *The essentials – Understanding Nanoscience and Nanotechnology*, Tata Mc Grew-Hill, New Delhi.

E-References:

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2. www.esri.com

V SEMESTER

17AGRU0508 PRACTICAL CROP PRODUCTION-I (*Kharif Crops*) 2 (0+2)

Objective:

To expose the students on hands on training in cultivation of crops from land preparation up to harvest including economics of cultivation

Learning outcome:

1. Students can learn about cultivation of crops in the field with practical exposure
2. Students can gain knowledge on working out cost of cultivation and CBR

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-pest 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, weed, 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

- Each student will be allotted a minimum of 100/200 m2 and he/she will do all field operations in the allotted land area for field preparation to harvest and processing
- Any irrigated Puddled low land rice/ any irrigated dry crops (maize /Sorghum/Pearl millet/ finger millet/cotton/groundnut/ *kharif* pulses like Black gram/ green gram/Red gram based on the availability of water in the farm

Practical Schedule:

- Rice (Transplanted rice or Direct sown rice)

Transplanted Rice

- Rice ecosystems- Climate and weather – seasons and varieties of Tamil Nadu
- Preparation of nursery- Application of manures to nursery- seed treatment- forming nursery beds and sowing seeds- Weed management and plant protection to nursery.
- Preparation of main field- Application of organic manures- green manuring – Bio-fertilizers- Pulling out seedlings and transplanting- ADT 43/ Rajarajan 1000(SRI)-Application of herbicides- Water management- Nutrient management- Plant protection measures- Mechanization in rice cultivation- Recording growth, yield attributes and yield.
- Harvesting , threshing, drying and cleaning the produce- Working out cost of cultivation and Economics

Practical Schedule:

Transplanted Rice

1. Study of rice ecosystems , climate, weather, seasons and varieties of Tamil Nadu
2. Selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery
3. Acquiring skill in seed treatment, seed soaking and incubation, nursery sowing and management
4. Study and practice of main field preparation and puddling operations
5. Practicing of field preparatory operations- sectioning of field bunds and plastering, leveling, and basal application of fertilizers
6. Estimation of plant population and acquiring skill in gap filling and thinning
7. Study of weeds and weed management in rice
8. Study and practice of green manuring and bio-fertilizers application in rice
9. Acquiring skill in nutrient management and practicing top dressing techniques
10. Study of water management practices for lowland rice
11. Observation of insect pests and diseases and their management
12. Recording growth and other related characters rice and Estimation of yield parameters of in rice
13. Harvesting ,threshing and cleaning of the produce
14. Working out cost of cultivation and economics
15. ESE Practical Examinations

References:

Text books

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini, 1998. *Scientific Crop production in India*. Rama publishing House, Meerut
2. Chidda Singh, 1997. *Modern Techniques of raising Field crops.* Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
3. ICAR 2006. *Hand Book of Agriculture*. Indian Council of Agricultural Research, New Delhi
4. *Crop production Guide*, 2005. Directorate of Agriculture, Chennai and TNAU
5. Rajendra Prasad, 2004. *Text book on Field Crop production*. Indian Council of Agricultural Research, New Delhi.
6. K.Annadurai and B.Chandrasekaran, 2009. *A Text Book of Rice Science*. Scientific Publishers

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2. www.crri.nic.in
3. www.drrindia.org

V SEMESTER

17SACU0505 MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT 3 (2+1)

Objectives:

1. To offer the elements of soil fertility management
2. To give a detailed idea about the preparation of manures and their importance in agriculture
3. To teach about chemical fertilizers and their reactions in soils

Learning Outcome:

1. Studying about organic manures and preparation techniques of organic manures
2. Studying the types of chemical Fertilizers
3. Studying about soil fertility and plant nutrition, nutrient transformation and Soil fertility evaluation.

Theory

Unit I : **Organic manures:** Introduction and importance of organic manures, properties, classification and methods of preparation of bulky and concentrated manures. Compost – Enriched FYM, Composting of organic wastes *viz,* coir pith, sugarcane trash, leaf litters and farm wastes; Green/leaf manures.

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

Unit III : **Soil fertility and plant nutrition:** History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.

Unit IV : **Transformation of essential nutrients:** Chemistry of essential nutrients namely sources – forms – transformation – mobility - uptake – fixation – losses of of soil Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur and Micronutrients.

Unit V : **Soil fertility evaluation:** Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Fertilizer recommendation approaches; Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), Methods of application under rainfed and irrigated conditions. Nutrient management strategies – INM, RTNM, SSNM

Practical

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

Theory Schedule:

1. Introduction and importance of organic manures, its properties and classification
2. Methods of preparation of bulky and concentrated manures.
3. Enriched FYM, composting of organic wastes *viz,* coir pith, sugarcane trash, leaf litters and farm wastes;
4. Green/leaf manures.
5. Chemical fertilizers: sources, classification, composition and properties of major nitrogenous fertilizers.
6. Sources, classification, composition and properties of major phosphatic fertilizers.
7. Sources, classification, composition and properties of major potassic fertilizers.
8. Secondary & micronutrient fertilizers.
9. Complex fertilizers.
10. Nano fertilizers.
11. Fertilizer Storage, Fertilizer Control Order
12. Soil amendments.
13. History of soil fertility and plant nutrition.
14. Criteria of essentiality- Essential plant nutrients
15. Role, deficiency and toxicity symptoms of primary plant nutrients
16. Role, deficiency and toxicity symptoms of secondary plant nutrients
17. Role, deficiency and toxicity symptoms of micro nutrients
18. Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.
19. Sources – forms – transformation – mobility - uptake – fixation – losses of soil Nitrogen.
20. Sources – forms – transformation – mobility - uptake – fixation – losses of Phosphorus.
21. Sources – forms – transformation – mobility - uptake – fixation – losses of potassium.
22. Sources – forms – transformation – mobility - uptake – fixation – losses of Calcium, Magnesium and Sulphur.
23. Sources – forms – transformation – mobility - uptake – fixation – losses of micronutrients.
24. Soil fertility evaluation – visual symptoms, plant analysis, rapid plant tissue tests, biological tests.
25. Soil fertility evaluation - Soil testing.
26. Critical levels of different nutrients in soil, Indicator plants.
27. Fertilizer recommendation approaches and methods.

28. Factor influencing nutrient use efficiency (NUE).
29. Methods of application under rainfed and irrigated conditions.
30. Nutrient management strategies – INM, RTNM, SSNM

Practical Schedule:

1. Principles, calibration and applications of pH and EC meter.
2. Colorimetry and Flamephotometry
3. Atomic absorption spectroscopy.
4. Estimation of soil organic carbon,
5. Estimation of alkaline hydrolysable N in soils.
6. Estimation of soil extractable P in soils.
7. Estimation of exchangeable K in soils
8. Estimation of exchangeable Ca and Mg in soils .
9. Estimation of soil extractable S in soils.
10. Estimation of DTPA extractable Zn in soils.
11. Estimation of N in plants.
12. Estimation of P in plants.
13. Estimation of K in plants.
14. Estimation of S in plants.
15. Final practical examination

References:

Text books

1. Das,P.C.1993. *Manures and Fertilizers*. Kalyani Publishers, Ludhiana
2. *Hand Book of Fertilizer Technology*. 2001. FAI, New Delhi
3. *Hand Book of Fertilizer Usage*. FAI, New Delhi
4. Kanwar, J.S. 1976. *Soil Fertility – Theory and Practice*. ICAR, New Delhi
5. Krishna, K.R.(Ed.). 2002. *Soil Fertility and Crop Production*. Oxford and IBH Publishing Co., New Delhi
6. Sehgal, J. 1996. *Pedology concepts and applications*. Kalyani Publishers, New Delhi
7. Singh, S.S.1995. *Soil Fertility and Nutrient Management*. Kalyani Publishers, Ludhiana.
8. Soil Survey Staff. 1996. *Soil Survey Manual*. Oxford and IBH Publishing Co., New Delhi
9. Tisdale, S.L., Nelson, W.L. and Beaton, J.D. 1990. *Soil Fertility and Fertilizers*. MacMillan Publishing Company, New York.

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1. agritech.tnau.ac.in
2. www.fao.org/ soils- portal

V SEMESTER
17PBGU0504 CROP IMPROVEMENT –I (*Kharif Crops*) 2 (1+1)

Objective:

- To impart knowledge to the students on the botanical description, origin, distribution and various breeding approaches used for the development of varieties / hybrids in various *kharif* crops

Learning Outcome:

- The student will learn about basic concepts of classical, wild species methodologies employed for *Kharif* crops and current trends in plant breeding will be exposed.

Theory

Unit I : **Centers of origin**, distribution of species, wild relatives – Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeon pea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Castor, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous.

Unit II : **Plant genetic resources**, its utilization and conservation, study of genetics of qualitative and quantitative character. Important concept of plant breeding - self pollinated, Cross pollinated, Vegetatively propagated crops.

Unit III : **Breeding objective and methods**, procedure for developing hybrids / varieties - Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeon pea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Castor, Cotton, Cowpea.

Unit IV : **Breeding objective and methods methods**, procedure for developing hybrids / varieties - Tobacco, Brinjal, Okra and Cucurbitaceous. Breeding for abiotic stress and biotic stress .Genotype – Environment interaction and adaptation.

Unit V : **Hybrid seed production technology** – Rice, Maize, Sorghum, Pearl millet and Pigeaon pea, Cotton. Ideotype concept and climate resilient crop varieties for future.

Practical

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

hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Theory Schedule:

1. Place of origin – distribution of species – related wild species – Rice, Maize.
2. Place of origin – distribution of species – related wild species – Sorghum, Pearl Millet, Ragi.
3. Place of origin – distribution of species – related wild species – Pigeonpea, Urdbean and Mungbean.
4. Place of origin – distribution of species – related wild species - Soybean, Cowpea.
5. Place of origin – distribution of species – related wild species – Groundnut, Seasame, Castor.
6. Place of origin – distribution of species – related wild species – Cotton, Jute.
7. Place of origin – distribution of species – related wild species – Tobacco, Brinjal, Okra and cucurbitaceous.
8. Plant genetic resources – definition and important - conservation – evaluation – documentation – distribution and utilization
9. Study of genetics of qualitative and quantitative character.
10. Important concept of plant breeding - self pollinated, Cross pollinated, vegetatively propagated crops.
11. Breeding objectives – major breeding procedures for development of hybrids / varieties – Rice, Maize
12. Breeding objectives – major breeding procedures for development of hybrids / varieties – Sorghum, Pearl Millet, Ragi.
13. Breeding objectives – major breeding procedures for development of hybrids / varieties – Pigeonpea, Urdbean, Mungbean,
14. Breeding objectives – major breeding procedures for development of hybrids / varieties – Soybean, Cowpea
15. Breeding objectives – major breeding procedures for development of hybrids / varieties – Groundnut, Seasame, Castor
16. Breeding objectives – major breeding procedures for development of hybrids / varieties – Cotton, Jute
17. Breeding objectives – major breeding procedures for development of hybrids / varieties – Tobacco, Brinjal, Okra and Cucurbitaceous
18. Breeding for resistance to biotic stresses disease resistance – mechanisms of disease resistance in plants – insect resistance – mechanism of insect resistance in plants.
19. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance- salt tolerance - Cold tolerance
20. Genotype, environment and their interaction – adptaion
21. Hybrid seed production technology – Rice, Maize
22. Hybrid seed production technology –Sorghum, Pearl Millet
23. Hybrid seed production technology –Pigeaonpea, Cotton.

24. Ideotype breeding – concept, factors affecting ideotypes – steps in ideotype breeding.

Practical Schedule:

1. Floral biology , Emasculation and Hybridization methods in Rice, Maize, Sorghum
2. Floral biology , Emasculation and Hybridization methods in Ragi , Pearl millet
3. Floral biology , Emasculation and Hybridization methods in Pigeonpea , Urdbean, Mungbean
4. Floral biology , Emasculation and Hybridization methods in Soybean, Cowpea
5. Floral biology , Emasculation and Hybridization methods in Groundnut , Sesame, Castor
6. Floral biology , Emasculation and Hybridization methods in Cotton , Jute
7. Floral biology , Emasculation and Hybridization methods in Tobacco , Brinjal ,Okra and Cucurbitaceous crops
8. Handling segregating populations – Pedigree method , Bulk Method and Single Seed Decent Methods
9. Hybrid Seed production in *Kharif* crops
10. Estimation of Heterosis
11. Estimation of Heritability and genetic advances
12. Handling of segregating generations – layout of breeding trails
13. Visit to seed production plots
14. ESE Practical Examination

References:

Text books

1. Singh, B.D. 2007. *Plant breeding - Principles and methods*. Kalyani Publishers, New Delhi
2. Chopra, V.L. 2000. *Breeding of Field Crops (Edt.)*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3. Manjit S. Kang 2004. *Crop Improvement: Challenges in the Twenti-First Century (Edt).* International Book Distributing Co. Lucknow.
4. Ram, H.H. and H.G. Singh. 1994. *Crop Breeding and Genetics*. Kalyani Publishers, New Delhi.
5. Sharma, A.K. 2005. *Breeding Technology of Crop Plants (Edt.)*. Yash Publishing House, Bikaner.
6. Phoelman, J.N. and Borthakur, 1969. *Breeding Asian field crops* .Oxford & IBH Publishing Co., New Delhi
7. Briggs, F.N. and P.F. Knowels, 1970. *Introduction to plant breeding*. Reinhold, New York.
8. Harihar Ram and Hari Govind Singh, 1994. *Crop breeding and Genetics*. Kalyani Publishers, New Delhi.

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2. www.biology200.gsu.edu

V SEMESTER

17AENU0502 PESTS OF CROPS AND STORED GRAINS AND THEIR MANAGEMENT 3 (2+1)

Objective:

- To study the scientific name, Order, Family, Host range, distribution, nature of damage and management strategies of major pests

Learning Outcome:

1. Identifying the major pests and their symptoms, biology and host range of Field and Horticulture Crops
2. Understanding important management practices of insect pest and non insect pests

Theory

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, Order, Family, Host range, Distribution, nature of damage and control practice.

Unit I : **Pests of Cereals, Millets and Pulses:** Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Red gram, Green gram, Black gram, Bengal gram and Cowpea

Unit II : **Pests of Oilseeds, Fibres, Sugars and Forage Crops:** Coconut, Groundnut, Castor, Gingelly, Sunflower, Cotton, Sugarcane, Subabul, Agathi and Sunhemp

Unit III : **Pests of Vegetables, Spices and Plantation:** Brinjal, Tomato, Bhendi, Curcurbits, Crucifers (cole crops), Moringa, Peas, Beans, Amaranthus, Pepper, Cardamom, Turmeric, Ginger, Chillies, Garlic, Curryleaf, Coriander, Oilpalm, Arecanut, Rubber, Coffee, Tea and Betelvine

Unit IV : **Pests of Fruits, Ornamentals and Medicinal crops:** Mango, Citrus, Cashew, Sapota, Guava, Banana, Pomegranate, Grapevine, Ber, Jack, Custard apple, Pineapple, Papaya, Apple, Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Gloriosa, Aswagantha, Belladonna, and Senna,

Unit V : **Pests of stored products and its management:** Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, Mites, Rodents, Birds and Microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management. Locusts – outbreaks – swarms – forewarning – methods of management

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, Spices & Condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

Theory Schedule:

1. Pests of Rice
2. Pests of Wheat, Maize, Sorghum, Cumbu, Ragi
3. Pests of Red gram, Green gram, Black gram, Bengal gram and Cowpea
4. Pests of Coconut
5. Pests of Groundnut and Castor, Gingelly, Sunflower
6. Pests of Cotton
7. Pests of Sugarcane
8. Pests of Subabul, Agathi and Sunhemp
9. Pests of Brinjal, Tomato, Bhendi,
10. Pests of Curcurbits and Crucifers (Cole crops)
11. Pests of Moringa, Peas, Beans, Amaranthus
12. Pests of Pepper and Cardamom
13. Pests of Turmeric, Ginger, Chillies, Garlic, Curryleaf, Coriander
14. Pests of Oilpalm, Arecanut, Rubber
15. Pests of Coffee, Tea and Betelvine
16. Pests of Mango, Citrus, Cashew,
17. Pests of Sapota, Guava and Banana
18. Pests of, Pomegranate, Grapevine
19. Pests of Ber, Jack, Custard apple, Pineapple, Papaya, Apple
20. Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Gloriosa,
21. Pests of Aswagantha, Belladonna, and Senna

22. Factors affecting losses of stored grain and role of Physical, Biological, Mechanical and Chemical factors in deterioration of grain
23. Insect pests, Mites, Rodents, Birds and Microorganisms associated with stored grain and their management
24. Storage structure and methods of grain storage and fundamental principles of grain store management
25. Locusts – outbreaks – swarms – forewarning – methods of management

Practical Schedule:

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce

1. Identification of Pests of Rice
2. Identification of Pests of Wheat, Maize, Sorghum, Cumbu, Ragi
3. Identification of Pests of Pulses (Redgram, Greengram, Blackgram, Bengalgram and Cowpea)
4. Identification of Pests of Oilseeds (Coconut, Groundnut, Castor, Gingelly, Sunflower)
5. Identification of Pests of Cotton and Sugarcane
6. Identification of Pests of Brinjal, Tomato, Bhendi, Curcurbits, Crucifers (Cole crops), Moringa, Peas, Beans, Amaranthus
7. Identification of Pests of Pepper, Cardamom, Turmeric, Ginger, Chillies, Garlic, Curryleaf, Coriander, Oilpalm, Arecanut, Rubber, Coffee, Tea and Betelvine
8. Identification of Pests of Mango, Citrus, Cashew, Sapota, Guava, Banana, Pomegranate, Grapevine, Ber, Jack, Custard apple, Pineapple, Papaya, Apple
9. Identification of Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Gloriosa, Aswagantha, Belladonna, and Senna
10. Identification of insect pests and Mites associated with stored grain
11. Determination of insect infestation by different methods and Assessment of losses due to insects
12. Calculations on the doses of insecticides application technique and Fumigation of grain store / godown
13. Identification of rodents, birds and their control operations in godowns
14. Determination of moisture content of grain and Methods of grain sampling under storage condition
15. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi and Visit to nearest FCI godowns
16. ESE Practical Examination

References:

Text books

1. Atwal, A.S. and G.S. Dhaliwal. 2003. *Agricultural Pests of South Asia and Their Management*. Kalyani Publishers, Ludhiana. 487p.
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8. Srivastava, K. P. And D. K. Butani. 1998. *Pest Management in Vegetables (part I & II)*. Research Periodicals & Book Publishing House, India. 589 p.

V SEMESTER

17APPU0502 DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT- I 3 (2+1)

Objective:

- To facilitate the students to learn and understand the Field and Horticultural crops plant disease symptoms and management practices

Learning Outcome:

1. Understanding the basic symptoms of diseases cereal, Millets, Oil seeds, Pulses and cash crops
2. Understanding important disease management methods in cereal, Millets, Oil seeds, Pulses and cash crops
3. Understanding the basic symptoms of diseases Fruits and vegetable crops
4. Understanding important disease management methods in Fruits and vegetable crops

Theory

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

Field Crops:

Unit I : **Rice**: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose.

Unit II : **Bajra** : Downy mildew and ergot; Finger millet: Blast and leaf spot; Groundnut: early and late leaf spots, wilt, Castor: Phytophthora blight, Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic.

Unit III : **Pigeon pea**: Phytophthora blight, wilt and sterility mosaic; Black & Green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Tobacco: black shank, black root rot and mosaic.

Horticultural Crops:

Unit IV : **Guava:** wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight.

Unit V : **Tomato**: Damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust.

Practical

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

Theory Schedule:

1. Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro
2. Maize: stalk rots, downy mildew, leaf spots
3. Sorghum: smuts, grain mold and anthracnose
4. Bajra : Downy mildew and ergot;
5. Finger millet: Blast and leaf spot;
6. Groundnut: early and late leaf spots, wilt,
7. Castor: Phytophthora blight,
8. Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic;
9. Pigeon pea: Phytophthora blight, wilt and sterility mosaic;
10. Black & Green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic;
11. Tobacco: black shank, black root rot and mosaic
12. Guava: wilt and anthracnose;
13. Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;
14. Papaya: foot rot, leaf curl and mosaic,
15. Pomegranate: bacterial blight;
16. Cruciferous vegetables: Alternaria leaf spot and black rot;
17. Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight;
18. Tomato: Damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic;
19. Okra: Yellow Vein Mosaic;

20. Beans: anthracnose and bacterial blight;
21. Ginger: soft rot; Colocasia: Phytophthora blight;
22. .Coconut: wilt and bud rot;
23. Tea: blister blight; Coffee: rust

Practical Schedule:

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.

1. Identification and histopathological studies of Rice diseases
2. Identification and histopathological studies of Bajra & Sorghum diseases
3. Identification and histopathological studies of Soybean & Pigeon diseases
4. Identification and histopathological studies of Castor & Groundnut diseases
5. Identification and histopathological studies of Black & Green gram diseases
6. Identification and histopathological studies of Beans & Brinjal diseases
7. Identification and histopathological studies of Banana & Guava diseases
8. Identification and histopathological studies of Crucifers & Ginger diseases
9. Identification and histopathological studies of Tomato & Okra diseases
10. Identification and histopathological studies of Coconut diseases
11. Identification and histopathological studies of Coffee
12. Identification and histopathological studies of Tea diseases
13. Field visit for the diagnosis of field problems.
14. ESE Practical Examination

Collection and preservation of plant diseased specimens for Herbarium;

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

References:

Text books

1. Agarwal, R.K. and C.L. Jandaik. 1986. *Mushroom cultivation in India*. Indian Mushroom Growers Association, Solan, HP p-83.
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5. Dube, H.C. 1978. *A Text Book of Fungi, Bacteria and Viruses*. Vikas Publishing House Pvt. Ltd., New Delhi.
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9. Pathak, P.N. 2001. *Diseases of Fruit Crops*. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.
10. Singh, R.S. 1993. *Plant Diseases*. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi
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V SEMESTER
17AENU0503 PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT 3 (2+1)

Objectives:

- To know about various pest and disease management methods
- To know about safety issues in pesticides

Learning Outcome:

1. Students will be able to comprehend the principles underlying integrated Pest and disease management.
2. To understand concept of ETL and EIL

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 – Types and mechanisms of resistance, cultural, mechanical, physical, legislative, Biological control– parasitoids, predators, viruses, bacteria, fungi and nematodes and their role in insect management and chemical control. Classification of pesticides, role of insecticides in pest management. Ecological management of crop environment.

Unit IV : **Introduction to conventional pesticides** for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module.

Unit V : **Implementation and impact of IPM** (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different

predators and natural enemies. Mass multiplication of *Trichoderma, Pseudomona*s, *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.

Theory Schedule:

1. Categories of insect pests and diseases
2. IPM: Introduction, history, importance, concepts
3. Principles and tools of IPM
4. Economic importance of insect pests, diseases and pest risk analysis
5. Methods of detection and diagnosis of insect pest and diseases
6. Calculation and dynamics of economic injury level and importance of Economic threshold level
7. Methods of control: Host plant resistance – Types and mechanisms of resistance
8. Cultural control
9. Mechanical control
10. Physical control
11. Legislative control
12. Biological control–parasitoids, predators, viruses, bacteria, fungi and nematodes and their role in insect management
13. Chemical control
14. Classification of pesticides
15. Role of insecticides in pest management
16. Ecological management of crop environment
17. Introduction to conventional pesticides for the insect pests and disease management
18. Survey surveillance and forecasting of Insect pest and diseases
19. Development and validation of IPM module.
20. Implementation and impact of IPM (IPM module for Insect pest and disease.
21. Safety issues in pesticide uses
22. Political, social and legal implication of IPM
23. Case histories of important IPM programmes
24. Case histories of important IPM programmes

Practical Schedule:

1. Methods of diagnosis and detection of various insect pests
2. Methods of diagnosis and detection of various plant diseases
3. Methods of insect pests measurement
4. Methods of plant disease measurement
5. Assessment of crop yield losses
6. Calculations based on economics of IPM
7. Identification of biocontrol agents, different predators and natural enemies
8. Mass multiplication of *Trichoderma, Pseudomona*s, *Trichogramma*, NPV

9. Identification and nature of damage of important insect pests and diseases and their management
10. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases
11. Plan & assess preventive strategies (IPM module) and decision making
12. Crop monitoring attacked by insect, pest and diseases
13. Awareness campaign at farmers fields
14. ESE Practical Examination

References:

Text books

1. Dhaliwal, G.S. and R. Arora. 2014. *Integrated Pest Managem*ent. Kalyani publishers.
2. Kogan, M. 1998. *Integrated Pest Management. Historical Perspectives and contemporary developments. Ann. Rev. Entomol*. 43: 243 – 270.
3. Koul, O. and G.W. Cuperus. 2007 *Ecologically Based Integrated Pest Managem*ent, CABI Publishing, London. 462p.
4. Koul, O., G.S. Dhaliwal and G.W. Cuperus. 2004 *Integrated Pest Management: Potential, Constraints and Challenge*s. CABI Publishing, Oxon, UK and Cambridge, USA 329p.
5. Metcalf, R.L. and W.H. Luckman. 1982. *Introduction to Insect Pest Managemen*t. John Wiley and Sons, New York, 577 p.

V SEMESTER

17ARCU0503 INTELLECTUAL PROPERTY RIGHTS 1 (1+0)

Objective:

- To teach about the intellectual property rights, patterns, legislation and acts.

Learning Outcome:

- To learn about the intellectual property rights, patents, legislation and Acts

Theory

Unit I : **Introduction and meaning of intellectual property**, brief introduction to GATT, WTO, TRIP and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty.

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

Unit III : **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 IV : **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, researchers and farmers rights. Traditional knowledge-meaning and rights of TK holders.

Unit V : **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.

Theory Schedule:

1. Introduction to IPR
2. TRIPS Agreement
3. Intellectual Property Rights: Madrid Protocol, Berne Convention, Budapest treaty
4. Copyright
5. Patent and Trade Marks
6. Geographical Indications

7. Patents Act 1970 and Patent system in India
8. Process and product patent, filing of patent, patent specification
9. Undisclosed information and Trade Secrets
10. Protection of plant varieties and farmers, right
11. Biological Diversity Act
12. Licensing of Technology
13. Important Databases for patent search.
14. Current developments on IPR in India

References:

Text books

1. Cullet, Pillippe. 2005. Intellectual *Property Protection and Sustainable Development*. London:Butterworth,
2. Erbisch, F.H. and K. Maredia. 1998. *Intellectual Property Rights in Agricultural Biotechnology.* Wallingford : CABI,
3. Santaniello, V., R.E. Evension, D. Zeberman, and G.A. Carlson.2003 *Agriculture and Intellectual Property Rights: Economic, institutional and implementation issues in bio technology*, Hyderabad, University Press,

V SEMESTER

17AEXU0503 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION 2 (1+1)

Objectives:

1. To impart knowledge to the students on entrepreneurship and its importance in socio-economic development of the nation.
2. To describe the concepts of entrepreneurship, Agri-preneurship, characteristics of entrepreneur, Motivation, Entrepreneurship and Project Management.

3. To gain knowledge and skills in Project Formulation, Project report preparation, Evaluation and Process of Supply Chain Management.

Learning Outcome:

- The students will be familiarized with Entrepreneurship, Agri-premiership, Organizational Skills and Supply Chain Management.

Theory

Unit I : **Entrepreneur:** Concepts and Functions of Entrepreneur, Characteristics of entrepreneurs, Entrepreneurship Development; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development.

Unit II : **Agribusiness/ Agri enterprises:** Impact of economic reforms on Agribusiness/ Agrienterprises, Entrepreneurial Development Process; Business Leadership Skills.

Unit III : **Leadership and Managerial Skill:** Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills) Problem solving skill.

Unit IV : **Finance and Agri-entrepreneurship**: Financing of enterprise, Opportunities for agrientrepreneurship and rural enterprise, Venture Capital – Concept, Aims, Features, Financing steps sources, Criteria to provide Venture Capital Finance, Export and Import Relevant to Agriculture Sector.

Unit V : **Supply chain management and Project Planning Formulation:** Supply chain management – meaning, advantages, stages, process, drivers and scope of agri-supply chain management, Total quality management, Women Entrepreneurship – concept problems and development of women entrepreneurs, Project Planning Formulation and report preparation.

Practical

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

Theory Schedule:

1. Concept and Functions of Entrepreneur, Characteristics of entrepreneurs.
2. Entrepreneurship Development.
3. SWOT Analysis & achievement motivation
4. Government policy and programs and institutions for entrepreneurship development.
5. Impact of economic reforms on Agribusiness/ Agrienterprises.
6. Entrepreneurial Development Process; Business Leadership Skills.
7. Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation) Developing Managerial skills
8. Business Leadership Skills (Communication, direction and motivation Skills) Problem solving skill
9. Financing of enterprise, Opportunities for agrientrepreneurship and rural enterprise
10. Venture Capital – Concept, Aims, Features, Financing steps sources, Criteria to provide Venture Capital Finance
11. Export and Import Relevant to Agriculture Sector.
12. Supply chain management – meaning, advantages, stages, process, drivers and scope of agri-supply chain management, Total quality management
13. Women Entrepreneurship – concept problems and development of women entrepreneurs.
14. Project Planning Formulation and report preparation.

Practical Schedule:

1. A Study on Assessing entrepreneurial traits
2. Problem solving skills,
3. Managerial skills and achievement motivation,
4. Exercise in creativity,
5. Time audit through planning,
6. Monitoring and supervision,
7. Identification and selection of business idea,
8. Preparation of business plan and proposal writing,
9. Visit to entrepreneurship development institute and entrepreneurs.
10. ESE Practicals Examination

References:

Text books

1. Gupta, C.B. 2001. *Management: Theory and Practice.* Sultan Chand and Sons, New Delhi.
2. Khanka, S.S.1999. *Entrepreneurial Development*. S. Chand and Co., New Delhi.
3. Mary Coulter. 2008. *Entrepreneurship in Action*. Prentice Hall of India Pvt. Ltd., New Delhi.
4. Mohanty, S.K.2009. *Fundamentals of Entrepreneurship*. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Sagar Mondal and G.L. Ray. 2009. *Text Book of Entrepreneurship and Rural Development,* Kalyani Publishers, Ludhiana.
6. Vasant Desai. 1997. *Small Scale Industries and Entrepreneurship*. Himalaya Publishing House, New Delhi.
7. Vasant Desai. 2000. *Dynamics of Entrepreneurial Development and Management,* Himalaya Publishing House, New Delhi.

E-References:

1. **www.dcmsme.gov.in**

VI SEMESTER
17AGRU0609 PRINCIPLES OF ORGANIC FARMING 2 (1+1)

Objectives:

- To learn about Importance of Organic farming
- To acquire knowledge on basic principles, future and prospect of Organic farming

Learning Outcomes:

- The Students understand the importance, Basic concept Principles of organic farming,
- The Students learn about the benefits of Organic Farming Certification process, agencies and Future possibilities of Organic farming.

Theory

Unit I : **Components and principles of Organic farming:** Organic farming : Definition, Scope, Principles and Concepts- Relevance, Ethics and Objectives and Characteristics -History of organic farming- Global scenario- biodiversity: Importance and measure to preserve biodiversity- Pre requisites for Organic farming: Soil organic carbon: status and improvement strategies

Unit II : **Organic Sources of nutrients**- Manures and other inputs- on farm and off farm sources- organic waste recycling- methods- soil and crop management – intercropping, crop rotation- green manures, cover crops, mulching – Bio fertilizers.

Unit III : **Non- chemical weed and pest disease management methods:** Preventive, physical, cultural, mechanical and biological measures- Bio-intensive pest and disease management.

Unit IV : **Indigenous Technical Knowledge (ITK):** ITK in organic agriculture – scientific rationale- soil, nutrient, weed, water management- Prospects and problems in organic farming

Unit V : **Organic Certification :** Organic certification – NPOP guidelines- Certification Types and Agencies in India- Crop production standards- Quality considerations- labeling and accreditation process- Marketing and export potential of organic products

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management;

Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

Theory Schedule:

1. Organic farming: Definition, scope, principles and concepts- Relevance, Ethics and Objectives and Characteristics -History of organic farming-
2. Global scenario- biodiversity: Importance and measure to preserve biodiversity- pre requisites for Organic farming:
3. Soil organic carbon: status and improvement strategies
4. Organic sources of nutrients- Manures and other inputs- on farm and off farm sources-
5. Organic waste recycling- methods- soil and crop management – intercropping, crop rotation- green manures, cover crops, mulching – Bio fertilizers.
6. Non- chemical weed and pest disease management methods**:** Preventive, physical, cultural, mechanical and biological measures-
7. Bio-intensive pest and disease management in organic farming.
8. Indigenous Technical Knowledge (ITK)**:** ITK in organic agriculture – Forms and Types of IK-
9. Scientific rationale- soil, nutrient, weed, water management
10. Prospects and problems in organic farming
11. Organic Certification **:** Organic certification – NPOP guidelines- certification agencies in India- Certification process and standards of organic farming
12. Crop production standards- Quality considerations- Processing,labeling and accreditation process-
13. Marketing and export potential of organic products

Practical Schedule:

1. Study of components of Organic farms
2. Preparation of Enriched FYM and compost making in Organic farming
3. Study of Vermicompost Techniques in Organic farming
4. Study of bio-fertilizers/bio-inoculants and their quality analysis
5. Indigenous technology knowledge (ITK) for nutrient management
6. Indigenous technology knowledge (ITK) for insect and pest management
7. Indigenous technology knowledge (ITK) for disease management
8. Indigenous technology knowledge (ITK) for weed management
9. Working out Cost of organic production system
10. Study of Post harvest management in Organic farming
11. Study of Quality aspect, grading, packaging and handling in Organic farming
12. Field visit to Organic farm and Certification Agencies
13. ESE Practical Examination

References:

Text books

1. IIRR (1996), *Recording and Using Indigenous Knowledge - A Manual*, International Institute of Rural Reconstruction, Silang, Cavite, Philippines.
2. Sundaramari M (2003) *Indigenous Agricultural Practices for Sustainable Farming*, Agrobios (India), Jodhpur.
3. Sharma K. Arun, 2002, *A Hand Book of Organic Farming*, Agrobios (India) Jodhpur.
4. Palaniappan.S.P and K. Annadurai (1999), *Organic Farming*. Scientific Publishers (India),Jodhpur
5. Dahama, A.K. 2002. *Organic Farming for Sustainable Agriculture*, Agrobios (India), Jodhpur pp 301.
6. Lampkin, N. 1990. *Organic farming*, Ipswich, U.K. Farming Press Books pp. 710.
7. Palaniappan, SP. and K. Annaduari. 1999. *Organic farming: Theory and Practice,* Scientific Publishers, Jodhpur.
8. Thampan, P.K. 1995. *Organic Agriculutre,* Peekay Tree Crops Development Foundation, Cochin pp. 354.
9. Vyas, S.C., Smriti Vyas, Sameer Vyas and H.A. Modi. 1998. *Biofertilizers and Organic farming*, Akta Prakashan, Nadiao, pp. 252.

E references:

- www.ifoam.org
- www.apeda.org
- www.cowindia.org
- www.ncof.org
- www.earthfooda.co.uk
- www.newfarm.org/training

VI SEMESTER

17AGRU0610 RAINFED AGRICULTURE AND WATERSHED MANAGEMENT 2 (1+1)

Objectives:

- To teach the students about the basic aspects and concept of rainfed agriculture
- To learn about soil and water conservation techniques and drought management in different crops
- To enrich knowledge on Watershed management

Learning Outcomes:

- The students acquire knowledge on basic aspects of rainfed agriculture and its management

The Students can learn the basic concept, benefits of Watershed Management.

Theory

Unit I : **Rainfed agriculture**: Introduction, Types- History of rainfed agriculture in India; Problems and prospects of Rainfed Agriculture in India- characteristics features- Importance and need for development

Unit II : **Soil moisture conservation** :Soil and climatic conditions prevalent in rainfed areas- Climatic constraints, Soil moisture constraints, Cultivation practices and Socio-economic constraints. Soil and water conservation techniques- In-situ soil moisture conservation.

Unit III : **Drought:** Definition- Classification of drought –Types-, effect of moisture stress on physio-morphological characteristics of the plants and plant growth- Crop adaptation and mitigation to drought

Unit IV **Water harvesting and contingent crop planning**: Importance, its techniques- Efficient utilization of water through soil and crop management practices- Management of crops in rainfed areas. Contingent crop planning for aberrant weather conditions;

Unit V : **Watershed management**: Definition, Concept, objective- Need and advantages- Principles and components of watershed management – Action plan and organizational requirement of watershed.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country andpattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.Critical analysis of rainfall and possible drought period in the country, effective

rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures.Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed**.**

Theory Schedule:

1. Rainfed agriculture – Definition and Introduction
2. History of rainfed agriculture –Dry farming and Rainfed farming
3. Problems and prospects of rainfed agriculture in India, Characteristics features of Rainfed Agriculture
4. Soil and climatic conditions prevalent in rainfed areas
5. Constraints for crop production in Rainfed Agriculture- Climatic constraints, Soil related constraints.
6. Crop management related constraints and socio-economic constraints
7. Soil and water conservation techniques- In-situ moisture conservation- Agronomic methods, mechanical methods and Agrostological methods
8. Drought: definition and types of drought.
9. Effect of moisture stress on physio-morphological characteristics of the plants and plant growth.
10. Crop adaptation and mitigation to drought – Measures to reduce evaporation, transpiration and ET losses- crop substitution
11. Water harvesting- importance, its techniques
12. Efficient utilization of water through soil and crop management practices
13. Management of crops in rainfed areas -Contingent crop planning for aberrant weather conditions
14. Watershed management: Definition, Concept, objective- Need and advantages- Principles and components of watershed management
15. Action plan and organizational requirement of watershed.

Practical Schedule:

1. Studies on climate classification,
2. Studies on rainfall pattern in rainfed areas of the country and
3. Pattern of onset and withdrawal of monsoons.
4. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.
5. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.
6. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation.
7. Studies on cultural practices for mitigating moisture stress.
8. Characterization and delineation of model watershed.
9. Field demonstration on soil & moisture conservation measures.

10. Field demonstration on construction of water harvesting structures.
11. Visit to rainfed research station/watershed**.**
12. ESE Practical Examination.

References:

Text books

1. Anonymous, 2002. '*NATP Project on Watershed Management Technology for Hot and Arid Regions', Annual Report*, Fatehpur- Shekawati, Rajasthan,.
2. Brooks, K.N., Folliott, P.F., Gregersen, H.M. and DeBango, L., 1997. *Hydrology and the Management of Watersheds*, 2nd edn, Ames, lowa University Press.
3. Sheng, T.C.,1990. *Watershed Management Field Manual- Watershed Survey and Planning,* United Nations Food and Agriculture Organisation, FAO Conservation Guide, 13/6.
4. Singh, P.K.,2000. *Watershed Management- Design and Practices*, Udaipur, India, Agrawal Printers Pvt. Ltd.
5. Burby, Raymond J., Edward J. Kaiser, Todd L. Miller, and David H. Moreau, 1983. *Drinking Water Supplies- Protection through Watershed Management*, Ann Arbor Science Publishers, Ann Arbor, MI,

VI SEMESTER

17AGRU0611 PRACTICAL CROP PRODUCTION-II (*Rabi Crops*) 2 (0+2)

Objectives:

To expose the students on hands on training in cultivation of crops from land preparation up to harvest including economics of cultivation

Learning Outcomes:

1. Students acquire skill in raising crops from land preparation upto harvest
2. Students get practical skill and can workout the cost of cultivation and BCR for a crop per unit area

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-pest 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, weed, 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.

- Each student will be allotted a minimum of 100/200 m2 and he/she will do all field operations in the allotted land area for field preparation to harvest and processing
- Any irrigated dry rabi crop (maize /Sesame/sunflower/ *rabi* pulses like Bengalgram/Coriander based on the availability of water in the farm

Practical Schedule:

- Sesame/Sunflower
- Oil seeds crop ecosystems- Climate and weather – seasons and varieties of Tamil Nadu
- Preparation of main field- Application of organic manures-
- Seed and sowing -Applicaton of herbicides- Water management- Nutrient management- Plant protection measures- Mechanization in Oil seeds crop cultivation- Recording growth, yield attributes and yield.
- Harvesting , threshing, drying and cleaning the produce- Working out cost of cultivation and Economics

Sesame / Sunflower

1. Study of Sesame/Sunflower morphology , climate, weather, seasons and varieties of Tamil Nadu
2. Acquiring skill in seed treatment, sowing and management of plant stand
3. Practicing of field preparatory operations- sectioning of field bunds and basal application of fertilizers
4. Practicing sowing methods in sesame and sunflower
5. Estimation of plant population and acquiring skill in gap filling and thinning
6. Study of weeds and weed management in sesame and sunflower

7. Acquiring skill in nutrient management and practicing top dressing and foliar spraying techniques
8. Study of water management practices for sesame and sunflower
9. Observation of insect pests and diseases and their management
10. Recording growth and other related characters of Oil seed crops
11. Estimation of yield and yield parameters in Oil seed crops
12. Harvesting ,threshing and cleaning of the produce
13. Working out cost of cultivation and economics
14. ESE Practical Examinations

References:

Text books

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini, 1998. *Scientific Crop production in India*. Rama publishing House, Meerut
2. Chiddasingh, 1997. *Modern Techniques of raising Field crops*. Oxford and IBH publishing Co. Pvt.Ltd., New Delhi.
3. ICAR 2006. *Hand book of Agriculture*. Indian council of Agricultural Research, New Delhi
4. *Crop production Guide*, 2005. Directorate of Agriculture, Chennai and TNAU.
5. Rajendra Prasad, 2004. *Text book on Field Crop production*. Indian Council of Agricultural Research, New Delhi.

E –References:

1. www.irri.org
2. www.crri.nic.in
3. www.drrindia.org

VI SEMESTER
17AGRU0612 EDUCATIONAL TOUR -I 1 (0+1)

Objectives:

To enrich the knowledge of students with different types of soils, crops, cultivation practices and latest techniques adopted in various Agro-climatic zones research station/institutes in South India.

Learning Outcomes:

The students aware and enriched with the details on latest varieties, technologies practiced in various field crops and horticultural crops in different zones of Tamil Nadu in South part of India.

Practical

Students will be taken to tour with in South India to study soils, crops, cropping pattern and cultivation practices for major crops in the various agro-climatic zones of the area. The duration of the tour will be 7-10 days. During the tour the students will visit important Research stations/Institutes .Students will maintain a Tour Dairy to record observations at the places of visit. A tour record has to be submitted after the tour. The evaluation procedure will be as follows

Evaluation procedure

1. Written test : 50 marks
2. Attendance and behavior : 20 marks
3. Record and pocket note book : 20 marks
4. Vivo-voce : 10 marks

Total : 100 marks

VI SEMESTER

17PBGU0605 CROP IMPROVEMENT – II (*Rabi Crops*) 2 (1+1)

Objective:

- To impart knowledge to the students on the botanical description, origin, distribution and various breeding approaches used for the development of varieties / hybrids in various *rabi* crops.

Learning Outcome:

- The student will learn about basic concepts of classical, wild species methodologies employed for *Kharif* crops and current trends in plant breeding will be exposed.

Theory

Unit I : **Centers of origin**, distribution of species, wild relatives – Wheat, Oat, Barley, Chickpea, Lentil, Field pea, French bean, Horse gram, Rapeseed, Mustard, Sunflower, Safflower , Sugarcane ,Line seed, Potato , Tomato , Chilli and Onion.

Unit II : **Plant genetic resources** - definition, importance, utilization and conservation, centre of diversity , study of genetics of qualitative and quantitative character.

Unit III : **Breeding objective and methods**, procedure for developing hybrids / varieties Wheat, Oat, Barley, Chickpea, Lentil, Field pea, French bean, Horse gram, Rapeseed mustard, Sunflower, Safflower , Sugarcane ,Line seed.

Unit IV :

Breeding objective and methods, procedure for developing hybrids / varieties - Potato, Tomato, Chilli, and Onion. Breeding for abiotic stress and biotic stress .Genotype – Environment interaction and adaptation.

Unit V :

Hybrid seed production technology – Wheat, Barley, Rapeseed mustard, Sunflower, Safflower, Sugarcane. Ideotype concept and climate resilient crop varieties for future.

Practical

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

Rabi crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

Theory Schedule:

1. Place of origin – distribution of species – related wild species – Wheat , Oat , Barley
2. Place of origin – distribution of species – related wild species – Chickpea, Lentil
3. Place of origin – distribution of species – related wild species – Field pea, Horse gram
4. Place of origin – distribution of species – related wild species - Rapeseed – Mustard, Line seed
5. Place of origin – distribution of species – related wild species – Sunflower, Safflower
6. Place of origin – distribution of species – related wild species – Sugarcane
7. Place of origin – distribution of species – related wild species – Potato, Tomato, Chili and onion
8. Plant genetic resources – definition and important - conservation – evaluation – documentation – distribution and utilization
9. Plant genetic resources germplasm activities – centres of diversity – types of biodiversity – centres of origin – Law of homologous series
10. Study of genetics of qualitative and quantitative character.
11. Breeding objectives – major breeding procedures for development of hybrids / varieties – Wheat , Oat , Barley
12. Breeding objectives – major breeding procedures for development of hybrids / varieties– Chickpea, Lentil
13. Breeding objectives – major breeding procedures for development of hybrids / varieties – Field pea, Horsegram
14. Breeding objectives – major breeding procedures for development of hybrids / varieties – Rapeseed – Mustard, Line seed
15. Breeding objectives – major breeding procedures for development of hybrids / varieties – Sunflower, Safflower
16. Breeding objectives – major breeding procedures for development of hybrids / varieties – Sugarcane
17. Breeding objectives – major breeding procedures for development of hybrids / varieties – Potato, Tomato, Chili and Onion
18. Breeding for resistance to biotic stresses disease resistance – mechanisms of disease resistance in plants - causes of disease resistance – genetic basis of disease resistance – insect resistance – mechanism of insect resistance in plants - genetics of insect resistance.
19. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance- salt tolerance - Cold tolerance
20. Genotype, environment and their interaction – adptaion
21. Hybrid seed production technology – Wheat , Oat , Barley ,Chickpea, Lentil
22. Hybrid seed production technology – Sunflower, Safflower
23. Hybrid seed production technology – Sugarcane
24. Ideotype breeding – concept, features, and factors affecting ideotypes – steps in ideotype breeding.

Practical Schedule:

1. Floral biology , Emasculation and Hybridization methods in Wheat, Oat,Barley
2. Floral biology , Emasculation and Hybridization methods in Chickpea, Lentil
3. Floral biology , Emasculation and Hybridization methods in Fieldpea, Horsegram
4. Floral biology , Emasculation and Hybridization methods in Rapeseed – Mustard, Line seed
5. Floral biology , Emasculation and Hybridization methods in Sunflower, Safflower
6. Floral biology , Emasculation and Hybridization methods in Sugarcane
7. Floral biology , Emasculation and Hybridization methods in Potato, Tomato, Chili and Onion
8. Handling segregating populations – Pedigree method , Bulk Method and Single Seed Decent Methods
9. Hybrid Seed production in *rabi* crops
10. Estimation of Heterosis ,
11. Estimation of Heritability and genetic advances
12. Handling of segregating generations – layout of breeding trails
13. Visit to seed production plots
14. ESE Practical Examination

References:

Text books

1. Singh, B.D. 2007. *Plant breeding - Principles and methods*. Kalyani Publishers, New Delhi
2. Chopra, V.L. 2000. *Breeding of Field Crops (Edt.)*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3. Manjit S. Kang 2004. *Crop Improvement: Challenges in the Twenty-First Century (Edt)*. International Book Distributing Co. Lucknow.
4. Ram, H.H. and H.G. Singh. 1994. *Crop Breeding and Genetics*. Kalyani Publishers, New Delhi.
5. Sharma, A.K. 2005. *Breeding Technology of Crop Plants (Edt.)*. Yash Publishing House, Bikaner.
6. Phoelman, J.N. and Borthakur, 1969. *Breeding Asian field crops* Oxford & IBH Publishing Co., New Delhi
7. Briggs, F.N. and P.F. Knowels, 1970. *Introduction to plant breeding*. Reinhold, New York.
8. Harihar Ram and HariGovind Singh, 1994. *Crop breeding and Genetics*. Kalyani Publishers, New Delhi.

E-References:

1. www.nmsu.edu
2. www.biology200.gsu.edu

VI SEMESTER

17AENU0604 MANAGEMENT OF BENEFICIAL INSECTS 2 (1+1)

Objectives:

- To study the importance of beneficial insects
- To study the techniques in rearing honey bees, silkworm and lac insects
- To know about minor productive insects and their importance

Learning Outcomes:

- Understanding the basic techniques in rearing honey bees, silkworm and lac insects
- Identifying the major Predators and Parasitoids used in pest control
- Identifying the important pollinators, weed killers and scavengers

Theory

Unit I : **Importance of beneficial Insects**, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit II : **Types of silkworm**, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons.

Unit III : **Pest and diseases of silkworm**, management, rearing appliances of mulberry silkworm and methods of disinfection, types of disinfectants, byproducts of sericulture.

Unit IV : **Species of lac insect**, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Uses of lac. Minor productive insects Cochineal insect, Gall insect, Food and Medicinal value of insects, Asthetic and Scientific value of insets.

Unit V : **Identification of major parasitoids** and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical

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

Theory Schedule:

1. Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management
2. Bee enemies and disease. Bee pasturage, bee foraging and communication
3. Insect pests and diseases of honey bee
4. Role of pollinators in cross pollinated plants
5. Types of silkworm, voltinism and biology of silkworm
6. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.
7. Rearing, mounting and harvesting of cocoons
8. Pest and diseases of silkworm and their management
9. Rearing appliances of mulberry silkworm and methods of disinfection, types of disinfectants,byproducts of sericulture
10. Species of lac insect, morphology, biology, host plant
11. Lac production – seed lac, button lac, shellac, lac- products. Uses of lac
12. Minor productive insects Cochineal insect, Gall insect, Food and Medicinal value of insects, Asthetic and Scientific value of insets
13. Identification of major parasitoids and predators commonly being used in biological control
14. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques
15. Important species of pollinator, weed killers and scavengers with their importance

Practical Schedule:

1. Honey bee species, castes of bees
2. Beekeeping appliances and seasonal management
3. Bee enemies and disease
4. Bee pasturage, bee foraging and communication
5. Types of silkworm, voltinism and biology of silkworm
6. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves
7. Identification of pests of silkworm
8. Identification of diseases of silkworm
9. Species of lac insect, host plant identification
10. Identification of other important pollinators, weed killers and scavengers

11. Identification of important predators and parasitoids
12. Mass multiplication techniques of natural enemies
13. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies
14. ESE Practical Examination.

References:

Text books

1. David, B.V. and V.V. Ramamurthy. 2010. *Elements of Economic Entomology (Revised Edition)*. Namrutha Publications, Chennai.
2. Ayyar, T.V.R. 1963, *Hand Book of Economics Entomology for South India*. Govt. Press Madras.
3. David, B.V. 2006. *Elements of Economic Entomology*. Popular Book Depot, Chennai.
4. De Bach P. 1964. *Biological Control of Insect Pests and Weeds*. Chapman and Hall, New York.
5. Dhaliwal GS and Arora R. 2001. *Integrated Pest Management: Concepts and Approaches*. Kalyani Publ., New Delhi.

VI SEMESTER
17APPU0603 DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT- II 3 (2+1)

Objective:

- To facilitate the students to learn and understand the Field and Horticultural crops plant disease symptoms and management practices

Learning Outcomes:

- Understanding the basic symptoms of diseases cereal, Millets, Oil seeds, Pulses and cash crops
- Understanding important disease management methods in cereal, Millets, Oil seeds, Pulses and cash crops
- Understanding the basic symptoms of diseases Fruits and vegetable crops
  Understanding important disease management methods in Fruits and vegetable crops

Theory

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

Field Crops:

Unit I : **Wheat:** rusts, loose smut, karnal bunt, powdery mildew, Alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng; Sunflower: Sclerotinia stem rot and Alternaria blight.

Unit II : **Mustard**: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

Horticultural Crops:

Unit III : **Mango:** Anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose;

Unit IV : **Apple**: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot. Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt;

Unit V : **Onion and garlic**: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

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

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

Theory Schedule:

1-2.Wheat: rusts, loose smut, karnal bunt, powdery mildew, Alternaria blight, and ear cockle;
3. Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng;
4. Sunflower: Sclerotinia stem rot and Alternaria blight.
5. Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot;
6. Gram: wilt, grey mould and Ascochyta blight;
7. Lentil: rust and wilt;
8-9. Cotton: anthracnose, vascular wilt, and black arm;
10. Pea: downy mildew, powdery mildew and rust.
11-12. Mango: Anthracnose, malformation, bacterial blight and powdery mildew;
13. Citrus: canker and gummosis;
14. Grape vine: downy mildew, Powdery mildew and anthracnose;
15-16. Apple: scab, powdery mildew, fire blight and crown gall;
Peach: leaf curl. Strawberry: leaf spot.
18-19. Potato: early and late blight, black scurf, leaf roll, and mosaic;
20-21. Cucurbits: downy mildew, powdery mildew, wilt;
22-23.Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl;
26. Turmeric: leaf spot Coriander: stem gall
27. Marigold: Botrytis blight;
28. Rose: dieback, powdery mildew and black leaf spot.

Practical Schedule:

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.

1. Identification and histopathological studies of Wheat diseases
2. Identification and histopathological studies of Sugarcane & Sunflower diseases
3. Identification and histopathological studies of Cotton &; Pea diseases
4. Identification and histopathological studies of Citrus & Grapes diseases
5. Identification and histopathological studies of Mango diseases
6. Identification and histopathological studies of Apple & Peach diseases
7. Identification and histopathological studies of Onion & Garlic diseases
8. Identification and histopathological studies of Cucurbits diseases
9. Identification and histopathological studies of Potato & Chilies diseases
10. Identification and histopathological studies of Turmeric
11. Identification and histopathological studies of Marigold diseases

12. Identification and histopathological studies of Rose diseases
13. Field visit for the diagnosis of field problems.
14. ESE Practical Examination

Collection and preservation of plant diseased specimens for herbarium.

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

References:

Text books

1. Agarwal, R.K. and C.L. Jandaik. 1986. *Mushroom cultivation in India*. Indian Mushroom Growers Association, Solan, HP p-83.
2. Agarwal, S.C. 1993. *Diseases of greengram and blackgram*, International Book

   Distributors, UP.

3. Agrios. G.N. 1997. *Plant Pathology, 4th Edn*, Academic Press, New York.
4. Dasgupta, M.K. 1988. *Principles of Plant Pathology*. Allied Publishers Pvt. Ltd., Bangalore.
5. Dube, H.C. 1978. *A Text Book of Fungi, Bacteria and Viruses*. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Agrios. G.N. 1997. *Plant Pathology, 4th Edn*, Academic Press, New York.
7. Arjunan, G. Karthikeyan, G. Dinakaran, D. and Raguchander, T. 1999. Diseases of Horticultural Crops, AE Publications, Coimbatore.
8. Dickson, J.G. 1997. *Diseases of Field Crops*. Daya Publishing House, New Delhi.
9. Pathak, P.N. 2001. *Diseases of Fruit Crops*. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.
10. Singh, R.S. 1993. *Plant Diseases*. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi

11. Singh, R.S. 1999. *Diseases of Fruit crops*.Oxford & IBH Publications. New Delhi. 350.

VI SEMESTER

17HORU0605 POST-HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES 2 (1+1)

Objective:

- To understand the basics and principles of postharvest technology and recent innovations in packaging, storage and value addition of horticultural crops

Learning Outcome:

- The students will be acquired knowledge on various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy and Squash. Students are also expected to gain knowledge on conventional and modern packaging methods.

Theory

Unit I : **Importance of post-harvest processing** of fruits and vegetables, extent and possible causes of postharvest losses.

Unit II : **Pre-harvest factors** affecting postharvest quality, maturity, ripening and changes occurring during ripening.

Unit III : **Respiration and factors** affecting respiration rate. Harvesting and field handling.Storage (ZECC, cold storage, CA, MA, and hypobaric).

Unit IV : **Value addition concept**, Principles and methods of preservation; 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

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

Theory Schedule:

1. Importance of post-harvest processing of fruits extent and possible causes of postharvest losses.
2. Importance of post-harvest processing of vegetables, extent and possible causes of postharvest losses.

3. Pre-harvest factors affecting postharvest quality, maturity, ripening Changes occurring during ripening.
4. Respiration and factors affecting respiration rate.
5. Harvesting and field handling.
6. Storage -(ZECC-Zero energy cool chamber).
7. Principles of cold storage.
8. Controlled atmosphere storage, Modified atmosphere storage, and hypobaric.
9. Value addition concept.
10. Principles and methods of preservation.
11. Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards.
12. Fermented and non-fermented beverages.
13. Tomato products- Concepts and Standards.
14. Drying/ Dehydration of fruits and vegetables – Concept and methods,
15. Osmotic drying.
16. Canning -– Concepts and Standards.
17. Packaging of products.

Practical Schedule:

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.
6. Preparation of RTS & nectar.
7. Preparation of squash & crush.
8. Preparation of osmotically dried products.
9. Preparation of fruit bar and candy and tomato products.
10. Preparation of canned products.
11. Preparation of pickles & sauce.
12. Quality evaluation of products -- physico-chemical and sensory.
13. Visit to processing industry.
14. ESE Practical Examination.

References:

Text books

1. Vennila, P. and S.Kanchana. 2003. *Principles and preservation of fruits and vegetables.* Ratna Publications, Madurai.
2. Cruesss, W.V. 2000. *Commercial fruit and vegetable products*. Agrobios(India),
3. Jodhpur Pandey,P.H.2002. *Post Harvest Technologies of fruits and vegetables*
4. *Principles and practices*. Saroj Publishers and Distributors, Allahabad.
5. Saraswathy S., T.L. Preethi, S. Balasubramanyan, J. Suresh, N. Revathy and S. Natarajan. 2008. *Post Harvest Management of Horticultural Crops*.
6. Srivastava, R.P and Sanjeev Kumar. 1994. *Fruit and vegetable preservation. Principles and practices*. International book Distributing Co., Lucknow. Sudheer,

7. K.P. and V. Indira. 2007. *Post Harvest Technology of Horticultural Crops*. New Delhi Publishing Agency, India.
8. Sumanbhatti and Uma Varma. 1995. *Fruit and vegetable processing*. CBS publishers and distributors, New Delhi
9. Thompson, A. K. 1996. *Post harvest Technology of fruits and vegetables*. Blackwell science, Inc. Cambridge.
10. Verma, L.R and V.K. Joshi 2000. *Post harvest technology of fruits and vegetables* (Vol I and II). Indus publishing company, New Delhi.

E – References:

1. http://www.fao.org/DOCKEP/005 Y4358E/Y4358e04.htm
2. http://home.att.net/~africantech/GhIE/QPLFood.htm

Journals

1. Indian food packer.
2. Processed Food Industry.

VI SEMESTER

17AECU0605 FARM MANAGEMENT, PRODUCTION AND RESOURCE ECONOMICS 2(1+1)

Objectives:

- To impart knowledge on students about the basic aspects of Farm management and farm business analysis.
- To impart knowledge on students about the concept of risk and uncertainty and the management of common property resources.

Learning outcomes:

- The students gained the knowledge about Farm Management and business analysis.

They have been equipped with management concepts and management of common resources.

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: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and productproduct relationship,

Unit II : **Law of equi-marginal/orprinciples** 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. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Unit IV : **Concept of risk and uncertainty** occurs in agriculture production, nature and sources of risks and its management strategies**,** Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources.

Unit V : **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.

Theory Schedule:

1	Farm management, objectives and relationship with other sciences
2	Meaning and definition of farms, its types and characteristics, factor determining types and size of farms
3	Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm
4	Factor-product, factor-factor and product relationship
5	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
6	importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income
7	Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises
8	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
9	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
10	Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies
11	Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation
12	Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources
13	Factors affecting cost of marketing; reasons for higher marketing costs of farm commodities
14	Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc

Practical

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

Practical

1. Preparation of farm layout.
2. Determination of cost of fencing of a farm.
3. Computation of depreciation cost of farm assets.
4. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
5. Determination of most profitable level of inputs use in a farm production process.
6. Determination of least cost combination of inputs.
7. Selection of most profitable enterprise combination.

8-9. .Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.

10-11 .Preparation of farm plan and budget, farm records and accounts and profit and loss accounts.

12-13. Collection and analysis of data on various resources in India.

14. ESE Practical Examination.

References:

Text books

1. Johl S.S. and Kapur T.R. 2001. Fundamentals of Farm Business Management, Kalyani publishers, Ludhiana.
2. Muniraj, R. 2000. Farm Finance for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
3. Raju V.T., 2002. Essentials of farm management, oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Sankhayan P.L., 2001. Introduction to Farm Management, Tata Mcgraw hill publishing Co. Ltd., New Delhi.
5. Subba reddy, S and P. Raghu Ram, 1996. Agricultural Finance and Management, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

VI SEMESTER

17AGEU0604 PROTECTED CULTIVATION AND SECONDARY AGRICULTURE 2

(1+1)

Objectives:

1. To study the importance and design principal of Green House
2. To study the engineering properties of agricultural materials
3. To study commercial grain dryers and material handling equipments..

Learning Outcomes:

1. The students can learn to design green house based on crop and environmental conditions.
2. The students can learn to handle equipments used to measure parameters in green house.
3. The students can learn Engineering properties of grains for designing post harvest equipments.
4. The students can learn the operation and maintenance of dryers and materials handling equipments.

Theory

Unit I : **Green House Technology** – introduction, advantages of Green houses, plant response to Green house environment parameter for plant growth in a Green house – light, temperature, soil temperature, air movement and humidity.

Unit II : **Types of Green houses** – Based on shape, utility, construction, covering materials, suitability and cost.

Unit III : **Design principles** – site selection, orientation, size, spacing and height of green house; components of Green house; Desirable environmental conditions for growth of a plant, cost estimation and economic analysis.

Unit IV : **Design criteria** for cooling arrangements in a Green house – Ventilation, Evaporative cooling and movable insulation ; Design criteria for heating arrangement in a Green house – Direct solar gain, indirect solar gain, external sources of heating; Equipments for Green house – Temperature, radiation, photosynthesis and Leaf area Index measurement.

Unit V : **Engineering properties of agricultural materials** – hydroscopic, physical, thermal, chemical and aerodynamic; basic drying theory – Equilibrium moisture content; Mechanical during types – thin bed and deep bed drying; Commercial grain dryer – solar cabinet drier, portable batch dryer, Recirculating batch dryer and tray dryer; Material handling equipment – bucket elevator and screw conveyor – components, function and suitability.

Practical

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

Theory Schedule:

1. Green house technology – introduction and advantages of Green house
2. Plant response to Green house environment and parameter for plant growth in a Green house
3. Types of Green houses based on shape and utility
4. Types of Green houses based on construction & covering material
5. Types of Green houses based on suitability & cost
6. Design principles – site selection and orientation
7. Components of Green house and desirable environmental conditions for growth of a plant
8. Cost estimation and economic analysis
9. Design criteria for cooling arrangements in a Green house
10. Design criteria for heating arrangements in a Green house
11. Equipments used for Green house
12. Engineering properties of agricultural materials
13. Basic drying theory
14. Commercial grain dryers
15. Material handling equipments.

Practical Schedule:

1. Study of different type of Green houses based on shape
2. Study of different type of Green houses based on utility
3. Study of different type of Green houses based on construction
4. Study of different type of Green houses based on covering material
5. Study of different type of Green houses based on suitability& cost
6. Draw components of typical Green house
7. Study of temperature measuring instruments
8. Study of radiation measuring instruments
9. Study of Leaf Area index measuring instruments
10. Determination of engineering properties of agricultural materials
11. Determination of moisture content of various grains by moisture meter
12. Visit to Indian Institute of Food Processing Technology, Thanjavur
13. Visit to Seed Testing Laboratory and Post Harvest Technology centre, Coimbatore
14. Visit to Modern rice mill unit at Dindigul.
15. ESE Practical Examination

References:

Text books

1. Er. Sanjay Kumar, Er. Vishal Kumar and Ram Kumar Sahu, 2012. *Fundamentals of Agricultural Engineering*, Kalyani Publishers New Delhi.
2. P.H. Pandey, 1994. *Principles of Agricultural Processing – A Text Book*. Kalyani Publishers New Delhi.
3. P.H. Pandey, 1998. *Principles of Practices of Post Harvest Technology– A Text Book*. Kalyani Publishers New Delhi.
4. R.P.Kachru, P.K.Srivastava, B.S.Bisht and T.P.Ojha, 1986 *Bankabel Post Harvest Equipment Developed in India.* Central Institute of Agricultural Engineering, Bhopal, India.

VI SEMESTER
17AFSU0604 PRINCIPLES OF FOOD SCIENCE AND NUTRITION 2(2+0)

Objectives:

To enable the student to

1. Gain knowledge regarding the physical and chemical properties of the food constituents
2. Understand the role of microbes in food processing and spoilage
3. Familiarize the principles of food preservation and the methods of preservation.
4. Know the fundamentals of human nutrition and its relationship to health/wellness

Learning Outcomes:

- The students have gained the knowledge about the Physical, chemical properties of foods and the role of Microbes in food processing and spoilage.
- They have been familiarized with methods of food preservation and the fundamentals of human Nutrition.

Theory

Unit I : **Food Composition and Chemistry:** Water- structure and properties, types of water; Carbohydrates – classification, structure and properties; Proteins- classification, structure and properties; Fats- classification, structure and properties; Vitamins & Minerals; flavours, colours, Miscellaneous bioactive substances in food and their properties; colloidal systems: sol, gel, emulsion and foam.

Unit II : **Concept of Food Science:** Food groups, basic operations in food preparation. Cooking methods- moist, dry and combination. Composition and nutritive value of plant and animal foods; Processing of plant foods- cereals, pulses, nuts/oilseeds, fruits, vegetables; Processing of animal foods – milk, meat, poultry, egg, fish; storage of plant and animal foods.

Unit III : **Food spoilage**: Food deterioration meaning, causes of spoilage– microorganisms, enzymes/chemical reactions, insects, rodents, birds; microbial spoilage of fresh foods- cereals, pulses, nuts/oilseeds, fruits and vegetables, milk, meat, poultry, egg and fish and the processed products of these. Production of fermented foods - wine, beer, vinegar, soy based products and cereal/pulse based fermented products.

Unit IV : **Food Preservation:** Principles and methods of food preservation**:** use of heat, low temperature, chemicals, fermentation, radiation, drying, evaporation, hurdle technology; novel methods – high pressure processing, ohmic heating, ozone processing, membrane processing, pulsed electric field, ultrasonication.

Unit V : **Food and Nutrition:** Functions of food, nutrients–carbohydrate, protein, lipid, vitamins and minerals classification, functions, RDA, food sources, deficiency and toxicity; energy metabolism – energy balance, energy sources, energy expenditure, factors influencing energy intake and expenditure, Malnutrition- over and under nutrition, nutritional problems in India; concept of balanced modified diet, menu planning, health and wellness; dietary guidelines for healthy living, dietary modification for various diseases/disorders.

Theory Schedule:

1. Water- structure and properties, types of water
2. Carbohydrates – classification, structure and properties
3. Proteins- classification, structure and properties Fats- classification, structure and properties
4. Vitamins & minerals; flavours, colours, miscellaneous bioactive substances in food and their properties Colloidal systems: sol, gel, emulsion and foam.
5. Food groups, basic operations in food preparation
6. Cooking methods- moist, dry and combination.
7. Composition and nutritive value of plant and animal Foods
8. Processing and storage of plant foods- cereals, pulses, nuts/oilseeds, fruits, vegetables
9. Processing and storage of animal foods – milk, meat, poultry, egg, fish
10. Food deterioration- meaning, causes of spoilage – microorganisms, enzymes/chemical reactions, insects, rodents, birds
11. Microbial spoilage of fresh foods- cereals, pulses, nuts/oilseeds, fruits and vegetables and their processed products
12. Microbial spoilage of fresh foods- Milk, meat, poultry, egg and fish and their processed products
13. Production of fermented foods - wine, beer, vinegar, soy based products and cereal/pulse based fermented products.
14. Principles and methods of food preservation**,** use of heat, low temperature, chemicals, fermentation
15. Radiation, drying, evaporation, hurdle technology
16. Novel methods - high pressure processing, ohmic heating, ozone processing
17. Novel methods - membrane processing, pulsed electric field, ultrasonication.
18. Functions of food, nutrients- carbohydrate- classification, functions, RDA, food sources, deficiency and toxicity
19. Protein- classification, functions, RDA, food sources, deficiency and toxicity
20. Lipid- classification, functions, RDA, food sources, deficiency and toxicity
21. Vitamins- classification, functions, RDA, food sources, deficiency and toxicity
22. Minerals- classification, functions, RDA, food sources, deficiency and toxicity
25. Energy metabolism – energy balance, energy sources, energy expenditure
26. Factors influencing energy intake and expenditure, Malnutrition- over and under nutrition, nutritional problems in India;
27. Concept of balanced modified diet, menu planning, health and wellness
28. Dietary guidelines for healthy living, dietary modification for various diseases/disorders.

References:
Text books

1. Swaminathan, M. (1999). *Food Science*, Chemistry and Experimental Foods. 2nd ed. The Banglore Printing and Publishing Co., Bangalore.
2. Many, N.S. and M.Shadaksharswamy (1996). *Food Facts and Principles*. 2nd ed. New Age International Pvt. Limited, New Delhi.
3. Kalia, M. and S.Sood (2010). *Food Preservation and Processing*. Revised edn. Kalyani Publishers, New Delhi.
4. Srilakshmi, B. (2018). *Food Science***.** 5th edn. New Age International. Pvt. Limited.
5. Jood, S. and N.Khetarpaul. (2002). *Food Preservation*. GeetaSomaniAgrotech Publishing Academy, Udaipur.
6. Sivasankar, B. (2002). *Food Processing and Preservation*, PHI Learning Pvt. Ltd. Delhi.
7. Frazier W.C and D.C.Westhoff (1992), *Food Microbiology*, Tata McGraw Hill Publishing Co., Ltd. New Delhi.
8. Ray, B (2001). *Fundamentals of Food Microbiology*, 2nd Ed, CRC press, Boca raton F.
9. Srilakshmi, B. (2018). *Nutrition Science*. 5th edn. New Age International. Pvt. Limited.
10. SeemaYadav, (1997). *Food Chemistry*, Anomol Publications Pvt. Ltd., New Delhi.
11. Meyer, (1991). *Food Chemistry*, AVI Publictions, New York.
12. Norman N. Potter and Joseph H. Hotchkiss. (2006). *Food Science*, 5th Ed. Chapman & Hall, New York, USA.
13. Srilakshmi, B. (2018). *Dietetics***.** 5th edn. New Age International. Pvt. Limited.

VII SEMESTER
17AEXU0704 RURAL AGRICULTURAL WORK EXPERIENCE 20 (0+20)

I. Village Attachment Training Programme (6 Weeks)

Studying Village Scenario

- Orientation & On campus training by different faculties and Survey of Village
  - Understanding social participation, leadership pattern, scientific orientation and role of women and youth in agricultural development
  - Conducting PRA to assess the resources.

- Study of rural situation – village settlement pattern, demography, climate, land utilization pattern, resources inventory, infrastructural facilities, rural institutions, organizations, groups, customs, beliefs and value systems

- Contacting individual farmers to assess the differential farming system practiced by marginal, small, medium, big farmers and Farm Women

- **Agronomical Interventions** - Study of cropping pattern, cropping systems, extent of adoption of latest technologies and constraints – cereals, pulses, oilseeds – productivity – Decline in productivity – Yield gap – constraints in production

  - Plant Protection Interventions

  - Soil Improvement Interventions (Soil sampling and testing)
  - Fruit and Vegetable production interventions
  - Food Processing and Storage interventions
  - Animal Production Interventions
  - Extension and Transfer of Technology activities
- Studying the existing indigenous technical knowledge and its importance for technology generation.

- Gathering the farm women's association / farmers association / commodity groups and knowing their functioning and use their services for dissemination

- Conducting need based skill demonstrations in the village.

II. Studying Development Departments (2 Weeks)

- Study the organizational structures and schemes implemented by the various Development Departments.
- Study of Agricultural Department – Organization pattern, role and functions of Department of Agriculture and other allied departments

- Study of KVK – Organization pattern, role and functions of Department of Agriculture and other allied departments

III. Studying NGO (2 Weeks)

- Study of NGO – Roles and objectives – organizational pattern – sources of funding – extension activities of NGO – Contacting target groups
- Study of SHG, Agri business, Agri clinic and documentation of success stories of the farmers

IV. Agro Industrial Attachment (2 Weeks)

- Students shall be placed in Agro-and Cottage industries and Commodities Boards
- 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 students
- Performance evaluation, appraisal and ranking of students

Evaluation Pattern

Components	**VATP (6 Weeks)**	**ADA /KVK (2 Weeks)**	**NGO (2 Weeks)**	**Agro Industry (2 Weeks)**	**Total (12 Weeks)**
Participation and oral presentation	30 marks	10 marks	10 marks	10 marks	60 marks
Record	10 marks	5 marks	5 marks	5 marks	25 marks
Total	40 marks	15 marks	15 marks	15 marks	85 marks
				Overall Exhibition	15 marks
				Grand Total	***100 marks***

VII SEMESTER
17AGRU0713 EDUCATIONAL TOUR -1I 1 (0+1)

Objective:

- To enrich the knowledge of students with different National and International Institutions related to Agriculture, Horticulture, Forestry and other allied fields in various states.

Learning Outcome:

- The students become aware and enriched with the details on various National and International Research and Development Institutions and industries in various states. They will get good exposure about different regions, people, culture of India.

Practical

1. The students will visit various National and International Institutions related to Agriculture, Horticulture, Forestry and other allied fields in various regions of the country. The students will gain first hand knowledge about different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economics status of the farming communities in different parts of the country. The duration of the tour will be 12-15 days (institutional visits and intermediate journey) exclusive of onward and return journey. The evaluation procedure will be as follows.

2. Students will maintain a tour diary to record their observations at the places of visit. A Tour Record has to be submitted after the tour. The evaluation procedure will be as follows

Evaluation Procedure

1.	Attendance	:	10
2.	Behaviour	:	15
3.	Tour diary	:	10
4.	Tour record	:	20
5.	Written test	:	15
6.	Viva-Voce	:	10
7.	Presentation	:	10

	TOTAL	**:**	**100**

VIII SEMESTER
17AEXU0805 PROJECT WORK 4 (0+4)

Introduction to thrust areas of research – Identification of research problem – Review of literature – Research methodology – Conduct of study – Data collection – Analysis and interpretation of data – Preparation of research report and submission.

References:

Text books

1. Kothari, C.R. 1997. *Research Methodology*, Wishawa Prakasam, New Delhi.
2. Rangaswamy, R. 1995. *A Hand Book of Agriculture Statistics*, Wiley Eastern Ltd., New Delhi.
3. Robert A.D.2001. *How to Write and Publish Scientific Paper*, Cambridge University Press, Cambridge.

VIII SEMESTER

17SDEU0801 SKILL DEVELOPMENT AND ENTREPRENEURSHIP – I 10 (0+10)

Modules for Skill Development and Entrepreneurship (I & II)

1. Production Technology for Bioagents and Biofertilizer 0+10
2. Seed Production and Technology 0+10
3. Mushroom Cultivation Technology 0+10
4. Soil, Plant, Water and Seed Testing 0+10
5. Commercial Beekeeping 0+10
6. Poultry Production Technology 0+10
7. Commercial Horticulture 0+10
8. Floriculture and Landscaping 0+10
9. Food Processing 0+10
10. Agriculture Waste Management 0+10
11. Organic Production Technology 0+10
12. Commercial Sericulture 0+10

***NOTE*:** In addition to above ELP modules other important modules may be given to the students .

A student has to register 20 credits opting for Two modules of (0+10) credits each (total 20 credits) from the package of modules.

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.	Feasibility Study and Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business Plan and Networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

VIII SEMESTER
17SDEU0802 SKILL DEVELOPMENT AND ENTREPRENEURSHIP - II
10 (0+10)

Modules for Skill Development and Entrepreneurship (I & II)

1. Production Technology for Bioagents and Biofertilizer 0+10
2. Seed Production and Technology 0+10
3. Mushroom Cultivation Technology 0+10
4. Soil, Plant, Water and Seed Testing 0+10
5. Commercial Beekeeping 0+10
6. Poultry Production Technology 0+10
7. Commercial Horticulture 0+10
8. Floriculture and Landscaping 0+10
9. Food Processing 0+10
10. Agriculture Waste Management 0+10
11. Organic Production Technology 0+10
12. Commercial Sericulture 0+10

***NOTE*:** In addition to above ELP modules other important modules may be given to the students.

A student has to register 20 credits opting for Two modules of (0+10) credits each (total 20 credits) from the package of modules.

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.	Feasibility Study and Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business Plan and Networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

ELECTIVE COURSES

WEED MANAGEMENT 3 (2+1)

Objectives:

1. To learn about Importance of Weed management and Herbicides
2. To learn about types, methods & techniques of Weed management.

Learning outcomes:

- The students have learned about the Importance of Weed management and Herbicides.
- The students have learnt above the types, methods & techniques of Weed management.

Theory

Introduction to Weeds, Characteristics of Weeds their harmful and beneficial effects on eco-system- Classification , reproduction and Dissemination of weeds- herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use- Introduction to mode of action of herbicide 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

Unit I : **Weeds**- Definition- Introduction, Importance and Characteristics of weeds- harmful and beneficial effects of weeds- classification of weeds- propagation and dissemination- weed biology and ecology- crop weed association and crop weed competition and allelopathy.

Unit II : **Concept of Weed management**- weed prevention, eradication and control- Methods of weed control; Physical, Cultural, Chemical, Biological and bio-technological methods- Integrated Weed Management (IWM).

Unit III : **Herbicides-** Definition, Classification and characteristics of herbicides- herbicide formulations- Methods of application of herbicides- Advantages and limitations of herbicide usage in India- Concept of adjuvants and surfactants

Unit IV : **Herbicide selectivity**- Selective and non selective herbicides- herbicide absorption and translocation- Compatibility of herbicides with other agro inputs- Herbicide residue management-

Unit V : **Herbicide Mixture:** Concept of herbicide mixture and utility in agriculture- Herbicide resistant weeds and their management- Herbicide

resistant crops- Weed management in major field and horticultural crops- weed shift- weed control in non-cropped areas- aquatic and problematic weed and their control.

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 agro-chemicals 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.

Theory Schedule:

1. Weeds- Definition- Importance and Characteristics of weeds
2. Weeds harmful and beneficial effects of weeds
3. Weed biology and ecological adaptation to different eco-systems
4. Classification of weeds of different agro ecosystems- lowland weeds, irrigated upland and dry land weeds
5. Classification and characteristics of Aquatic, parasitic and obnoxious weeds
6. Life cycle of weeds , weed migration, weed seed distribution, dormancy , germination, establishment and presentation of weeds in different ecosystems
7. Crop weed Interactions- critical period of crop weed competition, competitive and allelopathic effects of weeds and crops
8. Principles and methods of weed management- Preventive , cultural and mechanical methods of weed control- merits and demerits
9. Principles and methods of weed management- chemical, biological and alternative methods
10. Integrated weed management(IWM)- Definition and its significance
11. Herbicide- Definition, classification and Characteristics
12. Herbicide formulations- History and Development of herbicides
13. Methods of application of herbicides- herbicide use efficiency- adjuvants, surfactants, herbicide protectants and antidotes.
14. Advantages and limitations of herbicide usage in India.
15. Mode of action of herbicides and their selectivity- Mechanism of action of herbicides and their selectivity
16. Herbicide persistence and degradation in plants and soils- herbicide residue and its management
17. Concept of herbicide mixture and utility in agriculture- Herbicide resistant weeds and their management
18. Herbicide resistant weeds and their impact on weed management-
19. Success of Herbicide resistant crops in Indian and World Agriculture
20. IWM in crops and cropping systems : Weed management in major field and horticultural crops

21. Weed shift- causes and management options for weed shift in crop production
22. Weed control in non-cropped areas- aquatic and problematic weed and their control
23. ESE Practical Examinations

Practical

1. Techniques of weed preservation- weed identification and their losses
2. Study- Biology of important weeds-
3. Study of herbicide formulations and mixture of herbicide-
4. Herbicide and agro-chemicals
5. Study- shift of weed flora
6. Study in long term experiments-
7. Study of methods of herbicide application, spraying equipments-
8. Calculations of herbicide doses
9. Calculations of weed control efficiency and weed index.
10. ESE Practical Examination

References:

Text books

1. Gupta, O.P.1998. *Modern Weed Management*. Agro Botanica, Bikaner, India
2. Subramanian,S., A. Mohammed Ali and R.Jayakumar, 1991.*All about Weed Control*. Kalyani publishers,New Delhi.
3. Jaganathan, R. and R.Jayakumar, 2003. *Weed Science Principles*. Kalyani Publishers, New Delhi.

E- References:

1. www.tnau.ac.in
2. www.fao.org
3. www.tnau.ac.in/agriportal

SYSTEM SIMULATION AND AGRO ADVISORY 3 (2+1)

Objectives:

1. To learn about Importance and Agro advisory services.
2. To learn about types, methods, tools & techniques of weather forecasting.

Learning Outcome:

- The Students can learn about the basic concept, benefits of Agro advisory Services and Weather forecasting .

Theory

Unit I : **System Approach for representing soil-plant-atmospheric** continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.

Unit II : **Evaluation of crop responses** to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation.

Unit III : **Crop production** in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Unit IV : **Weather forecasting**, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity;

Unit V : **Crop-Weather Calendars**; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

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.

Theory Schedule:

1. System Approach for representing soil-plant-atmospheric continuum, system boundaries
2. Crop models, concepts & techniques
3. Types of crop models, data requirements, relational diagrams.
4. Evaluation of crop responses to weather elements;
5. Elementary crop growth models;
6. Calibration, validation, verification and sensitivity analysis.
7. Potential and achievable crop production- concept and modelling techniques for their estimation
8. Crop production in moisture and nutrients limited conditions;
9. Components of soil water and nutrients balance
10. Weather forecasting, types, methods, tools & techniques,
11. Forecast verification
12. Value added weather forecast
13. ITK for weather forecast and its validity
14. Crop-Weather Calendars
15. Preparation of agro-advisory bulletin based on weather forecast.
16. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination

Practical Schedule:

1. Preparation of crop weather calendars.
2. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.
3. Working with statistical and simulation models for crop growth.
4. Potential & achievable production; yield forecasting.
5. Potential & achievable production; Insect & disease forecasting models.
6. Simulation with limitations of water management options.
7. Simulation with limitations of nutrient management options
8. Sensitivity analysis of varying weather.
9. crop management practices.
10. Use of statistical approaches in data analysis.
11. Preparation of historical, past and present meteorological data for medium range weather forecast.
12 .Feedback from farmers about the agro advisory.
12. ESE Practical Examination.

References:

Text books

1. Ghadekar S. R. 2001. *Meteorology.* Agromet Publishers, Nagpur, Maharastra, India,251 pp.
2. Griffiths, J. F. (ed). 1994. *Handbook of Agricultural Meteorology*. Oxford University Press, United Kingdom, 320 pp.
3. Jackson, I. J. 1989. *Climate, Water and Agricultural in the Tropics* (2nd edition). Longman, United Kingdom, 377 pp.
4. Jones, H. G. 1992. *Plants and Microclimate*. Cambridge University Press, U. K., 428 pp.
5. Mavi, H,S. 1986. *Introduction to Agrometerology*. Oxford and IBH publishing company, New Delhi, India, 237 pp.
6. Murthy, V.R.K. 1995. *Practical Manual on Agricultural Meteorology*. Kalyani Publishers, Ludhiana, India, 86 pp.

COMMERCIAL PLANT BREEDING 3 (1+2)

Objective:

- To learn basic knowledge about the hybrid seed production and plant

  Breeding techniques

Learning Outcome:

- The students will be thoroughly exposed about the application of Plant breeding

Unit I : **Mode of reproduction**, Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production.

Unit II : **Genetic Purity test** of commercial hybrids. Advances in hybrid seed production of rice, maize, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica. Quality seed production of vegetable crops.

Unit III : **Alternative strategies** for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.

Unit IV : **IPR issues in commercial plant breeding**; DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India.

Unit V : **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.

Theory Schedule:

1. Mode of reproduction
2. Line development and maintenance breeding in self pollinated crops (A/B/R and two line system) for development of hybrids and seed production
3. Line development and maintenance breeding in cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production
4. Genetic Purity test of commercial hybrids.
5. Advances in hybrid seed production of rice, maize
6. Advances in hybrid seed production of sorghum, pearl millet
7. Advances in hybrid seed production of castor, sunflower,
8. Advances in hybrid seed production of cotton, pigeon pea, Brassica.
9. Quality seed production of vegetable crops.
10. Alternative strategies for the development of the line and cultivars : haploid inducer
11. Alternative strategies for the development of the line and cultivars : tissue culture techniques and biotechnological tools
12. IPR issues in commercial plant breeding
13. DUS testing and registration of varieties under PPV & FR Act
14. Variety testing, release and notification systems in India
15. Principles and techniques of seed production, types of seeds,
16. Quality testing in self pollinated crops.
17. Quality testing in crosses pollinated crops.

Practical Schedule:

1. Floral biology ,selfing , crossing techniques in Rice , Wheat , Barley
2. Floral biology ,selfing , crossing techniques in Oat , Finger Millet
3. Floral biology , selfing , crossing techniques in Black gram , Green gram
4. Floral biology , selfing , crossing techniques in Cow pea , Chick pea, Field bean
5. Floral biology , selfing , crossing techniques in Soy bean , Ground nut
6. Floral biology , selfing , crossing techniques in Jute, Tomato
7. Floral biology , selfing , crossing techniques in Maize , Pearl Millet
8. Floral biology , selfing , crossing techniques in Sun flower , Safflower
9. Floral biology , selfing , crossing techniques in Castor , Mustard
10. Floral biology , selfing , crossing techniques in Coconut , Sunnhemp
11. Techniques of seed production in self pollinated crops using A/B/R and two line system
12. Techniques of seed production in Cross pollinated crops using A/B/R and two line system
13. Breeder's kit, Maintenance of crossing ledger , field note book, basic record and pedigree record in crops
14. Concept of rouging in seed production plot
15. Concept of line its multiplication and purification in hybrid seed production
16. Role of pollinators in hybrid seed production

17. Hybrid seed production techniques in Rice and Maize
18. Hybrid seed production techniques in Sorghum and Pearl millet
19. Hybrid seed production techniques in Rapeseed – Mustard and sunflower
20. Hybrid seed production techniques in Castor and Pigeon pea
21. Hybrid seed production techniques in Cotton and vegetable crops
22. Sampling and analytical procedures for purity testing and detection of spurious seed
23. Seed structure
24. Seed drying and storage
25. Quality seed management
26. Screening techniques during seed processing – grading and packaging
27. Visit to pubic private seed production and processing plants
28. ESE Practical Examination

References:

Text books

1. Daniel Sundararaj, D. and G Thulasidas, 1993. *Botany of Field Crops*. MacMillan India Ltd., New Delhi.
2. Chakravarty, A. 1999. *Post Harvest Technology of Cereals,* Pulses and Oil Seeds. Oxford and IBH Pub. New Delhi.
3. Arya, P.S. 2001. *Breeding and Seed Production*. Kalyani Pub., Ludhiana
4. R.L. Agarwal, 1995. *Seed Technology*, Oxford & IBH Publication, New Delhi

MICRO PROPAGATION TECHNOLOGIES 3 (1+2)

Objective:

To provide students with hands on training on various techniques of plant tissue culture

Learning Outcome:

- The students will be hands on experience and Exposed in plant tissue culture

Theory

Unit I : **Introduction**, History of plant tissue culture-Concepts– Advantages and limitations, Factors affecting plant tissue culture.

Unit II : **Organogenesis and embryogenesis**, Micro propagation – stages of micro propagation, Ovule, ovary endosperm culture, synthetic seeds.

Unit III : **Callus culture**- cell culture, shoot tip culture – meristem/meristem tip culture for virus elimination-virus indexing- anther and microspore culture.

Unit IV : **Protoplast culture** and fusion techniques Applications ,Somatic embryogenesis (direct and indirect), cell suspension culture.

Unit V : **Production of secondary metabolites**, somaclonal variation - *In vitro* mutagenesis- *In vitro* germplasm conservation.

Practical

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

Theory Schedule:

1. History of Plant Tissue Culture – Concepts
2. Plant tissue culture – Advantage and Limitations
3. Totipotency and Morphogenesis

4. Micro propagation – Stages of Micro propagation
5. Anther culture, pollen culture
6. Ovule culture, embryo culture
7. Shoot tip culture, meristem culture
8. Endosperm culture
9. Protoplast isolation, culture, manipulation and fusion
10. Products of somatic hybrids and cybrids
11. Somatic embryogenesis
12. Cell Suspension Culture
13. Secondary metabolites
14. Somaclonal variation Types
15. *In vitro* germplasm conservation

Practical Schedule:

1. Plant tissue culture laboratory organization
2. Identification and use of equipments in tissue culture Laboratory
3. Sterilization Techniques
4. Preparation of Stock solutions - MS medium
5. Preparation of MS medium

6 & 7. Media Preparation for Embryo culture in Maize
8 & 9.Media Preparation for Meristem tip culture in Tapioca
10 & 11.Explant Inoculation of Meristem tip culture
12 & 13.Shoot tip culture in Banana
14 & 15.Media Preparation for Nodal and Shoot tip culture in rose
16 &17. Explant Inoculation of Nodal and Shoot tip Shoot tip culture in rose
18 & 19. Medium preparation of sub culturing of rose
20 & 21.Anther culture and microspore culture in rice
22 & 23.Pretreated anther culture
24 & 25.Visit to commercial tissue culture laboratory
26 .Video show on tissues culture techniques
27. ESE Practical Examination

References:

Text books

1. Bhojwani and Dantu, 2013. *Plant Tissue culture: An introductory Text*, Springer, New Delhi.
2. Bhojwani, S.S and Razdan. M.K. 2009. *Plant Tissue culture-Theory and Practice*. Elsevier India Pvt.Ltd
3. Cassells, A. C and Peter B. Gahan. 2006. *Dictionary of Plant Tissue culture*. Food Products Press, an Imprint of the Haworth Press, Inc., New York-London-Oxford.

BIOPESTICIDES & BIOFERTILIZERS 3 (2+1)

Objectives:

1. To know about the importance of biopesticides and biofertilizers
2. To familiarize students with the microbes used as bio fertilizers for various crop plants and their advantages over chemical fertilizers.

Learning Outcomes:

- Understanding the uses of Microbial Biofertilizers and Biopesticides
- Understanding the methods of Application of Biofertilizers and Biopesticides

Theory

Unit I : **History and concept of biopesticides**. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides.

Unit II : **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.

Unit III : **Biofertilizers -** Introduction, status and scope**.** Structure and characteristic features of bacterial biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM *mycorrhiz*a and *ectomycorhiza.*

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

Unit V : **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, Metarhyzium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of

biopesticides. Isolation and purification of *Azospirillum , Azotobacter, Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Theory Schedule:

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

Practical Schedule:

1. Isolation and purification of important biopesticides: *Trichoderma, Pseudomona,* and its production
2. Isolation and purification of important biopesticides:*, Bacillus, Metarhyzium* and its production
3. Identification of important botanicals
4. Visit to biopesticide laboratory in nearby area
5. Field visit to explore naturally infected cadavers

6. Identification of entomopathogenic entities in field condition
7. Quality control of biopesticides
8. Isolation and purification of *Azospirillum , Azotobacter, Rhizobium*
9. Isolation and purification of P-solubilizers and Cyanobacteria
10. Mass multiplication and inoculums production of biofertilizers
11. Isolation of AM fungi -Wet sieving method method
12. Isolation of AM fungi - sucrose gradient method
13. Mass production of AM inoculants
14. ESE Practical Examination

References:

Text books

1. Subba Rao, N.S. 1999. *Biofertilizers in Agriculture and Agroforestry*. Oxford and IBH, New Delhi.
2. Subba Rao, N. S. 2000. *Soil Microbiology*. Oxford and IBH, New Delhi.
3. Alexander, M. 1985. *Introduction to Soil Microbiology*, John Willey and Sons Inc. N. Y. and London
4. Rangaswami, G. and D. J. Bagyaraj, 1999. *Agricultural Microbiology***,** Asia Publishing House, New Delhi.
5. Wicklow, D.T. and B.E. Soderstrom. 1997, *Environmental and Microbial Relationships*. Springer ISBN.
6. Kannaiyan, S. (2003). *Biotechnology of Biofertilizers*, CHIPS, Texas.
7. Mahendra K. Rai (2005). *Hand book of Microbial Biofertilizers*, The Haworth Press, Inc. New York.

AGROCHEMICALS 3 (2+1)

Objectives:

- To know about various agrochemicals and its usage in agricultural production
- To know about classification of herbicides, fungicides, insecticides

Learning Outcomes:

- Understanding the pesticide classification, merits and demerits of their uses in agriculture

Theory

Unit I : **An introduction to Agrochemicals**: Their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.

Unit II : **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.

Unit III : **Introduction and classification of Insecticides**: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Plant bio-pesticides for ecological agriculture, Bio-insect repellent

Unit IV : **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.

Unit V : **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.

Practical

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

Theory Schedule:

1. An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health
2. Merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture
3. Herbicides-Major classes, properties and important herbicides. Fate of herbicides
4. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper
5. Mode of action-Bordeaux mixture
6. Mode of action copper oxychloride
7. Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and Maneb
8. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use
9. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals
10. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use
11. Fate of insecticides in soil & plant
12. IGRs Biopesticides
13. Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses
14. Plant bio-pesticides for ecological agriculture
15. Bio-insect repellent
16. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers
17. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate
18. Preparation of bone meal and basic slag
19. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate
20. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures

21. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes
22. Fertilizer control order
23. Fertilizer logistics and marketing

Practical Schedule:

1. Sampling of fertilizers and pesticides
2. Pesticides application technology to study about various pesticides appliances
3. Quick tests for identification of common fertilizers
4. Identification of anion and cation in fertilizer
5. Calculation of doses of insecticides to be used
6. To study and identify various formulations of insecticide available in market
7. Estimation of nitrogen in Urea
8. Estimation of water soluble P2O5 and citrate soluble P2O5 in single super phosphate
9. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer
10. Determination of copper content in copper oxychloride
11. Determination of Sulphur content in sulphur fungicide
12. Determination of Thiram
13. Determination of Ziram content
14. ESE Practical Examination

References:

Text books

1. Buchel, K. H. 1983 *Chemistry of Pesticides*. John Wiley and Sons New York.
2. Collings G. H. 1955 *Commercial Fertilizers.* Mc. Grew Hill Publishing Co. New York.
3. Geroge W. W 1986. *Fundamentals of Pesticides- A self instruction Guide*. Thomas publication P.O. Box 9335. Freno, California.
4. Sree Ramulu, U. S. 1979. *Chemistry of Insecticides and Fungicides*. Oxford and IBH Publishing House Co. New Delhi.
5. Sree Ramulu,U.S.1990. *Methods of Pesticides Analysis*, Oxford-IBH
6. Gunter Zweig Academic *Pesticides, Plant Growth Regulators and Food Additives*, Vol I to XI ,Gunter Zweig Academic .
7. Vogel.A.I. – 1989 ..*A Textbook of Practical Organic Chemistry.* ELBS with Longman, 5th Ed.,

- Understanding the fertilizers and their importance

HI-TECH. HORTICULTURE 3(2+1)

Objectives:

1. To impart knowledge on the protected cultivation of vegetables, fruits and Flower crops.
2. To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops.

Learning Outcome:

- After completion of this course, the students will be learned in the field of crop production in protected cultivation and precision farming techniques and aims to bring the students to the required level of knowledge and skill.

Theory

Unit I : **Introduction:** Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods.

Unit II : **Importance and methods of Protected cultivation:** Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling.

Unit III : **High density planting:** Canopy management, high density orcharding

Unit IV : **Concept and introduction of Precision Horticulture:** Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA).

Unit V : **Precision farming techniques for Horticultural crops:** Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

. **Practical**

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

Theory Schedule:

1. Hi-tech culture- overview – global scenario of protected cultivation of horticultural Crops.
2. Scope of hi-tech culture in India and Tamil Nadu for vegetable crops.
3. Nursery raising in protected structures like poly-tunnels, types of benches and containers.
4. Different media for growing nursery.
5. Nursery management and mechanization.
6. Micro propagation of horticultural crops.
7. Micro propagation and its advantages and disadvantages.
8. Modern field preparation and planting methods.
9. Protected cultivation.
10. Advantages of Protected cultivation.
11. Controlled conditions, method and techniques.
12. Micro irrigation systems and its components.
13. EC based fertilizer scheduling.
14. PH based fertilizer scheduling.
15. Canopy management.
16. High density orcharding.
17. Components of precision farming.
18. Remote sensing.
19. Geographical Information System (GIS).
20. Application of Geographical Information System.
21. Differential Geo-positioning System (DGPS).
22. Variable Rate applicator (VRA).
23. Precision horticulture, Principles and concepts.
24. Precision equipments, computers and robotics in precision farming.
25. Application of precision farming technology in horticulture crops.
26. Precision farming technology in fruit crops.
27. Precision farming technology in tomato.
28. Precision farming technology in bitter gourd.
29. Precision farming technologies for tapioca.
30. Precision farming technologies in cabbage.
31. Precision farming technology in ornamental crops.
32. Mechanized harvesting of produce.

Practical Schedule:

1. Types of Polyhouses.
2. Types of shade net houses.
3. Practising Intercultural operations in fruits and vegetables.
4. Identification and application of Tools and equipments.
5. Learning about them Micro propagation techniques.
6. Practising preparation of raising seedlings in Nursery-protrays.
7. Design, layout and installation of drip and fertigation in precision farming
8. Practising application of micro-irrigation methods.

9. EC, PH based fertilizer scheduling,
10. Canopy management in precision farming
11. Visit to hi-tech orchard/nursery.
12. Visit to different greenhouses.
13. Acquiring knowledge about precision farming techniques in horticultural crops.
14. End semester practical examination.

References:

Text books

1. Anonymous 2003. Proc. *All India Seminar on Potential and Prospects for Protective Cultivation.* Organised by Institute of Engineers, Ahmednagar. Dec.12-13, 2003.
2. Chandra, S. and V. Som. 2000. *Cultivating Vegetables in Green House*. Indian Horticulture 45: 17-18.
3. Prasad, S and U. Kumar. 2005. *Greenhouse Management for Horticultural Crops*. 2nd Ed. Agrobios.
4. Tiwari, G.N. 2003. *Green House Technology for Controlled Environment.* Narosa Publ. House

Journals:

1. Vegetable sciences
2. Acta Horticulture
3. Indian Journal of Horticulture
4. Asian Journal of Horticulture
5. Indian Horticulture

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1. http://www.informaworld.com/smpp/title~db=all~content=g904622674
2. http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html
3. http://attra.ncat.org/attra-pub/manures.html
4. http://ucanr.org/freepubs/docs/8129.pdf

LANDSCAPING 3 (2+1)

Objectives:

1. To learn about Importance, Principles of Landscape Horticulture and Garden components

2. To learn about the Lawn making and Landscape Designs

Learning Outcome:

- The students get familiarized with various landscaping methods, designing , selection of garden components and implementation of landscaping techniques, according to the need.

Theory

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

Unit II : **Trees: selection, propagation, planting schemes**, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers:

Unit III : **Importance, Selection, Propagation**, Planting, Annuals, selection, propagation, planting scheme, other garden plants: palms, ferns, grasses and cacti, succulents. Pot plants: selection, arrangement, management.

Unit IV : **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.

Unit V : **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.

Theory Schedule:

1. Importance and scope of landscaping.
2. Principles of landscaping.
3. Garden styles and types.
4. Terrace gardening.
5. Vertical gardening.
6. Garden components, adornments.
7. Lawn making.
8. Rockery.
9. Water garden, walk-paths, bridges, other constructed features etc.
10. Gardens for special purposes.
11. Trees - selection, propagation, planting schemes and canopy management.
12. Shrubs- selection, propagation, planting schemes and canopy management.
13. Herbaceous perennials: selection, propagation, planting schemes and architecture.
14. Climber -importance, selection, propagation and planting.
15. Creepers-importance, selection, propagation and planting.
16. Annuals- selection, propagation, planting scheme.
17. Palms and ferns.
18. Lawn grass.
19. Cacti and succulents.
20. Pot plants: selection, arrangement and management.
21. Bio-aesthetic planning: definition, need and planning.
22. Landscaping of urban and rural areas.
23. Peri-urban landscaping.
24. Landscaping of schools.
25. Public places like bus station, railway station and townships.
26. Landscaping of river banks, hospitals and play grounds.
27. Landscaping of airports and industries.
28. Landscaping of institutions.
29. Bonsai- principles and management.
30. Methods of lawn establishment.
31. Maintenance of lawn.
32. CAD application.

Practical Schedule:

1. Identification of Important ornamental trees.
2. Identification of Important ornamental shrubs & lawn grasses.
3. Identification of Important ornamental pot plants & water garden plants.
4. Propagation of trees, shrubs and annuals care and maintenance of plants.
5. Practicing preparation of potting and repotting of plants.
6. Identification of tools and implements used in landscape design.
7. Training and pruning of plants for special effects.

8. Lawn establishment and maintenance.
9. Layout of formal garden and informal gardens.
10. Special type of gardens (sunken garden, terrace garden, rock garden).
11. Designing of conservatory and lathe house.
12. Use of computer software.
13. Visit to important gardens/ parks/ institutes.
14. End semester practical examination.

References:

Text books

1. Bose, T.K. and D. Mukherjee. 1977. *Gardening in India*. Oxford and IBH Publishers and Co., Calcutta.
2. Gopalsamy Iyengar, 1990. *Complete Gardening in India*. IBH, Bangalore.
3. John Ainsworth. 1988. *The Act of Indoor Bonsai*. Wardlock Publishing ltd., London.
4. John Ravenscroft. 1996. *Gardeners Diary*. Marshall Cavendish Publishers Italy.
5. Lancaster, P. 1991. *Gardening in India.* Oxford and IBH publishers Pvt. Ltd., Calcutta.
6. Nambisan, K. M. P. 1992. *Design Elements of Landscape Gardening*. Oxford and IBH Publications Co., (P) Ltd, New Delhi.
7. Peter McHoy. 1997. *The A-Z Guide to House Plants*. Marshall Cavendish publishers, Italy.

Journals

1. J. Orn. Hort. Indian Society of Ornamental Horticulture,
2. Floraculture International.
3. "Floriculture Today"

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2. www.centralfloridagarden.blogspot.com
3. www.intuxford.tripod.com
4. www.lawngrasses.com
5. www.personal.psu.edu
6. www.sunny.crk.umn.edu/courses
7. www.webct.uark.edu

PROTECTED CULTIVATION 3 (2+1)

Objectives:

1. Understanding the principles and theoretical aspects of protected cultivation.

2. Developing skills in erection of protected structures and cultivation of horticultural crops.

Learning Outcomes:

- After completion of this course, the students will learn in the field of crop production in protected environments under given climatic and economic, and technical conditions and aims to bring the students to the required level of knowledge and skill.

Theory

Unit I : **Importance and methods of Protected cultivation in horticultural crops:** 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.

Unit II : **Greenhouse cultivation:** 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.

Unit III : **Protected cultivation technology for Flower crops:** Greenhouse cultivation of important horticultural crops – Rose, Carnation, Chrysanthemum, Gerbera, Orchid, Anthurium.

Unit IV : **Protected cultivation technology for Vegetable crops:** Greenhouse cultivation of important horticultural crops- Lilium, Tulip, Tomato, Bell pepper, Cucumber, Strawberry, Pot plants, etc.

Unit V : **Protected cultivation technology for Medicinal and Aromatic crops:** 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 protrays 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.

Theory Schedule:

1. Protected cultivation- importance and scope.
2. Status of protected cultivation in India and World.
3. Types of protected structure based on site and climate.
4. Cladding material involved in greenhouse/ poly house.
5. Greenhouse design and layout.
6. Study of environmental control systems- light and temperature.
7. Study of environmental control systems - humidity, oxygen and carbon – dioxide.
8. Study of fogging systems for greenhouse.
9. Study of ventilation systems for greenhouse.
10. Soil preparation and management, Substrate management.
11. Types of benches and containers.
12. Irrigation management systems inside the protected structures.
13. Fertigation, water soluble fertilizers and micro fertilizer mixtures.
14. Propagation and production of quality planting material of horticultural crops.
15. Greenhouse cultivation of Rose.
16. Greenhouse cultivation of Carnation.
17. Greenhouse cultivation of Chrysanthemum.
18. Greenhouse cultivation of Gerbera.
19. Greenhouse cultivation of Orchid.
20. Greenhouse cultivation of Anthurium.
21. Greenhouse cultivation of lilium.
22. Greenhouse cultivation of Tulip.
23. Greenhouse cultivation of tomato.
24. Practicing mulching, training, pruning, trellising in tomato.
25. Greenhouse cultivation of bell pepper.
26. Greenhouse cultivation of cucumber.
27. Greenhouse cultivation of strawberry.
28. Greenhouse cultivation of pot plants, etc.
29. Cultivation of economically important medicinal plants.
30. Cultivation of economically important aromatic plants.
31. Off-season production of flowers and vegetables.
32. Insect pest and disease management.

Practical Schedule:

1. Study of various protected structures - Greenhouses, polyhouses, Shade houses, poly tunnels and rain shelters.
2. Structure components- Low cost/medium cost/high cost structures.
3. Design and layout of green house.
4. Environment control - management in green house.
5. Raising of seedlings and saplings under protected conditions.
6. Use of protrays in quality planting material production.
7. Bed preparation and planting of crop for production.
8. Green house cultivation techniques for cucumber and Tomato.
9. Inter cultural operations in green house cultivation.
10. Special horticultural practices in training & staking.
11. Soil EC and pH measurement.
12. Regulation of irrigation and fertilizers through drip, fogging and misting.
13. visit to commercial greenhouse units.
14. End semester practical exam.

References:

Text books

1. Aldrich, R.A. and J.W. Bartok. 1994. *Green House Engineering*. NRAES, Riley, Robb Hall, Cornell University, Ithaca, New York.
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- Benefits and advances in maintaining growth parameters for protected cultivation and off season production is highlighted through this course for entrepreneurship development.

AGRI-BUSINESS MANAGEMENT 3 (2+1)

Objectives:

1. Student will understand & experience the importance of Agribusiness in present day of crop cultivation
2. Developing skills in Personnel, Financial, Input Management and preparation of projects

Learning outcomes:

- The students have understood the importance of Agribusiness in present day crop cultivation.
- They have gained skills in Personal, Financial and preparation of projects.

Unit I : **Introduction to Agri Business Management: Agri business** – Meaning, Definition, Scope, Structure, Characteristics.-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.

Unit II : **Introduction to Principles of Management: Management** – Definition, Elements, Concepts and Functions- Entrepreneur–Small business – characteristics and stages of growth.

Management functions –Roles and Activities. Planning –Types of Plan. Organizing –Forms of agri business organization – Staffing, Directing, Supervision, Motivation and Controlling – Types, performance, evaluation and control techniques. Components of a business plan, Management approaches – Profit centre approach, Management By Objectives (MBO) and Quality Circles (QC). Strength Weakness Opportunities and Threats (SWOT) analysis.

Unit III : **Production and Personal Management:** Functional areas of agri business – production and operations management – functions, planning, physical facilities and managing quality. Inventory management– raw material procurement, inventory types, costs. Personnel management – recruitment, selection and training.

Agro-based industries - Importance and Need, Classification and Types. Institutional arrangement and procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages.

Unit IV : **Financial and Marketing Management:** Financial management – Importance, Characteristic of Capital, Working Capital, Types, -Balance sheet and Profit Loss statement– Financial ratio analysis (Liquidity, Coverage and Profitability)-Marketing management- Marketing environment, marketing mix.

Unit V : **Input Marketing: Input marketing** firms-types and distribution channels. Processing firms-Types, size and managerial problems. Management Information System (MIS) – concept and applications. Business standards – ISO – Government policies for agri business. WTO and its impact on agri business - Intellectual Property Rights and patenting.

Project- Meaning and Definition, Characteristics and Types-Project Cycle -identification, formulation, appraisal, implementation, monitoring and evaluation. Undiscounted and Discounted Techniques (NPW,BCR,IRR,NBIR and Sensitivity Analysis)

Business environment: Consumer behaviour analysis, Product Life Cycle (PLC). Sales and Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle.

Practical

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

Theory Schedule:

1. Agri business – Meaning, Definition, Scope, Structure, Characteristics.- Transformation of agriculture into agribusiness
2. Various stakeholders and components of agribusiness systems- Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness
3. Management – Definition, Elements, Concepts and Functions-
4. Entrepreneur – small business – characteristics and stages of growth.

5. Management functions –Roles and Activities. Planning –Types of Plan. Organizing –Forms of agri business organization
6. Staffing, Directing, Supervision, Motivation and Controlling – Types, performance, evaluation and control techniques.
7. Components of a business plan, Management approaches – Profit centre approach, Management By Objectives (MBO) and Quality Circles (QC).
8. Strength Weakness Opportunities and Threats (SWOT) analysis.
9. Functional areas of Agri business – production and operations management – functions, planning, physical facilities and managing quality.
10. Inventory management– raw material procurement, inventory types, costs.
11. Personnel management – recruitment, selection and training.
12. Agro-based industries - Importance and Need, Classification and Types. Institutional arrangement and procedures to set up agro based industries. Constraints in establishing agro-based industries.
13. Agri-value chain: Understanding primary and support activities and their linkages.
14. Financial management – Importance, Characteristic of Capital, Working Capital, Types, -Balance sheet and Profit Loss statement
15. Financial ratio analysis (Liquidity, Coverage and Profitability)-Marketing management- Marketing environment, marketing mix.
16. Input marketing firms-types and distribution channels. Processing firms-types, size and managerial problems.
17. Management Information System (MIS) – concept and applications. Business standards – ISO – Government policies for Agri business. WTO and its impact on Agri business - Intellectual property rights and patenting.
18. Project- Meaning and Definition, Characteristics and Types
19. Project Cycle -identification, formulation, appraisal, implementation, monitoring and evaluation.
20. Undiscounted and Discounted Techniques (NPW, BCR, IRR, NBIR and Sensitivity Analysis)
21. Business environment: Consumer behaviour analysis, Product Life Cycle (PLC).
22. Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle.

Practical Schedule:

1. Business plan preparation – identification and business opportunities.
2. Study of agri-input markets: Seed, fertilizers, pesticides.
3. Study of output markets: grains, fruits, vegetables, flowers.
4. Study of product markets, retails trade commodity trading, and value added products.
5. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness
   Finance Limited, NABARD.
6. Preparations of projects and Feasibility reports for agribusiness entrepreneur.
7. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques.
8. Visit and Case study of agro-based industries.

9. Trend and growth rate of prices of agricultural commodities.
10. Net present worth technique for selection of viable project. Internal rate of return
11. Presentation and discussion on consumer survey reports.
12. Market potential assessment for agro-inputs and agro products
13. Product pricing methods.
14. ESE Practical Examination

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Text books

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FOOD SAFETY AND STANDARDS 3(2+1)

Objectives:

To enable the student to

- Understand the importance of food safety in food service institutions
- Know the tools used for assessment of food safety and quality
- Familiarize the food laws and standards ensuring food quality

Learning outcome:

- The students have understood the importance of food safety, assessment of food safety and food laws and standards ensuring food quality.

Theory

Unit I : **Food safety concepts:** Food safety- definition, importance and scope; Factors affecting food safety; Food hazards- meaning, biological, chemical, physical hazards; control and preventive measures; Hazard management during storage, processing, handling and distribution ; Sources of contamination;Waste disposal, pest and rodent; Water analysis: testing water quality-physic-chemical and microbiological, Surface sanitation -personnel and plant hygiene.

Unit II : **Food safety measures:** Food safety management- basic concepts; HACCP- principles, importance accreditation and auditing; Food safety practices- PRPs, GHPs, GMPs, SSOPs; TQM - Concept and need for quality, Components of TQM, Accreditation and Auditing; ISO series, Risk analysis; kaizen (or) continuous improvement.

Unit III : **Food quality criterion:** Food quality- meaning; sensory attributes, subjective and objective evaluation of foods, Food analysis- nutrient, microbial, pesticide, toxicant, heavy metals; Food additives- definition, common food additives and its functions, Food adulterants-meaning and types; Food packaging- functions, requirements**,** materials, package testing; Food labeling-definition, principles, requirements and nutritional labeling, nutrition claims.

Unit IV : **Food laws and standards**- need and importance; Indian food regulatory regime; global scenario- Codex Alimentarius Commission (CAC); other laws and standards related to food-National food legislation- AGMARK, BIS, FPO, PFA, FSSA and Essential commodities act; International organization- FAO, WTO, WHO and APEDA.

Unit V : **Novel approaches for food safety:** Genetically modified foods- meaning, role, merits and demerits.GM foods- golden rice, brinjal, tomtato, potato and kiwi; biofortification; Organic foods - meaning, advantages and limitations of organic farming; nutraceuticals/functional foods meaning, advantages and limitations.

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. Detection of adulterants in foods. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens; Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

Theory Schedule:

1. Food safety- definition, importance and scope; factors affecting food safety
2. Food hazards- meaning, biological, chemical, physical hazards, control and preventive measures
3. Hazard management during storage, processing, handling and distribution
4. Sources of contamination, waste disposal, pest and rodent
5. Water analysis: testing water quality- physic-chemical and microbiological
6. Surface sanitation, personnel and plant hygiene.
7. Food safety management- basic concepts; HACCP- principles, importance, accreditation and auditing;
8. Food safety practices- PRPs, GHPs,
9. Food safety practices - GMPs, SSOPs
10. TQM - concept and need for quality, components of TQM, accreditation and auditing
11. ISO series, risk analysis; kaizen (or) continuous improvement.
12. Food quality- meaning; sensory attributes, subjective evaluation of foods
13. Objective evaluation of foods, food analysis- nutrient, microbial
14. Food analysis- pesticide, toxicant, heavy metals

15. Food additives- definition, common food additives and its functions
16. Food adulterants- meaning and types;
17. Food packaging- functions, requirements**,** materials, package testing
18. Food labeling-definition, principles, requirements
19. Nutritional labeling, nutrition claims.
20. Need and importance; Indian food regulatory regime; global scenario- Codex Alimentarius Commission (CAC)
21. National food legislation- AGMARK, BIS, FPO
22. National food legislation- PFA, FSSA and Essential commodities act
23. International organization- FAO, WTO
24. International organization- WHO and APEDA.
25. Genetically modified foods meaning, role, merits and demerits GM foods- golden rice, brinjal,
26. Merits and demerits GM foods tomtato, potato and kiwi, biofortification
27. Organic foods meaning, advantages and limitations of organic farming
28. Nutraceuticals/functional foods meaning, advantages and limitations.

Practical Schedule:

1. Water quality analysis – physicochemical and microbial quality
2. Assessment of surface sanitation by swab/rinse method.
3. Preparation of different types of media for microbial examination.
4. Microbiological examination of different food samples.
5. Biochemical tests for identification of bacteria.
6. Detection of adulterants in foods.
7. Scheme for the detection of food borne pathogens.
8. Preparation of plans for Implementation of FSMS- HACCP
9. Preparation of plans for Implementation of FSMS- ISO: 22000.
10. ESE Practical Examination

References:

Text books

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AGRICULTURAL JOURNALISM 3 (2+1)

Objectives:

- To impart knowledge on Agricultural Journalism and Characteristics and functions of Newspaper and Magazines.
- To impart knowledge on Form and Content of Newspapers and Magazines
- To gain knowledge on gathering Agricultural Journalism, writing stories and Editorial Mechanics.

Learning Outcomes:

- Students will be familiarized about the journalism and Newspapers.
- Students may able to know about the gathering Agricultural related information's and their presentations.

Theory

Unit I : **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.

Unit II : **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.

Unit III : **Gathering agricultural information:** Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

Unit IV : **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.

Unit V : **Editorial mechanics:** Copy reading, headline and title writing, proofreading, lay outing.

Practical

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

Theory Schedule:

1. Agricultural Journalism: The nature and scope of agricultural journalism characteristics.
2. Training of the agricultural journalist.
3. How agricultural journalism is similar to and different from other types of journalism.
4. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines.
5. Characteristics of newspaper and magazine readers.
6. Form and content of newspapers and magazines: Style and language of newspapers and magazines
7. Parts of newspapers and magazines
8. The agricultural story: Types of agricultural stories
9. Subject matter of the agricultural story.
10. Structure of the agricultural story.
11. Gathering agricultural information: Sources of agricultural information
12. Interviews
13. Coverage of events,
14. Abstracting from research and scientific materials,
15. Wire services, other agricultural news sources.
16. Writing the story:
17. Organizing the material,
18. Treatment of the story,
19. Writing the news lead and the body,
20. Readability measures.
21. Illustrating agricultural stories: Use of photographs,
22. Use of artwork (graphs, charts, maps)
23. Writing the captions.
24. Editorial mechanics: Copy reading,
25. Headline and
26. Title writing,
27. Proofreading,
28. Lay outing.
29. ESE Examination.

Practical Schedule:

1. Practice in interviewing.
2. Covering agricultural events.
3. Abstracting stories from research and scientific materials and from wire services.
4. Writing different types of agricultural stories.
5. Selecting pictures and artwork for the agricultural story.
6. Practice in editing.
7. Copy reading.
8. Headline
9. Title writing.
10. Proofreading.
11. Lay outing.
12. Testing copy with a readability formula.
13. Visit to a publishing office.
14. ESE Practical Examination

References:

Text books

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