

DHANALAKSHMI SRINIVASAN UNIVERSITY
SCHOOL OF AGRICULTURAL SCIENCES
2023 - B.Sc. (Hons.) HORTICULTURE CURRICULUM

Semester I

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23HOR101	Fundamentals of Horticulture	2+1	3
2.	23HOR102	Plant propagation and nursery management	1+1	2
3.	23VSC101	Tropical and subtropical vegetable crops	2+1	3
4.	23HOR103	Botany of Horticultural crops	1+1	2
5.	23AGR101	Introduction to major field crops	1+1	2
6.	23BIC101	Fundamentals of Plant Biochemistry	1+1	2
7.	23FOR111	Introduction to Forestry	1+1	2
8.	23LAN101	Comprehension and Communication Skills in English	1+1	2
9.	23SAC101	Fundamentals of Soil Science	2+1	3
		Total	12+9	21
10.	23 NSS/ NCC 101	NSS or NCC *	0+1*	1*
11.	23 PED 101	Physical Education and Yoga Practices*	0+1*	1*

*Non- gradial courses

Semester II

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23FSC101	Tropical and subtropical fruits	2+1	3
2.	23PSM101	Spices and condiments	2+1	3
3.	23AEX101	Fundamentals of Agricultural Extension Education	2+1	3
4.	23AGR102	Introductory Agro-Meteorology and Climate Change	1+1	2
5.	23AGR103	Weed and water management of Horticulture crops	1+1	2
6.	23AGM101	Fundamentals of Microbiology	2+1	3
7.	23CRP111	Fundamentals of Crop Physiology	2+1	3
8.	23FSN111	Principles of Food Science and Nutrition	1+1	2
9.	23MAT111	Elementary Mathematics	2+0	2
		Total	15+8	23
10.	23 NSS/ NCC 101	NSS or NCC	0+1#	1#
11.	23 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

Semester III

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23FLG201	Commercial floriculture	2+1	3

2.	23FSC201	Temperate fruit crops	1+1	2
3.	23HOR201	Growth and development of horticultural crops	1+1	2
4.	23VSC201	Temperate vegetable crops	1+1	2
5.	23AEN201	Fundamentals of Entomology	2+1	3
6.	23AMP201	Livestock and Poultry Management	2+1	3
7.	23FMP111	Farm Machinery and Power	1+1	2
8.	23PAT201	Fundamentals of Plant Pathology	2+1	3
9.	23STA201	Statistical Methods and computer application	2+1	3
		Total	14+9	23
10.	23HOR202	Study Tour*	0+1*	1*
11.	23 NSS/ NCC 101	NSS or NCC	0+1#	1#
12.	23 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV * Non- gradial Course

Semester IV

S. No	Course Code	Course Title	Credit Hours	Total Credits
1	23FLG202	Ornamental Horticulture	1+1	2
2	23FSC202	Dry land Horticulture	1+1	2
3	23FSC203	Orchard and estate management	1+1	2
4	23PSM201	Plantation crops	2+1	3
5	23AEC201	Economics and marketing	2+1	3
6	23AEX201	Communication Skills and Personality Development	1+1	2
7	23AEN202	Insect pest of fruit, plantation, medicinal and aromatic plants	2+1	3
8	23PAT202	Diseases of fruit, plantation, medicinal and aromatic plants	2+1	3
9	23PBG201	Principles of Plant Breeding	2+1	3
		Total	14+9	23
12.	23 NSS/ NCC 101	NSS or NCC	0+1#	1#
13.	23 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

Semester V

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23FLG301	Principles of landscape architecture	1+1	2
2.	23HOR301	Crop production of vegetables or flowers or spices	0+1	1
3.	23HOR302	Breeding of vegetable , tuber and spice	2+1	3

		crops		
4.	23HOR303	Post Harvest Management of horticultural crops	1+1	2
5.	23AEC301	Horti business management	2+0	2
6.	23AEN301	Insect pest of vegetables, ornamental and spice crops	2+1	3
7.	23AGR301	Principles of Organic farming	1+1	2
8.	23ARM301	Entrepreneurship Development and Business Communication	1+1	2
9.	23PAT301	Diseases of vegetables, ornamental and spice crops	2+1	3
10.	23SAC301	Manures, Fertilizers and Soil Fertility Management	2+1	3
		Total	14+9	23

Semester VI

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23FLG302	Precision farming and Protected Cultivation	2+1	2
2.	23FLG303	Breeding and seed production of flower and ornamental plants	2+1	3
3.	23HOR304	Breeding of fruits and plantation crops	2+1	3
4.	23HOR305	Seed production of vegetable, tuber and spice crops	1+1	2
5.	23PSM301	Medicinal and aromatic crops	2+1	3
6.	23ABT301	Plant Biotechnology	2+1	3
7.	23AEN302	Apiculture, sericulture and lac culture	1+1	2
8.	23ENS301	Environmental Studies and Disaster Management	2+1	3
9.	23FSN301	Processing of horticulture crops	1+1	2
10.	23SAC302	Soil , water and plant analysis	0+1	1
		Total	15+10	25

Semester VII

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23 HOR 401	Rural Horticultural Work Experience and – Agro Industrial Attachment (RHWE& AIA)	0+20	20
2.	23 HOR 401	Project Work	0+1	1
3.	23 HOR 402	All India Study Tour*	0+1*	1*
		Total	0+22	22

* Non- gradial Course

Semester VIII

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	23 ELP ***	Experiential Learning Programme I	0+10	10
2.	23 ELP ***	Experiential Learning Programme II	0+10	10
		Total	0+20	20

ABSTRACT

SNO	Semester	Credit
1	I	21+2*
2	II	23
3	III	23+1*
4	IV	23
5	V	23
6	VI	25
7	VII	22+1*
8	VIII	20
	Total	180+4*

* Non- gradial Course

School of Agricultural Sciences
B.Sc. (Hons) Agriculture (Batch 2022) Curriculum

Department wise distribution of courses

Course Code	Department / Discipline	Number of courses	Credit Hours	Total Credits
Agronomy		11	9+9	18
22 AGR 101	Fundamentals of Agronomy and Agricultural Heritage		2+1	3
22 AGR 102	Introductory Agro-Meteorology and Climate Change		1+1	2
22 AGR 201	Crop Production Technology- I (Kharif Crops)		1+1	2
22 AGR 202	Principles of Weed Management		1+1	2
22 AGR 204	Crop Production Technology- II (Rabi Crops)		1+1	2
22 AGR 205	Rainfed Agriculture and Watershed Management		1+1	2
22 AGR 301	Practical Crop Production- I (Kharif Crops)		0+1	1
22 AGR 302	Farming System and Sustainable Agriculture		1+0	1
22 AGR 303	Practical Crop Production- II (Rabi Crops)		0+1	1
22 AGR 304	Principles of Organic Farming		1+1	2
Genetics and Plant Breeding		4	7+4	11
22 PBG 101	Introduction to Agricultural Botany		1+1	2
22 PBG 201	Fundamentals of Genetics		2+1	3
22 PBG 301	Fundamentals of Plant Breeding		2+1	3
22 PBG 302	Crop Improvement		2+1	3
Seed Science and Technology		1	2+1	3
22 SST 201	Principles of Seed Technology		2+1	3
Soil Science and Agricultural Chemistry		3	6+2	8
22 SAC 101	Fundamentals of Soil Science		2+1	3
22 SAC 201	Problematic soils and their Management		2+0	2
22 SAC 301	Manures, Fertilizers and Soil Fertility Management		2+1	3
Agricultural Entomology		3	6+3	9
22 AEN 201	Fundamentals of Entomology		2+1	3
22 AEN 202	Management of Beneficial and Harmful Insects		2+1	3
22 AEN 301	Pests of Crops and Stored Grain and their Management		2+1	3
Agricultural Social Sciences		9	14+6	20
22 AEC 101	Fundamentals of Agricultural Economics		2+0	2
22 AEC 201	Farm Management, Production and Resource Economics		1+1	2
22 AEC 301	Agricultural Marketing Trade and Prices		2+1	3
22 AEC 302	Agricultural Finance and Co- operation		2+1	3
22 AEC303	Intellectual Property Rights		1+0	1
22 AEX 101	Rural Sociology and Educational Psychology		2+0	2
22 AEX 102	Fundamentals of Agricultural Extension Education		2+1	3
22 AEX 201	Communication Skills and Personality Development		1+1	2
22 ARM 301	Entrepreneurship Development and Business Communication		1+1	2
Allied Courses		4	5+3	8
22 LAN 101	Comprehension and Communication Skills in English		1+1	2
22 MAT 111	Elementary Mathematics		2+0	2
22 STA 211	Statistical Methods		1+1	2

22 COM 211	Agri-informatics	1+1	2	
Agricultural Engineering		4	5+4	9
22 SWE 111	Soil and Water Conservation Engineering	2+1	3	
22 FMP 211	Farm Machinery and Power	1+1	2	
22 ERG 211	Renewable Energy and Green Technology	1+1	2	
22 APE 311	Protected Cultivation and Secondary Agriculture	1+1	2	
Horticulture		5	5+5	10
22 HOR 111	Fundamentals of Horticulture	1+1	2	
22 HOR112	Production Technology for Vegetables and Spices	1+1	2	
22 HOR 211	Production Technology for Fruit and Plantation Crops	1+1	2	
22 HOR 212	Production Technology for Ornamental Crops, MAP and Landscaping	1+1	2	
22 HOR 311	Post Harvest Management and Value Addition of Fruits and Vegetables	1+1	2	
Plant Pathology		4	7+4	11
22 PAT 201	Fundamentals of Plant Pathology	2+1	3	
22 PAT 202	Principles of Plant Disease Management	1+1	2	
22 PAT 301	Diseases of Field and Horticultural Crops and their Management I	2+1	3	
22 PAT 302	Diseases of Field and Horticultural Crops and their Management II	2+1	3	
Food Science and Technology		1	1+1	2
22 FSN 111	Principles of Food Science and Nutrition	1+1	2	
Supplementary Courses		7	11+7	18
22 BIC 101	Fundamentals of Plant Biochemistry	1+1	2	
22 CRP 101	Fundamentals of Crop Physiology	2+1	3	
22 AGM 101	Fundamentals of Microbiology	2+1	3	
22 FOR 111	Introduction to Forestry	1+1	2	
22 ENS 301	Environmental Studies and Disaster Management	2+1	3	
22 ABT 301	Plant Biotechnology	2+1	3	
22 RSG 301	Geo-informatics, Nanotechnology and Precision Farming	1+1	2	
Animal Production		1	2+1	3
22 AMP 201	Livestock and Poultry Management	2+1	3	
Elective Courses		3	6+3	9
22 ELC ***	Elective Courses I	2+1	3	
22 ELC ***	Elective Course II	2+1	3	
22 ELC ***	Elective Course III	2+1	3	
TOTAL		58	86+53	141
Student READY		4	0+41	41
22 AEX 401	Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE& AIA)	0+20	20	
22 ELP ***	Experiential Learning Programme I	0+10	10	
22 ELP ***	Experiential Learning Programme II	0+10	10	
22 AGR 401	Project Work	0+1	1	
Non- Gradial Courses*		4	0+4*	4*
22 NSS/ NCC 101	NSS or NCC	0+1	1	
22 PED 101	Physical Education and Yoga Practices	0+1	1	

22 AGR 203	Study Tour	0+1	1
22 AEX 402	All India Study Tour	0+1	1
TOTAL		8	0+45
Grand Total		67	86+94+4*

ELECTIVE COURSES

S. No	Course Code	Course Title	Credit Hours	Total Credits	Semester
Elective Course I					
1	22 ELC 201	Agricultural Journalism	2+1	3	IV
2	22 ELC 202	Food Safety and Standards	2+1	3	IV
3	22 ELC 203	Hi-tech Horticulture	2+1	3	IV
Elective Course II					
1	22 ELC 301	Bio Pesticides and Bio Fertilizers	2+1	3	V
2	22 ELC 302	Agribusiness Management	2+1	3	V
3	22 ELC 303	Micro Propagation Technologies	2+1	3	V
Elective Course III					
1	22 ELC 304	Commercial Plant Breeding	2+1	3	VI
2	22 ELC 305	Agrochemicals	2+1	3	VI
3	22 ELC 306	Landscaping	2+1	3	VI

Semester wise distribution of courses

Semester I

S. No	Course Code	Course Title	Credit Hours	Total Credits
12.	22 AGR 101	Fundamentals of Agronomy and Agricultural Heritage	2+1	3
13.	22 SAC 101	Fundamentals of Soil Science	2+1	3
14.	22 HOR 111	Fundamentals of Horticulture	1+1	2
15.	22 AEX 101	Rural Sociology and Educational Psychology	2+0	2
16.	22 BIC 101	Fundamentals of Plant Biochemistry	1+1	2
17.	22 FOR 111	Introduction to Forestry	1+1	2
18.	22 LAN 101	Comprehension and Communication Skills in English	1+1	2
19.	22 PBG 101	Introduction to Agricultural Botany	1+1	2
20.	22 NSS/ NCC 101	NSS or NCC *	0+1*	1*
21.	22 PED 101	Physical Education and Yoga Practices*	0+1*	1*
		Total	11+9	20

*Non- gradial courses

Semester II

S. No	Course Code	Course Title	Credit Hours	Total Credits
12.	22 AGR 102	Introductory Agro-Meteorology and Climate Change	1+1	2
13.	22 AEC 101	Fundamentals of Agricultural Economics	2+0	2
14.	22 SWE 111	Soil and Water Conservation Engineering	2+1	3
15.	22 HOR 112	Production Technology for Vegetables and Spices	1+1	2
16.	22 FSN 111	Principles of Food Science and Nutrition	1+1	2
17.	22 AEX 102	Fundamentals of Agricultural Extension Education	2+1	3
18.	22 CRP 101	Fundamentals of Crop Physiology	2+1	3
19.	22 AGM 101	Fundamentals of Microbiology	2+1	3
20.	22 MAT 111	Elementary Mathematics	2+0	2
Total			15+7	22
21.	22 NSS/ NCC 101	NSS or NCC	0+1#	1#
22.	22 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

Semester III

S. No	Course Code	Course Title	Credit Hours	Total Credits
13.	22 AGR 201	Crop Production Technology I (Kharif Crops)	1+1	2
14.	22 AGR 202	Principles of Weed Management	1+1	2
15.	22 AEN 201	Fundamentals of Entomology	2+1	3
16.	22 PBG 201	Fundamentals of Genetics	2+1	3
17.	22 AEC 201	Farm Management, Production and Resource Economics	1+1	2
18.	22 FMP 211	Farm Machinery and Power	1+1	2
19.	22 HOR211	Production Technology for Fruit and Plantation Crops	1+1	2
20.	22 PAT 201	Fundamentals of Plant Pathology	2+1	3
21.	22 STA 211	Statistical Methods	1+1	2
22.	22 AMP 201	Livestock and Poultry Management	2+1	3
23.	22 AGR 203	Study Tour*	0+1*	1*
Total			14+11	25
24.	22 NSS/ NCC 101	NSS or NCC	0+1#	1#
25.	22 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV * Non- gradial Course

Semester IV

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	22 AGR 204	Crop Production Technology II (Rabi Crops)	1+1	2
2.	22 AGR 205	Rainfed Agriculture and Watershed Management	1+1	2
3.	22 COM 211	Agri-Informatics	1+1	2
4.	22 PBG 202	Fundamentals of Plant Breeding	2+1	3
5.	22 SAC 201	Problematic soils and their management	2+0	2
6.	22 AEN 202	Management of Beneficial and Harmful Insects	2+1	3
7.	22 ERG 211	Renewable Energy and Green Technology	1+1	2
8.	22 PAT 202	Principles of Plant Disease Management	1+1	2
9.	22 HOR 212	Production Technology for Ornamental Crops, MAP and Landscaping	1+1	2
10.	22 AEX 201	Communication Skills and Personality Development	1+1	2
11.	22 ELC ***	Elective Course I	2+1	3
Total			15+10	25
12.	22 NSS/ NCC 101	NSS or NCC	0+1#	1#
13.	22 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

Semester V

S. No	Course Code	Course Title	Credit Hours	Total Credits
11.	22 AGR 301	Practical Crop Production I (Kharif Crops)	0+1	1
12.	22 AGR 302	Farming System and Sustainable Agriculture	1+0	1
13.	22 SST 301	Principles of Seed Technology	2+1	3
14.	22 SAC 301	Manures, Fertilizers and Soil Fertility Management	2+1	3
15.	22 AEN 301	Pests of Crops and Stored Grain and their Management	2+1	3
16.	22 AEC 301	Agricultural Marketing Trade and Prices	2+1	3
17.	22 APE 311	Protected Cultivation and Secondary Agriculture	1+1	2
18.	22 PAT 301	Diseases of Field and Horticultural Crops and their Management I	2+1	3
19.	22 HOR 311	Post Harvest Management and Value Addition of Fruits and Vegetables	1+1	2
20.	22 ARM 301	Entrepreneurship Development and Business Communication	1+1	2
21.	22 ELC ***	Elective Course II	2+1	3
		Total	16+10	26

Semester VI

S. No	Course Code	Course Title	Credit Hours	Total Credits
11.	22 AGR 303	Practical Crop Production II (Rabi Crops)	0+1	1
12.	22 AGR 304	Principles of Organic farming	1+1	2
13.	22 PBG 302	Crop Improvement	2+1	3
14.	22 AEC 302	Agricultural Finance and Co-operation	2+1	3
15.	22 PAT 302	Diseases of Field and Horticultural Crops and their Management II	2+1	3
16.	22 ABT 301	Plant Biotechnology	2+1	3
17.	22 RSG 301	Geo-informatics, Nanotechnology and Precision Farming	1+1	2
18.	22 ARM 302	Intellectual Property Rights	1+0	1
19.	22 ENS 301	Environmental Studies and Disaster Management	2+1	3
20.	22 ELC ***	Elective Course III	2+1	3
		Total	15+9	24

Semester VII

S. No	Course Code	Course Title	Credit Hours	Total Credits
4.	22 AEX 401	Rural Agricultural Work Experience and Agro- Industrial Attachment (RAW& AIA)	0+20	20
5.	22 AGR 401	Project Work	0+1	1
6.	22 AEX 402	All India Study Tour*	0+1*	1*
		Total	0+22	22

* Non- gradial Course

Semester VIII

S. No	Course Code	Course Title	Credit Hours	Total Credits
3.	22 ELP ***	Experiential Learning Programme I	0+10	10
4.	22 ELP ***	Experiential Learning Programme II	0+10	10
		Total	0+20	20

U.G. Degree - B.Sc. Agriculture 2022 batch

I Semester courses

Semester I

S. No	Course Code	Course Title	Credit Hours	Total Credits
22.	22AGR101	Fundamentals of Agronomy and Agricultural Heritage	2+1	3
23.	22SAC101	Fundamentals of Soil Science	2+1	3
24.	22HOR111	Fundamentals of Horticulture	1+1	2
25.	22AEX101	Rural Sociology and Educational Psychology	2+0	2
26.	22BIC101	Fundamentals of Plant Biochemistry	1+1	2
27.	22FOR111	Introduction to Forestry	1+1	2
28.	22LAN101	Comprehension and Communication Skills in English	1+1	2
29.	22PBG101	Introduction to Agricultural Botany	1+1	2
30.	22 NSS/ NCC 101	NSS or NCC *	0+1*	1*
31.	22 PED 101	Physical Education and Yoga Practices*	0+1*	1*
		Total	11+9	20

*Non- gradial courses

22AGR101 FUNDAMENTALS OF AGRONOMY & AGRICULTURAL HERITAGE(2+ 1)

Course objectives

- To have a general understanding of the Agronomy, seasons, crop and its classification
- To appraise the students about crops, planting/sowing, growth and factors influencing growth and crop nutrition and its general management
- To study the impact of weeds on crop production and its management

Course outcomes

- Basics of crop characteristics and its classifications understood
- Fundamentals of growth, factors influencing and its relationship with nutrients studied
- Scientific knowledge on weeds its impacts on crop growth and the Integrated weed management studied

Theory

Unit - I: Importance of agriculture

Agriculture - Definition - Importance and scope - Branches of agriculture - Evolution of human and agriculture - History of agricultural development in the World and India.

Unit - II: Agricultural heritage

Agriculture heritage - Agriculture in ancient India - Chronological agricultural technology development in India - Kautilya's Arthashastra - Sangam literature - Kambar Eazhupathu - Development of scientific Agriculture - National and International Agricultural Research Institutes in India - Indian agriculture.

Unit - III: Agroclimatic zones, crops and soils

Agronomy - Definition - Importance and scope - Agro-climatic zones of Tamil Nadu - Agro ecological zones of India - Crops and their classification - Economic and agronomic - Major crops of India and Tamil Nadu - Major soils of Tamil Nadu - Factors affecting crop production - climatic - edaphic - biotic - physiographic and socio economic factors.

Unit - IV: Tillage and after cultivation

Tillage - Definition - Types - Objectives - Modern concepts of tillage - Main field preparations - Seeds - seed rate - sowing methods - Crop establishment methods - Planting geometry and its effect on growth and yield - After cultivation - Thinning - Gap filling - Weeds - Definition - Weed control methods.

Unit - V: Cropping and farming systems

Manures and fertilizers (organic, in-organic, green manure) - time and method of application - Irrigation

- Principles and concepts - Cropping patterns and cropping systems - Sustainable agriculture - integrated farming systems - Organic agriculture - Principles and concepts - Dry farming - Principles and concepts.

Text books

1. Sankaran, S. and Subbiah Mudaliar, V.T. 1991. Principles of Agronomy. Bangalore, Printing & Publishing Co., Bangalore
2. Chandrasekaran. B, Annadurai. K and Somasundaram. E. A textbook of agronomy 2010 reprint 2016. New international (P) limited, publishers, New Delhi

References

1. Reddy. T.Y and Reddy, G.H.S. 1995. Principles of Agronomy, Kalyani Publishers, Ludhiana.
2. Balasubramanian, P and Palaniappan, S.P. 2001. Principles and Practices of Agronomy. AgroBios (India) Ltd., Jodhpur.
3. De, G.C. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi.
4. Gupta, O.P. 2000. Weed Management - Principles and Practices. Agrobios (India) Ltd., Jodhpur
5. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7th ed.). Pearson Education, Delhi.
6. Rao, V.S. 2000. Principles of Weed science. Oxford & IBH Publishing Co. New Delhi.

22SAC101 FUNDAMENTALS OF SOIL SCIENCE (2 + 1)

Course Objectives:

- To impart knowledge about the soil forming process.
- To learn about physical properties of soil.
- To have a general understanding on soil chemical properties reactions.
- To study the impacts of soil pollution and the remediation measures.

Course Outcomes:

- Knowledge gained about the soil forming process.
- Physical properties of soil studied.
- Various soil chemical properties and reactions understood.
- Impact of soil pollution and remediation measures learnt.

Theory

Unit I

Soil as a natural body, Pedological and edaphological concepts of soil. Components of soil. Soil genesis: Composition of Earth's crust- soil forming rocks and minerals – Primary and secondary minerals. Weathering of rocks and minerals. Factors of soil formation. Soil forming processes. Soil Profile.

Unit II

Soil physical properties: Soil texture, structure, density and porosity, soil colour, consistence and plasticity. Soil water retention, movement and availability. Soil air, composition, gaseous exchange-problem and its effect on crop growth. Source, amount and flow of heat in soil, Soil temperature and crop growth.

Unit III

Soil physico chemical and chemical properties: Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability. Electrical conductivity. Soil colloids - inorganic and organic. Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation.

Unit IV

Soil organic matter: composition, properties and its influence on soil properties. Humic substances - nature and properties. Soil Biology: Soil organisms : macro and micro organisms, their beneficial and harmful effects. Soil enzymes. Soil pollution – Types and behaviour of pesticides. Inorganic contaminants. Prevention and mitigation of soil pollution.

Text books

1. Das, D.K. 1997. Introductory Soil Science. Kalyani Publishers New Delhi

References

1. Biswas, T.D. and Mukherjee, S.K. 1987. Text Book of Soil Science. Tata McGraw Hill Publishing Co., New Delhi
2. Black, C.A. 1982. Methods of Soil Analysis, Part I ASA, Madison, USA.
3. Brady, N.C. and Raymond, C.Weil. 2013. The Nature and Properties of Soils (14th Edition). Pearson Education, Inc. Publishing as Prentice Hall.

22HOR111 FUNDAMENTALS OF HORTICULTURE (1 + 1)

Course Objectives

- To study the basics of horticulture and horticultural practices
- To expose the students to different horticulture divisions
- To impart knowledge on different types of plant propagation and propagating structures

Course Outcome

- Basics of horticulture and classification of crops learned
- Different types of plant propagation techniques and propagating structures studied
- Gain practical knowledge in special horticultural practices

Theory

Unit I

History, evolution and scope of horticulture

Origin of horticulture – history – evolution – definitions – scope and importance of horticulture – division and classification of horticultural crops – fruits, vegetables, spices and plantation crops, floriculture, landscaping, ornamental gardening, medicinal and aromatic crops – nutritive value and global and national scenario of horticultural crops.

Unit II

Sexual propagation

Sexual propagation – importance, advantages and disadvantages – methods of enhancement of seed viability – types of dormancy – seed invigoration – seed treatments

Unit III

Asexual propagation

Asexual propagation, importance, advantages and disadvantages - Asexual propagation types viz., Types of cutting, layering, grafting and budding. Use of specialized plant parts in propagation. Propagation structures and their role. Rootstock influence – stock / scion relationship in fruit crops. Scope and importance of micro propagation in horticultural crops. Direct and indirect organogenesis – media for micro propagation and hardening.

Unit IV

Planting systems and pollination

Principles of orchard establishment - Methods of planting systems including HDP and UHDP in horticultural crops – crop regulatory practices for horticultural crops – training, pruning, special operations in horticultural crops – off season production of horticultural crops. Flowering,

pollination, fruit set, fruit drop, parthenocarpy, fruit ripening and senescence – Unfruitfulness and its causes.

Unit V

Principles and types of garden

Principles and types of garden – principles and types of parks – principles of herbal garden

Text books

1. Jitendra Singh, 2004. Basic of horticulture. Kalyani publishers, Ludhiana.
2. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil, TamilNadu.

References

1. Sadhu, M.K.1989. Plant Propagation. Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi- 110 002. Bose, T.K., S.K. Mitra, M. K. Sadhu and B. Mitra. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prakash 206, Bidhan Sarani, Calcutta-6, India. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 1997. Plant Propagation - Principles and Practices. Prentice Hall of India Private Ltd., New Delhi. Nanda, K.K and V.K. Kochhar. 1995. Vegetative Propagation of Plants. Kalyani Publishers, Ludhiana.
2. George Acquaah, 2002. Horticulture – principles and practices. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Hartman, H.T. and Kester, D.E. 1986. Plant propagation – Principles and Practices – Prentice Hall of India Ltd., New Delhi.
4. Jules Janick. 1979. Horticultural Science. Surjeet Publications. New Delhi.

22AEX101 RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY (2+ 0)

Course objectives

- To get an idea of sociological behaviour of rural population
- To familiarize the functions of rural society social stratification and social changes
- To understand the behaviour pattern and theories of motivation

Course outcomes

- Students learnt the rural society and their behaviour pattern
- Students gained the practical knowledge of functions of social institution
- Familiarize the concept of agricultural extension practices

Theory

Unit I

Introduction to Sociology, Social groups, Culture and Social Values

Sociology and Rural Sociology – definitions; Society – rural and urban, characteristics, differences and relationships, important characteristics of Indian rural society; Social groups – definition, classification, role of social groups in extension; Culture – concept, cultural traits, characteristics, functions, Ethnocentrism, Acculturation, Cultural lag, Cultural diffusion, Marginal man, Ethos. Social Values – definition, values and norms, characteristics of values, functions;

Unit II

Social Structure, Social Stratification and Migration

Structure of Rural Society – patterns of rural settlement, social institutions, social organizations, ecological entities (Region, Community, Neighbourhood, Family); Social Stratification – concept, functions, types, differences between class and caste system; Migration – concept, factors influencing migration.

Unit III

Social Control, Social Customs

Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos; Social Interaction Process – definition, basic social processes; Social Change – concept, factors influencing social change, indicators of social change; Social development:

Unit IV

Introduction to Educational Psychology, Intelligence, Teaching-Learning Process

Education – Psychology – Educational Psychology – Social Psychology – definitions, importance in extension; Basic principles of Human behaviour – Sensation, Attention, Cognitive,

affective, psychomotor domain Perception – meaning, characteristics; Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, measurement, factors influencing personality; Teaching–Learning Process – Teaching – definition, meaning, principles of teaching, steps in extension teaching; Learning – definition, meaning, principles, types of learning, learning situation.

Unit V

Motivation, Attitude

Motivation – concept, Maslow’s hierarchy of needs, intrinsic and extrinsic motivation, techniques of motivation, importance in extension; Attitude – concept, factors influencing the development of attitudes.

Text books

1. Chauhan, S.S. 2001. Advanced Educational Psychology, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Chitambar, J.B.1997. Introductory Rural Sociology, New Age International (P) Ltd., Publishers, New Delhi.

References

1. Adivi Reddy, A. 2001. Extension Education, Sree Lakshmi Press, Bapatla, Andhra Pradesh. Chatterjee, S. 2000. Advanced Educational Psychology, Books & Allied (P) Ltd., Calcutta.
2. Dahama, O.P. and O.P. Bhatnagar. 2007. Education and Communication for Development, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Kundu, C.L and Tutoo, D.N. 2001. Educational Psychology, Sterling Publishers Pvt. Ltd., New Delhi.
4. Lester Crow, D and Alice Crow. 1973. Educational Psychology, Eurasia Publishing House Pvt. Ltd.,
5. New Delhi.
6. Madumita Gupta. 2011. Fundamentals of Sociology, Pacific Publications, New Delhi. Mangal, S.K. 2000. Educational Psychology, Prakash Brothers, Ludhiana.
7. Shankar Rao, C.N. 2012. Sociology – Principles of Sociology with an Introduction to Social Thought, S.Chand & Co. Ltd., New Delhi.
8. Sharma, R.N. 1968. Principles of Sociology, Asia Publishing House, New Delhi.
9. Supe. S.V. 2012. Text book of Extension Education, Agrotech Publishing Academy, Udaipur. Usha Rao. 2008. Advanced Educational Psychology, Himalaya Publishing House, New Delhi.
10. Vidya Bhushan and Sachdeva, D.R. 2003. An Introduction to Sociology, Kitab Mahal, Allahabad.

22BIC101 Fundamentals of Biochemistry (1+1)

Theory

Unit I: Carbohydrates

Carbohydrates - occurrence and classification. Structure of monosaccharides, oligosaccharides and polysaccharides. Physical and chemical properties of carbohydrates – optical isomerism, optical activity, mutarotation, reducing property, reaction with acids and alkalies.

Unit II: Lipids

Lipids - occurrence and classification. Storage lipids - Fatty acids and triacyl glycerol. Essential fatty acids and phospholipids - types and importance; Sterols - basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

Unit III: Proteins

Amino acids - Classification and properties, essential amino acids. Importance and classification of proteins based on functions and solubility. Structure of proteins. Properties and reactions of proteins.

Unit IV: Enzymes

Enzymes - Properties, classification and nomenclature. Coenzymes, cofactors and isoenzyme Mechanism of enzyme action. Factors affecting enzyme activity. Allosteric enzymes.

Unit V: Nucleic acids

Nucleic acids: Function, classification, structure, replication, transcription and translation.

References:

1. Berg JM, Tymoczko JL and Stryer L, (2007), Biochemistry, 7th Ed. Wiley Eastern Ltd.ISBN:0-7167-8724-5.
2. Thayumanavan, B, Krishnaveni, S and Parvathi, K, (2004), Biochemistry for Agricultural Sciences, Galgotia Publications Pvt Ltd., New Delhi. ISBN :81-7515-459-4.
3. Lehninger, Nelson, D. L. and Michael, M. C. 2004. Principles of Biochemistry. Freeman Publishers.
4. Rameshwar, A. 2006. (3rd edit). Practical Biochemistry. Kalyani Publishers, New Delhi.
5. Sadasivam, S and Manickam, A. 1996. Biochemical methods for Agricultural sciences. Newage International publishers, New Delhi.

E-References:

1. Cox, MM and Nelson, DL. (2011), Principles of Biochemistry, Fourth (Indian edition) Macmillan, Worth Publishers. <http://bcs.whfreeman.com/lehninger6e> - Web links/ Tutorials/ Lecture companion Art
2. Harper's illustrated Biochemistry -<https://freemedbooks.files.wordpress.com/2014/01/harpers-illustrated-biochemistry-28th-edition.pdf>
3. J M Berg, J L Tymoczko and L Stryer , Biochemistry, Sixth Edition - <http://www.irb.hr/users/precali/Znanost.o.Moru/Biokemija/Literatura/Lubert%20Stryer%20-%20Biochemistry.pdf>
4. Sadasivam, S and Manickam, A. (2009), Biochemical Methods, 3rd Edn, New Age International.
5. Wilson, K. and Walker, J.M. (2000), Principles and techniques of Practical Biochemistry,

5thEdn. – Cambridge University Press.

6. www.ncbi.nlm.nih.gov

22FOR 111 INTRODUCTION TO FORESTRY (1 + 1)

Course objectives

- To study the importance of forest and agroforestry systems in sustaining the land productivity
- To understand the crop tree interactions in different types of agroforestry systems
- To get an idea of the productive and protective functions of agroforestry

Course outcome

- Students learnt about the concepts of agroforestry practiced in various agro ecosystems
- Basic understanding of the multipurpose trees in agroforestry systems
- Beneficial effects of agro forestry such as nitrogen fixing, soil conservation, litter dynamics and nutrient cycles will be studied

Theory

UNIT I

Forest and Forestry

Introduction - Definition of Forest and Forestry - Role of Forest (Production, Protection and Amelioration) - Classification of Forest (Regeneration, Age, Composition, ownership, object of management, growing stock) - National Forest Policy 1988.

UNIT II

Silviculture and Forest plantation

Forest regeneration - Natural regeneration- Seeds and vegetative parts (Coppice, Root suckers) - Artificial regeneration, Objectives - Nurseries - Types of nurseries, Quality seedling production techniques - Silvicultural practices for *Eucalyptus spp*, *Casuarina equisetifolia*, *Tectona grandis*, *Ailanthus excelsa*, *Melia dubia*, *Leucaena leucocephala*. Tending operations - Weeding, Cleaning, Thinning and pruning.

UNIT III

Forest Mensuration

Forest Mensuration - Objectives- Diameter measurements, instruments used in diameter measurement-Height measurement, instrumental methods of height measurement - Tree form, form factor, Volume estimation of standing and felled trees.

UNIT IV

Social forestry and Agroforestry

Social Forestry and its branches - Extension Forestry, Urban forestry - Agroforestry, definition-Importance- Agroforestry systems - Shifting Cultivation, Taungya, Alley cropping, Wind break,

Shelter belt, Home garden - Tree and crop combination in Agroforestry - Tree crop interaction in Agroforestry - National Agroforestry Policy 2014.

UNIT V

Forest Utilization

Forest Utilization - Definition - Wood products - solid wood and composite wood.- Non Wood Forest Products - fibres , floss, bamboo, tan, dye, resin, oleoresin.

Text books

1. Puri, S and Panwar, P. (ed.). 2007. Agroforestry Systems and Practices. New India Publishing Agency, New Delhi, 643p

References

2. Gupta, R.K. 1993. Multipurpose Trees for Agroforestry and Wasteland Utilization. Oxford and IBH, 562p
3. Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwere Academic Publications, Dordrecht, The Netherlands, 499p

22LAN101 COMPREHENSION & COMMUNICATION SKILLS IN ENGLISH (1 +1)

Theory

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science
Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B.
Shaw. 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. Functional grammar:
Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct
and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing
and Proposal writing. The Style: Importance of professional writing. Preparation of
Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance
and process.

Text books

1. Sundararajan, N, Attentive Listening: How it Matters, University News, March 19-25, 2005.
2. Greenbaum Sidney, Oxford English Grammar, New Delhi, Oxford University Press. Peregoy, 2009.

References

1. Goodale, Malcolm, Professional Presentations, Cambridge University, 2005.
2. Jones Daniel, English Pronouncing Dictionary, Cambridge University Press, 2006.
3. Lynch, Tony and Kenneth Anderson, Study Speaking, Cambridge University, 1992.
4. Martin Cutts, Oxford Guide to Plain English, Oxford University Press, 2004.
5. Sahaneya Wandy, et.al., IELTS, Preparation and Practice, Oxford University, 2005.

22PBG101 INTRODUCTION TO AGRICULTURAL BIOLOGY (1 + 1)

Course objectives

- To have a general understanding of the botanical names, crops and its systematic classification
- To appraise the students about crops, botanical importance and their floral parts
- To study the economic important parts of agricultural plants

Course outcomes

- Basics of crop characteristics and its classifications understood
- Fundamentals of growth, factors influencing and its relationship with nutrients studied

Scientific knowledge on weeds its impacts on crop growth and the Integrated weed management studied

Theory

Unit I

Systems of classification and general morphological description

Bentham and Hooker's classification of plant kingdom — International code of nomenclature and its major guidelines – author citation – Agricultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

Unit II

Botanical description and economic uses of Poaceae

List of cultivated crops, economic parts, chromosome number and family description of Poaceae: Key botanical features of Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, Cenchrus and Sugarcane

Unit III

Botanical description and economic uses of Papilionaceae

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram, Green gram, Cowpea, Lablab, Horse gram, Groundnut, Lucerne, Stylosanthes, Clitoria, Agathi and Sunnhemp

Unit IV

Botanical description and economic uses of Pedaliaceae, Asteraceae, Oleaceae, Brassicaceae, Euphorbiaceae, Arecaceae and Malvaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Pedaliaceae - Gingelly; Asteraceae - Sunflower, Safflower, Chrysanthemum; Oleaceae – Jasmine; Brassicaceae - Rapeseed and Mustard, Cabbage, Cauliflower; Euphorbiaceae: Castor; Jatropha and Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm, Sugarpalm; Malvaceae: Cotton, Mesta and Bhendi.

Unit V

Botanical description and economic uses of Tiliaceae, Piperaceae, Chenopodiaceae, Solanaceae, Mimosae, Moraceae, Cucurbitaceae, Alliaceae, Musaceae, Rubiaceae, Theaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and key botanical features of the crops given against them. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet; Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul and Acacia; Moraceae: Mulberry; Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic; Musaceae: Banana, Manila hemp; Rubiaceae: Coffee; Theaceae: Tea

Text books

1. Sambamurthy, V.S. and N.S. Subramanian, 1989. Text Book of Economic Botany, Wiley Eastern, New Delhi
2. John Joel, A., C. Vanniarajan, T.S. Raveendran, and A. Gopalan 2006. Fundamentals of Crop Botany, Directorate of ODL, Tamil Nadu Agricultural University, Coimbatore-641 003.

References

1. Purse glow, 1988. Tropical Crops - Monocotyledons. The English Language book Society and Longman Co., Singapore
2. Albert F. Hill and O.P. Sharma, 1996. Economic Botany. Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
3. Daniel Sundararaj, D. and G. Thulasidas, 1993. Botany of field crops. MacMillan India Ltd., New Delhi.

22NSS/NCC 101 (0 + 1) ** (non gradial)

NATIONAL SERVICE SCHEME NSS

I Year

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – Women and child welfare – Education for all – National days – Commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

II Year

Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities – National days – commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers day, Sports meet and other University / College functions.

NSS Volunteers will attend one special camp in the selected village for a duration of 10 days and undertake various activities based on the need of that village.

For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance). Special camp activity will be conducted in a village situated within a radius of 15 – 20 KM.

Evaluation

A. Regular activities

60 marks	= I Semester	15 marks
	II Semester	15 marks
	III Semester	15 marks
	IV Semester	15 marks

(Written test 10 marks – participation in programmes and behavior 5 marks) 80% attendance is mandatory for attending special camp

B. Special camp activities

- a. Attendance in daily activities during special camp: 30 marks
- b. Special camp activity report : 5 marks
- c. Viva-voce on the 10th day of special camp : 5 marks

Total : 40 marks

NATIONAL CADET CORPS NCC

I Year

General - Military History – Introduction to NCC – Aims of NCC – Principles of NCC, NCC organization, Duties of good citizen – system of NCC training – Foot drill – Arms drill – Guard of Honour – Ceremonial Drill – Weapon training – First aid – Rifle and Light machine gun – Map reading – Civil defence – Leadership.

II Year

Drill – Weapon drill – Weapon training and firing – Introduction to National Integration – Historical – geographical – Religions back ground of India – Health and Sanitation – Aid to Civil Authorities – Civil defence – Ecology / Nature awareness – Map reading – Social service – Adventure Activities – Leadership qualities.

Besides the above schedule, NCC cadets will be involved during important occasions during convocation, Independence day, Republic day, etc.

Evaluation:

		Sem I	Sem II	Sem III	Sem IV	Total
A.	Regular activities and Behaviour	10	10	10	10	40
B.	Participation in camps and special assignments	5	5	5	5	20
C.	Written test and viva	10	10	10	10	40
	Total	25	25	25	25	100

22PED101 PHYSICAL EDUCATION AND YOGA PRACTICES (0 + 1)(non gradial)

Practical

(17 Practical classes – 2½ hours each class – 17 classes will be converted into 40 practical hours and 2½ hours for evaluation)

I Semester (20 Hours)

Exercises for strength, agility, co-ordination, flexibility, co-operation, vital capacity endurance, speed and for various systems of our body and team spirit.

Exercise for Good Posture – Conditioning and calisthenics for various Athletic activities *i.e* (a) Before start – Arm stretch, hand stretch and cat stretch (b) Loosening up jogging, bending and twisting (c) Standing – Lateral Arc, triangle and hands to feet pose (d) Sitting – camel kneel, spinal twist and supine knee bend (e) Relaxation – The corpse pose, quick and deep relaxation. Basic gymnastic exercises – participation of athletic events – running, throwing and jumping events.

Skill development in anyone of the following games

Warming up, suitable exercise, lead up games, advance skill for all the games.

Basket Ball : Dribbling, pass, two or three men pass, pivot, lay up shot, shooting, pass break, hook pass, screening, positional play, defence and offence tactics.

Volley Ball : Fingering, under arm pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementary dive, flying dive, roll, blocking and various types of services.

Ball Badminton : Grip, service, foot work, fore hand stroke, back hand stroke, lob, smash, volley, wall practice, spin service and defence tactics.

Foot ball : Dribbling, passing, dodging, kicking, heading, screening, chest pass, throwing, dragging, goal kick, defence and offence tactics.

Hockey : Grip, bully, dribbling, hitting, drive, push strokes, scoop, flick, stopping, various types of passes, dodging, defence and offence tactics.

Kho-Kho : Quadra ped, bi-ped, how to given kho, taking a direction, recede, parallel toe method, bullet tow method, distal method, foot out, dive, ring game, chains and pursue and defence skills.

Chess : Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation.

Kabaddi : Raid, touch, cant, catch, struggle, various types of defence and offence tactics.

Cricket : Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.

Tennis : Grip, forehand drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics.

Table Tennis : Grip, tossing and serving, spin serve, rally, smash, flick, defence and offence tactics.

Shuttle Badminton : Grip, foot work, service, setting, smash, volley, forehand and back hand stroke, back hand serve and defence.

Gymnastics : Balanced walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

ATHLETICS

- Sprint : Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.
- Jumps : Western roll, belly roll, eastern cut off, fass ferry flop, approach, take off, straddle, hitch-kick, handging, clearance, landing, strides etc.
- Throws : Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method pary obraine, discoput, rotation, carry and glide.
- Hurdles : Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

Lead up games, advance skills and game for any one of the above games.

II Semester (20+ 2 ½ hours)

Rules and regulations of anyone of the games and athletic events.

Aims and objectiaves of yoga – asanas : ie. padmasana, pujankasana, sarvangasana, chakrasana, dhanurasana, halasana, mayurasana and savasana, asanas for ailments, back pain, arthritis, abdominal problems, stress, fatiguel, Insomnia, obsity, circulation, hypertension, varicose veins, respiration, heart, digenstion, headaches, depression, addiction and eye problems.

Mental balance and importance – development of concentration suriyanamaskar – advance skills of any one of the games which were taught in the I semester.

METHOD OF EVALUATION:

a.	Attendance	60 Marks
b.	Behavior	10 Marks

c.	Participation in Sports and Games	20 Marks
d.	Final <i>Viva Voce</i>	10 Marks

Marks will be awarded at the end of the IV Semester based on the above method of evaluation procedure. Final class grade chart of each student will be sent to the Dean of Agricultural Sciences, DSU.

2022 Batch

II Semester courses

Semester II

S. No	Course Code	Course Title	Credit Hours	Total Credits
23.	22 AGR 102	Introductory Agro-Meteorology and Climate Change	1+1	2
24.	22 AEC 101	Fundamentals of Agricultural Economics	2+0	2
25.	22 SWE 111	Soil and Water Conservation Engineering	2+1	3
26.	22 HOR 112	Production Technology for Vegetables and Spices	1+1	2
27.	22 FSN 111	Principles of Food Science and Nutrition	1+1	2
28.	22 AEX 102	Fundamentals of Agricultural Extension Education	2+1	3
29.	22 CRP 101	Fundamentals of Crop Physiology	2+1	3
30.	22 AGM 101	Fundamentals of Microbiology	2+1	3
31.	22 MAT 111	Elementary Mathematics	2+0	2
Total			15+7	22
32.	22 NSS/ NCC 101	NSS or NCC	0+1#	1#
33.	22 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

22 AGR 102 INTRODUCTORY AGRO-METEOROLOGY & CLIMATE CHANGE (1+1)

Course objectives:

- Explain the importance of agro-meteorology and its uses in agricultural field
- Discuss about climate change and its impact on agriculture.
- Illustrate the relationship between crop and weather to predict various crop yields

Course outcome: Upon completion students will be able to

- Appreciate the importance of weather variables in agriculture
- Comprehend the role solar radiation in crop growth

- Analyze various forms of precipitation
- Interpret the role of weather hazards and climate change in crop growth
- Understand the correlation between weather and agriculture
- Measure weather parameters essential for crop growth

Theory

Unit I- Climate and weather

Meteorology - Agricultural Meteorology - Importance and scope in crop production - Coordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere (stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu and climatic characteristics of India.

Unit II- Solar radiation, RH and Wind

Solar radiation - Light intensity, quality, direction and duration - Air and Soil temperature - Diurnal variation - importance in crop production. Heat unit and its importance in agriculture. Relative Humidity and its importance - vapor pressure deficit and its importance - Wind and its effect on crops.

Unit III- Atmospheric pressure and precipitation

Atmospheric pressure - cyclones, anticyclones, tornado, hurricane and storms - Wind systems of the world -. Clouds - types and their classification. Precipitation - forms - monsoon - Seasons of India- rainfall variability drought, flood and their effect - Cloud seeding - Evaporation - transpiration - Evapotranspiration - PET.

Unit IV- Agroclimatic zones and remote sensing

Agro climatic Zones of India and Tamil Nadu - Agro climatic normals - Weather forecasting - synoptic chart - crop weather calendar - Remote sensing - Impact of climate and weather on crop production and pest and diseases.

Unit V- Climate change

Climate change- climate variability - definition and causes of climate change - Impact of climate change on Agriculture.

Practical:

Site selection and layout for Agromet Observatory and calculation of local time. Measurements of solar radiation, sunshine hours, air and soil temperature, grass minimum thermometer, humidity wind direction and wind speed, atmospheric pressure, rainfall, evaporation . Heat Unit concept. Probability analysis of rainfall for crop planning. Synoptic charts and weather calendars. Length of growing periods using weekly rainfall data. Water

balance studies. Identification of efficient cropping zone- RYI, RSI. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.

Lecture schedule

1. Meteorology - Agricultural Meteorology - Definition, their importance and scope in crop production.
2. Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
3. Climate and weather - Factors affecting climate and weather. Macroclimate - Meso climate - Microclimate - Definition and their importance - Different climates of India and Tamil Nadu and their characterization.
4. Solar radiation - Radiation balance - Wave length characteristics and their effect on crop production - Light - effect of intensity, quality, direction and duration on crop production.
5. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature - Isotherm, Heat unit and its use - Heat and cold injuries.
6. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
7. Humidity - Types - Dew point temperature - Vapour pressure deficit - Diurnal variation in Relative humidity and its effect on crop production - Wind and its role on crop production.
8. Atmospheric pressure, diurnal and seasonal variation - Isobar – cyclone, hurricane, tornado and storms.
9. **Mid Semester Examination.**
10. Wind systems of the world - wind speed in different seasons -. Clouds and their classification - Concepts of cloud seeding - present status.
11. Precipitation - Forms of precipitation - Isohyte - Monsoon - Different monsoons of India - Rainfall variability - Drought and flood - Impact on crop production.
12. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration - Definition and their importance in agricultural production. Agroclimatic zones of Tamil Nadu - Agroclimatic normals for field crops.
13. Weather forecasting - Types, importance, Agro Advisory Services - Synoptic chart - Crop weather calendar.
14. Remote sensing and its application in agriculture.
15. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.
16. Climate change, climate variability - definition and causes of climate change.
17. Impact of climate change on Agriculture.

Practical schedule

1. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements.
2. Measurements of solar radiation (pyranometers), sunshine hours (sunshine recorder) - working out weekly and monthly mean for graphical representation.

3. Measurement of air and soil temperature and grass minimum thermometers and thermographs - drawing isolines.
4. Humidity measurements - use of wet and dry bulb thermometers - Psychrometers - Hygograph - Measurement of wind direction and wind speed and conversion (KMPH, KNOT, and M/Sec.) -Beaufort's scale.
5. Measurement of atmospheric pressure - barograph - Fortein-s barometer - Isobars based on past data for different seasons.
6. Measurement of rainfall - Ordinary and self-recording rain gauges - Measurement of Dew - dew gauge- study of Automatic weather station.
7. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data-Measurement of Evapotranspiration- Lysimeter.
8. Heat Unit concept- GDD, HTU, PTU for fixing time of sowing.
9. Probability analysis of rainfall for crop planning.
10. Drawing Synoptic charts for understanding weather.
11. Preparation of crop weather calendars and forecast based agro advisories.
12. Preparation pest weather calendar and pest forewarning.
13. Estimation of length of growing periods using weekly rainfall data.
14. Water balance studies.
15. Identification of efficient cropping zone- RYI, RSI.
16. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
17. **Final Practical Examination.**

Text books

1. Mahi, G.S. and Kingra, P.K. 2015. Fundamentals of Agrometeorology. Kalyani Publishers, New Delhi.
2. Reddy, S.R. and Reddy, D.S. 2014. Agrometeorology, Kalyani Publishers New Delhi.
3. John Warren Smith. 2007. Agricultural Meteorology: The Effect of Weather on Crops. Macmillan publishers, UK.
4. Sahu, DD. 2007. Agrometeorology and Remote Sensing: Principles and Practices, Agrobios, Jodhpur.
5. Mavi, HS and Tupper GJ. 2004. Agrometeorology: Principles and Application of Climate Studies in Agriculture, Haworth Press.
6. Varshneya, MC. and Balakrishana Pillai P. 2003. Textbook of Agricultural Meteorology, ICAR.

Reference books

1. Latief, A., R.H.Kanth, S. Parvaze and S.S.Mahdi. 2017. Experimental Agrometeorology: A Practical Manual. Springer International Publishing AG.
2. Mote, B.M. and D.D. Sahu. 2014. Principles of Agricultural Meteorology. Scientific Publishers, Jodhpur.
3. Srivastava, A.K. and P. K. Tyagi. 2011. Practical Agricultural Meteorology. New India Publishing Agency, New Delhi.

4. Adaptation and mitigation of climate - Scientific Technical Analysis. 2006. Cambridge University Press, Cambridge.
5. Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
6. Variraju, R and Krishnamurthy 1995. Practical Manual on Agricultural Meteorology, Kalyani publications, New Delhi.

Web references

1. www.tawn.tnau.ac.in
2. <http://www.fao.org/docrep/x5672e/x5672e09.htm>
3. www.imd.gov.in
4. <https://library.wmo.int>
5. www.usbr.gov/pn/agri.met

22 AEC 101 FUNDAMENTALS OF AGRICULTURAL ECONOMICS (2+0)

Course objectives:

- To study the significance of agriculture in economic development.
- Expose the students to economics principles and their applications.
- Train the students in economics tools for agricultural decision making
- Students will use economic models in domestic and global contexts to analyze individual decision making, how prices and quantities are determined in product and factor markets, and macroeconomic outcomes.

Course outcome:

- Students will gain knowledge in application of economics tools for agricultural decision making.
- Students will be able to understand the links between household behaviour and the economic models of demand
- Students will use data to describe the relationships among variables in order to analyze economic issues.
- Students will get knowledge of market activities and behaviour: production, distribution, selling, purchasing etc. in relation to agriculture.

Unit 1- Nature and scope of economics

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, classification and characteristics, desire, want - meaning and characteristics, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

Unit 2-Theory of consumption

Demand: meaning, kinds of demand, law of demand, demand schedule and demand curve, determinants; *Utility theory* - cardinal and ordinal utility; law of diminishing marginal utility, equi-marginal utility principle, Indifference curve analysis and properties - budget line: definition, assumptions, limitations and applications - consumer's equilibrium and derivation of demand curve. Concept of consumer surplus and its importance. *Elasticity of demand*: concept and measurement of price elasticity, income elasticity and cross elasticity. Factors influencing elasticity of demand - Importance of elasticity of demand – Standard of Living: Definition, Engel's Law of Family Expenditure.

Unit 3-Theory of production

Production: process, creation of utility, factors of production definition and characteristics – Input Output Relationship. *Laws of returns*: Law of variable proportions and Law of returns to scale. *Cost*: Cost concepts, short run and long run cost curves. *Supply*: Stock versus supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.

Unit 4-Exchange and theory of distribution

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. *Distribution theory*: meaning, factor market and pricing of factors of production - Concepts of Rent and Quasi rent - *Wages*: Real wage and money wage - *Interest*: Pure interest and gross interest – *Profit*: Meaning of economic profit.

Unit 5-Macroeconomic concepts

National income: Meaning and importance, circular flow, concepts of national income - accounting and approaches to measurement, difficulties in measurement. *Population*: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. *Money*: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. *Banking*: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. *Agricultural and public finance*: meaning, micro versus macro finance, need for agricultural finance, public revenue and public expenditure. *Tax*: meaning, direct and indirect taxes, agricultural taxation, VAT and GST. *Economic systems*: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Theory schedule:

1. *Economics*: Meaning, scope and subject matter, definitions, activities.

2. Approaches to economic analysis; micro and macroeconomics, positive and normative analysis.
3. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior.
4. Basic concepts: Goods and services - classification and characteristics, desire, want – meaning and characteristics, demand, utility, cost and price, wealth, capital, income and welfare.
5. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development.
6. Agricultural planning and development in the country.
7. *Demand*: meaning, kinds of demand, law of demand, demand schedule and demand curve, determinants.
8. *Utility theory* - cardinal and ordinal utility; law of diminishing marginal utility.
9. Equi-marginal utility principle, Indifference curve analysis and properties - budget line - definition, assumptions, limitations and applications.
10. Consumer's equilibrium and derivation of demand curve.
11. Concept of consumer surplus, producer surplus and its importance.
12. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Factors influencing elasticity of demand, Importance of elasticity of demand.
13. Standard of Living: Definition, Engel's Law of Family Expenditure.
14. *Production*: process, creation of utility, factors of production definition and characteristics - Input Output Relationship.
15. *Laws of returns*: Law of variable proportions and law of returns to scale.
16. *Cost*: Cost concepts, short run and long run cost curves.

17. Mid Semester Examination

18. *Supply*: Stock versus supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.
19. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets.
20. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.
21. Distribution theory: meaning, factor market and pricing of factors of production.
22. Concepts of Rent and Quasi rent - *Wages*: Real wage and money wage.
23. *Interest*: Pure interest and gross interest –*Profit*: Meaning of economic profit.
24. *National income*: Meaning and importance, circular flow.
25. Concepts of national income - accounting and approaches to measurement, difficulties in measurement.
26. *Population*: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control.
27. *Money*: Barter system of exchange and its problems, evolution, meaning and functions of money
28. Classification of money, money supply and theories.

29. General price index, inflation and deflation.
30. *Banking*: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy.
31. *Agricultural and public finance*: meaning, micro versus macro finance, need for agricultural finance, public revenue and public expenditure.
32. *Tax*: meaning, direct and indirect taxes, agricultural taxation, VAT and GST.
33. *Economic systems*: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies.
34. Economic Planning and elements of economic planning.

Text books

1. Dewett, K, K., 2004. Modern Economic Theory, New Delhi: Syamlal Charitable Trust. pp 1-1024
2. Samuelson, P., 2004. Economics, (18/e), New Delhi: Tata Mc-graw-Hill. pp 1-205

Reference books

1. Seth, M. L., 2005. Principles of Economics, New Delhi: Lakshmi Narain Agarwal Co., Agra, pp 1- 888
2. Subba Reddy, S., & Raghu Ram, P., 2011. Agricultural Finance and Management, New Delh: Oxford & IBH. pp 1-268

Web-references

1. www.fp.unmas.ac.id/wp-content/uploads/2018/03/principles-of-agricultural-economics.pdf
2. www.economicshelp.org/
3. www.sparknotes.com/economics/
- 4.

22 SWE 111 SOIL AND WATER CONSERVATION ENGINEERING 2 + 1

Course objectives

- To understand the water resources of the country and state

- To study the soil water plant relationship and soil moisture constant
- To introduce the concept of water requirement of crops and irrigation management

Course outcomes

- Students learnt the estimation of the irrigation requirement by various methods
- Students gained the practical knowledge of implementation of surface, pressurized and micro irrigation
- Familiarize the concept of water productivity and principles of drainage

Theory

UNIT I

SURVEYING

Surveying and levelling – chain and compass – levelling – land measurement – difference in elevation.

UNIT II

SOIL EROSION

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion – universal soil loss equation - water erosion - causes - stages of water erosion - splash, sheet, rill and gully erosion - ravines - land slides – wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep

UNIT III

SOIL CONSERVATION AND WATERSHED MANAGEMENT

Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping – cropping systems – vegetative barriers - windbreaks and shelterbelts - shifting cultivation - mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – Rain water harvesting — Runoff computation - rational formula - water harvesting – farm ponds and percolation ponds -watershed concept – integrated approach and management

UNIT IV

IRRIGATION AND DRAINAGE

Irrigation - measurement of flow in open channels - velocity area method - rectangular weir - Cippoletti weir - V notch - orifices - Parshall flume - duty of water - irrigation efficiencies - conveyance of irrigation water - surface irrigation methods - borders, furrows and check basins - drip and sprinkler irrigation component– agricultural drainage - surface and sub-surface drainage systems - drainage coefficient

UNIT V

WELLS AND PUMPS

Types of wells– pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps

PRACTICAL

Study of survey instruments - chains and cross staff surveying - linear measurement - plotting and finding areas. Compass survey - observation of bearings - computation of angles- radiation, intersection. Levelling – fly levels – determination of difference in elevation – contouring. Design of contour bund and graded bund. Drip systems and Sprinkler irrigation systems. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement - agricultural drainage. Study of different types of wells and its selection.- Study of pumps and its selection- Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Operation of sprinkler, drip and common micro irrigation systems; Visit to a water management research station. Visit to soil and water conservation areas

Text books

1. SankaraReddi, G.H. and Yellamananda Reddy, T. 2003. Efficient Use of Irrigation Water.Kalyani Publishers, Ludhiana.

References

1. Michael, A.M. 2007. Irrigation Theory and Practice (2nd Ed.). Vikas Publishing House Pvt.Ltd., New Delhi.
2. Lenka, D. 2005. Irrigation and Drainage (3rd Ed.). Kalyani Publishers, Ludhiana.

22 HOR 112 PRODUCTION TECHNOLOGY OF VEGETABLES AND SPICES (1+1)

Course Objective:

1. To impart knowledge on basic cultural practices of Vegetables, Fruits and Plantation Crops.
2. To insist on modern techniques to increase the yield and production.
3. To learn about the economic estimation of commercial Horticultural crops.

Course Outcome:

1. The student gains a thorough knowledge on basic production technology.
2. Familiarize on basic pruning and training techniques of fruits and plantation crops.
3. Acquaintance on commercial oriented cultural practices.

Theory

Vegetables

Unit I: Scope, Importance and classification of vegetables

Importance of vegetable growing –area and production of vegetables in India and Tamil Nadu- National economy- nutritive value of vegetables and human nutrition.

Unit II: Production technology of tropical vegetable crops

Origin - climate and soil – varieties and hybrids – seeds and sowing – transplanting – water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulators -physiological disorders - maturity indices –harvest – pest and diseases – seed production

Crops: Tomato, chilli, brinjal, bhendi, gourds (ash gourd, pumpkin, bitter gourd, ridge gourd, bottle gourd, snake gourd and watermelon) onion, cassava, amaranthus and moringa.

Unit III: Production technology of temperate vegetable crops

Origin -climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrient and plant growth regulators- physiological disorders- maturity indices – harvest – pest and diseases – seed production

(Crops: Cabbage, cauliflower, potato, carrot, radish, beetroot, peas and french beans, Protected cultivation of vegetables (tomato, capsicum and cucumber).

SPICES

Unit IV: Crop production techniques of major spices

Spices- scope and importance - classification of spices - origin, area and production - role of commodity boards- export potential of spices.

Climate and soil - varieties - propagation - nursery management and planting – cropping systems- training practices - nutrient, water and weed management - shade regulation - maturity indices - harvest and yield - pests and diseases - processing - value addition.

Black pepper, Cardamom, Turmeric, Ginger and Garlic

Unit V: Crop production techniques in seed spices, tree spices and other spices

Climate and soil- varieties - propagation, nursery management and planting- training , pruning canopy management- weed and water management- shade regulation- nutrient management including drip and fertigation – harvest and yield – pests and diseases – processing – value addition.

Coriander, Fenugreek, Cumin, Fennel, Clove, Nutmeg, Cinnamon, Curry leaf, Tamarind and Herbalspices Practical Vegetables

Layout of kitchen garden – seed sowing – nursery management – grafting in vegetables water and nutrient management – fertigation – weed management – practices in use of plant growth regulators - Special horticultural practices in vegetable production - study of maturity indices - Identification of physiological disorders - protected cultivation - visit to vegetable nursery unit/ protected cultivation unit.

Spices

Identification of spices –description of varieties-Propagation methods –rapid multiplication techniques seed collection and extraction - raising of nurseries - seed sowing- seed treatment- fertilizer application-harvesting –pests and diseases-processing-cost economics-visit to spice gardens

Black pepper, Cardamom, Turmeric, Ginger, Coriander, Fenugreek, Curry leaf, Clove, Nutmeg and Cinnamon

Lecture schedule

1. Importance of vegetable growing –area and production of vegetables in India and Tamil Nadu- National economy- nutritive value of vegetables and human nutrition .
2. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator -physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of tomato, chilli and brinjal
3. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of bhendi and onion.
4. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator -physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of gourds (ashgourd, pumpkin, bittergourd, ridgegourd, bottlegourd, snake gourd and watermelon)
5. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator -physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of cassava and potato

6. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator -physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of moringa and amaranthus.
7. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micro nutrients and plant growth regulator physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of cabbage and cauliflower.
8. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator -physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of carrot, beetroot and radish.
9. **Mid -semester examination**
10. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulator -physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of french beans and peas .
11. Protected cultivation of vegetables (tomato, capsicum and cucumber)
12. **Spices-** scope and importance - classification of spices - origin, area and production - role of commodity boards- export potential of spices. Black pepper - climate and soil- varieties – propagation – rapid multiplication techniques - nursery management and planting- nutrient, water and weed management - special horticultural practices - role of growth regulators - shade regulation- maturity indices – harvest and yield - pests and diseases – post harvest practices- processing and value addition.
13. **Cardamom** - climate and soil - varieties - propagation - nutrient, water and weed management- shade regulation- mulching - maturity indices - harvest and yield - pests and diseases – post harvest practices- processing and value addition.
14. **Turmeric, Ginger and Garlic** - Climate and soil- varieties - propagation, nursery management and planting- nutrient, water and weed management- inter cropping- physiological disorders - maturity indices - harvest and yield - pests and diseases – post harvest practices- processing and value addition.
15. **Seed Spices-** climate and soil seed treatment/sowing – nutrient, water and weed management- intercropping - maturity indices - harvest and yield - pests and diseases – post harvest practices- processing and value addition. (Coriander, Fenugreek, Cumin and Fennel)
16. **Tree spices** - climate and soil - varieties - propagation, nursery management and planting - nutrient, water and weed management- training and pruning practices- cropping system- special horticultural practices maturity indices - harvest and yield - pests and diseases – post harvest practices- processing and value addition. (Clove, Nutmeg and Cinnamon)
17. **Tamarind, Curry leaf and herbal spices** - climate and soil- varieties - propagation, nursery management and planting- nutrient, water and weed management- canopy management- maturity indices - harvest and yield - pests and diseases – post harvest practices- processing and value addition.

Practical schedule

1. Layout of kitchen garden.
2. Seed treatment and sowing practices in direct sown vegetables
3. Nursery management of transplanted, bulb and tuber vegetable crops
4. Grafting in vegetable crops
5. Water and nutrient management – fertigation in vegetable crops
6. Practices in use of plant growth regulators in vegetable crops

7. Special horticultural practices in vegetable production
8. Identification of physiological disorders in vegetable crops
9. Study of maturity standards and harvesting of vegetables
10. Practices in protected cultivation of vegetable crops
11. Visit to vegetable nurseries/protected vegetable cultivation unit
12. Black pepper and cardamom- identification and description of varieties – seed propagation and vegetative propagation – fertilizers application - preparation of plant bio regulators and application pests and diseases- harvest and post harvest practices.
13. Turmeric and ginger- identification and description of varieties- propagation, fertilizers application - preparation of plant bio regulators and application – pests and diseases- harvest and post harvest practices.
14. Coriander and Fenugreek-identification and description of varieties- seed treatment, sowing fertilizer application - pests and diseases- harvest and post harvest practices.
15. Clove, Nutmeg and Cinnamon - identification and description of varieties – seed collection and extraction - propagation – fertilizer application – training and pruning – pests and diseases- harvest and post harvest practices.
16. Tamarind and curry leaf- identification and description of varieties – seed collection and extraction - propagation – fertilizer - application – canopy management – pests and diseases- harvest and post harvest practices.
17. Visit to spice gardens or commodity boards and working out cost economics of spice crops.

REFERENCES

Gopalakrishnan, T.R. 2007. Vegetable Crops. Horticultural Science Series (Series Editor K.V.Peter). New India Publishing Agency.

E-References

1. <http://www.jhortscib.com>
2. <http://journal.ashspublications.org>
3. <http://www.actahort.org/>
4. <http://www.aphorticulture.com/crops.htm>
5. <http://cpcri.nic.in/> <http://indiancoffee.org>

22 FSN 111 PRINCIPLES OF FOOD SCIENCE AND NUTRITION (1+1)

Course objectives

- To equip the students to study the various processes involved in the development of products.
- To understand the correct unit operation for each product.
- To acquire knowledge on selection of suitable equipments for product development.

Course outcome

- The students will understand various processes involved in the development of products.
- The students will be able to identify suitable unit operation for processed product.
- The students will be able to evaluate selection of suitable equipments for product development.

Theory

Unit I - Principles of food science and nutrition

Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid. Methods of cooking - moist, dry and microwave - principles, merits and demerits. Importance and scope of nutrition – relation of nutrition to health.

Unit II - Carbohydrate, protein and fat

Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA). Energy value of foods – determination. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention. Deficiency states of protein, carbohydrate and fat nutrition – signs and symptoms.

Unit III - Vitamin and mineral nutrition

Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements.

Unit IV- Food preservation and processing

Introduction – preservation by sugar - processing of jam, squash, jelly, marmalade and beverages. Preservation by using salt, chemicals, dehydration technology, canning technology, preservation by low temperature and irradiation techniques. Processing of puffed, flaked and extruded products. Quality control of raw and processed products.

Unit V Food quality and safety

Food packaging materials – requirements- methods – nutrition labeling. Food adulterants and their detection methods. Food laws and regulations and quality control standards - FSSAI,ISO, EU standards, FDA, HACCP and Codex Alimentarius commission

Practical:

Cooking tests for cereals and pulses. Determination of energy value of food. Estimation of Moisture, Protein, Fat, Ascorbic acid, Iron and Crude fibre. Processing of Jam and Jelly, Processing of Squash and RTS. Puffing of pulses. Extrusion of cereals and millets. Canning of fruits and Vegetables. Processing of dehydrated fruit and vegetable products. Identification of common food adulterants. Visit to Food processing Unit and Quality control lab

Lecture schedule

1. Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid.
2. Methods of cooking - moist, dry and microwave - principles, merits and demerits.
3. Importance and scope of nutrition – relation of nutrition to health.
4. Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA), Deficiency. Energy value of foods – determination.
5. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Deficiency
6. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention.
7. Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency.
8. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements.

9. Mid Semester Examination

10. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements.
11. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements
12. Preservation by sugar - processing of jam, squash, jelly, marmalade and beverages
13. Preservation by using salt, chemicals, dehydration technology, canning technology
14. Preservation by low temperature and irradiation techniques
15. Processing of puffed,flaked and extruded products. Quality control of raw and processed products. Food packaging materials – requirements - methods – nutrition labeling
16. Food adulterants and their detection methods.
17. Food laws and regulations and quality control standards - FSSAI,ISO, EU standards, FDA, HACCP and Codex Alimentarius commission

Practical schedule

1. Cooking tests for cereals and pulses
2. Determination of energy value of food
3. Estimation of Moisture
4. Estimation of Protein
5. Estimation of Fat
6. Estimation of Ascorbic acid
7. Estimation of Iron
8. Estimation of Crude fibre
9. Processing of Jam and Jelly
10. Processing of Squash and RTS
11. Puffing of pulses
12. Extrusion of cereals and millets

13. Canning of fruits and Vegetables
14. Processing of dehydrated fruit and vegetable products
15. Identification of common food adulterants
16. Visit to Food processing Unit and Quality control lab

17. Final Practical Examination

Text books

1. Gaurav Tewari and Vijay K. Juneja. (2007). Advances in Thermal and Non-Thermal Food Preservation. Blackwell Publishing, Ames, Iowa, USA.
2. James G. Brennan. (2006). Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, PP 1-602.
3. M. Shafiur Rahman. (2007). Handbook of Food Preservation, 2nd Ed. CRC Press, Boca Raton, FL, USA, PP 1-1088.
4. Marcus Karel and Darvl B. Lund. (2003). Physical Principles of Food Preservation, 2nd Ed. Marcel Dekker, Inc., NY, USA, PP 1-640.
5. Norman N. Potter and Joseph H. Hotchkiss. (1995). Food Science, 5th Ed. Chapman & Hall, NY, USA.
6. Srilakshmi, B. (2018). Food Science (7th Ed). New Age International Ltd, publishers, New Delhi, India, PP 1-512.
7. Stavros Yanniotis. (2008). Solving Problems in Food Engineering. Springer Science + Business Media, NY, USA.

Reference books

1. Potter, N. (2005). Food Science, CBS Publishers and Distributors, Delhi
2. Srilakshmi .B. (2015). Nutrition Science. New Age International Pvt. Ltd. New Delhi.
3. Vijaya Khader. (2001). Textbook of Food Science and Technology, Indian Council of Agricultural Research, New Delhi.

Web-references

1. <http://www.ifis.org>
2. http://www.fao.org/infofoods/index_en.stm
3. <https://fstjournal.org>

22 AEX 102 FUNDAMENTALS OF AGRICULTURE EXTENSION EDUCATION 2 + 1

Unit I

Extension education and programme planning

Education- meaning, definition & types; extension education –meaning, definition, scope and process; objectives and principles of extension education. Programme planning – definition, meaning, process, principles and steps in programme development

Unit II

Extension System in India

Extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development scheme, Gurgaon Experiment, etc.) Post – independence era (Etawah pilot project, Nilokheri Experiment, etc.,) Various extension/ agricultural development programmes launched by ICAR/Govt. of India(IADP, IAAP, HYVP,KVK, ORP, ND, NATP, NAIP etc.,)

Unit III

Rural Development, Administration, monitoring and evaluation

Rural Development –Concept, meaning, definition: various rural development programmes launched by Govt. of India. Community development –meaning, definition, concepts and principles, physiology of community development. Rural leadership: concept and definition, types of leaders in rural context: extension administration: meaning, concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes

Unit IV

New Trends in Agricultural Extension

New trends in agricultural extension –Privatization of extension, Cyber extension/ E-extension, (Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Village Knowledge Centre (VKC), DEMIC, Geographical Information System (GIS), market led extension, farmer led extension, expert systems etc.,

Unit V

Transfer of Technology, Diffusion of Innovations and extension methods

Transfer of technology concept, models, capacity building of extension personnel, extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies: communication: meaning, definition, models elements, characteristics and barriers to communication Agricultural Journalism: Agricultural journalism (Print media) - definition, principles, importance, ABC of news, types of news. Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; 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 newstories 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.

Text books:

1. Dipak de, Basavaprabhu Jirli. 2010. A Handbook of Extension Education, Agrobios, India.
2. Katar Singh. 1999. Rural Development – Principles, Policies and Management, Sage Publications India Pvt. Ltd., New Delhi.
3. Kelsey, L.D and C.C. Hearne. 1967. Cooperative Extension Work, Cornell University Press, New York.
4. Manoharan Muthiah, P. and R. Arunachalam. 2003. Agricultural Extension, Himalaya Publishing House, Mumbai.
5. Narayanasamy, N. 2009. Participatory Rural Appraisal Principles, Methods and Application, Sage Publications India Pvt. Ltd., New Delhi.
6. Neela Mukherjee. 1993. Participatory Rural Appraisal: Methodology and Applications, Concept Publishing Co.

References:

1. Pandey, B.K. 2005. Rural Development, ISHA Books, New Delhi.
2. Pandey, V.C. 2003. Information Communication Technology and Education (The Changing World ICT Governance), Isha Publishers.
3. Ray, G.L. 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
4. Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra Pradesh.
5. Rishipal. 2011. Training and Development Methods, S.Chand and Co. Ltd., New Delhi.
6. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, New York.
7. Sagar Mondal and Ray, G.L. 2007. Text book of Rural Development, Kalyani Publishers, New Delhi.
8. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
9. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
10. Sanjay Prakash Sharma. 2006. Panchayat Raj, Vista International Publishing House, New Delhi.
11. Singh, A.K. 2012. Agricultural Extension, Agrobios, New Delhi.
12. Sivasudevaro, B and Rajannikanthu, G. 2007. Rural Development and Entrepreneurship Development, The Associated Publications, Ambala.
13. Supe, S.V. 1997. An Introduction to Extension Education, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
14. Van den Ban, A.W and H.S. Hawkins. 2002. Agricultural Extension, CBS Publishers & Distributors, New Delhi.

22 CRP 101 FUNDAMENTALS OF CROP PHYSIOLOGY 2 + 1

Course Objectives:

- To introduce the students to crop physiology and biochemical changes during crop development.
- To impart knowledge on transport system in plants, photosynthesis and respiration
- To understand growth and growth characteristics

Course Outcome:

- Knowledge gained on different aspects of crop physiology.
- Learned detailed understanding of the physiological mechanisms involved in the uptake and transport of water and the translocation of food by plants.
- Study growth pattern of plants and growth parameters in crop production.

Theory

Unit I

Introduction to Crop Physiology and importance of Crop Physiology in Agriculture – Plant cell: an overview, organelles- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole, Structure and role of water, water potential and its components, diffusion and osmosis; imbibition, plasmolysis, Field Capacity and Permanent Wilting Point, Absorption of water, Mechanisms of water absorption, Pathways of water movement, Apoplast and symplast, Translocation of water, ascent of sap and its mechanisms - Transpiration and Stomatal physiology: structure of stomatal pore, mechanisms of stomatal opening and closing, guttation, antitranspirants.

Unit II

Mineral nutrition of plants: Criteria of essentiality, classification of nutrients, macro, micro, mobile, immobile and beneficial elements, Physiological functions and deficiency symptoms of nutrients, nutrient uptake mechanism; Hidden hunger, Foliar nutrition, root feeding and fertigation, sand culture, hydroponics and aeroponics.

Unit III

Photosynthesis: Light and dark reactions, Photosystems, red drop and Emerson enhancement effect, Photolysis of water and photophosphorylation, Z scheme, C3, C4 and CAM plants; Photosynthetic pathways of C3, C4 and CAM plants, difference between three pathways, Factors affecting photosynthesis, Photorespiration – pathway and its significance, Phloem transport, Munch hypothesis, Phloem loading and unloading, Source and sink strength and their manipulations. Respiration: Glycolysis, TCA cycle and electron transport chain; Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient. Fat metabolism: fatty acid synthesis and breakdown.

Unit IV

Plant growth regulators: physiological roles and agricultural uses, Hormones- classifications - Biosynthetic pathway and role of auxins, gibberellins, cytokinins, ethylene and ABA, Novel and new generation PGRs, Brassinosteroids and salicylic acid, Growth retardants, Commercial uses of PGRs. Photoperiodism - short, long and day

neutral plants, Chailakhyan's theory of flowering, Forms of phytochrome, Pr and Pfr, regulation of flowering, Vernalisation - Theories of vernalisation, Lysenko theories, Seed germination - physiological and biochemical changes, seed dormancy and breaking methods, Senescence and abscission, physiological and biochemical changes, Physiology of fruit ripening, climacteric and non-climacteric fruits, factors affecting ripening, Manipulations. Physiological aspects of growth and development of major crops: growth analysis, role of physiological growth parameters in crop productivity.

Unit V

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation – compatible osmolytes – membrane properties - compartmentalization – stress alleviation - Global warming – green house gases – physiological effects on crops - Carbon Sequestration.

Practical

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

Text books

1. Pandey, S. N. and B. K. Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.

References

1. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
2. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

22 AGM 101 FUNDAMENTALS OF MICROBIOLOGY 2 + 1

Theory

Unit I Introduction

Definition and scope of Microbiology. Milestones in Microbiology; biogenesis and abiogenesis theory; contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman. Germ theory of diseases and fermentation.

Unit II Microbiological Techniques

General principles of light microscopy - magnification, resolving power and numerical aperture. Different types of light and electron microscopes; three dimensional imaging - Atomic force and Confocal scanning laser microscopy. Staining techniques - principle and types of stains; simple, negative, differential and structural staining. Sterilization and disinfection techniques; principles and methods of sterilization - physical methods – heat, filters and radiation; chemical methods. Isolation, enrichment and purification techniques of bacteria, yeast, molds and actinobacteria. Preservation of microbial cultures.

Unit III Microbial World

Evolutionary relationship among the living organisms. Whittaker's five kingdom concept of living organism and Carl Woese systems. Procaryotic and eukaryotic microorganisms. Three domains of life – similarities and differences; Modern approach to the bacterial systematics. Bergey's Manual of Systematic Bacteriology. Bacteria – bacterial size, shape and arrangement; bacterial cell structure and function. Morphology of fungi and algae. General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages.

Unit IV Microbial Growth and Metabolism

Bacterial growth- population growth- growth cycles of population; environment on growth – temperature, oxygen, pH and salts; nutritional classification – chemoautotrophy and photo autotroph. Energy generation in bacteria. Aerobic and anaerobic respiration and fermentation in bacteria.

Unit V Microbial Genetics and Immunology

Central dogma of life. Genetic elements of bacteria; bacterial chromosomal DNA, plasmids, IS elements and transposons; Mutation - types and mutagens. Genetic recombinations; transformation, transduction and conjugation. Genetic engineering – an introduction. Basic concepts of immunology – antigen – antibody reactions and vaccines.

Practical

Microbiological safety in the laboratory; introduction to microbiology laboratory and its equipments. Microscopes- handling with microscope. Micrometry. Methods of sterilization and equipments used for sterilization. Nutritional media and their preparations. Enumeration of microbial population - bacteria, fungi and actinobacteria. Methods of purification and preservation of microbial cultures. Staining and microscopic observations; simple and differential staining - spore staining. Measurement of bacterial growth. Identification of microorganisms - morphological identification of yeasts, molds and algae. Identification- cultural, physiological and biochemical tests for bacteria and actinobacteria. Isolation of bacteriophages. Isolation of mutants employing physical or chemical mutagens.

Reference :

1. [Michael T. Madigan , Kelly S. Bender Daniel H. Buckley , W. Matthew Sattley, David A. Stahl](#) 2017. Brock Biology of Microorganisms, 15th edition
2. ebook.: Prescott, Harley and Klein, 2013. Microbiology, 9th edition, McGraw Hill Publishing
3. ebook: Michael J. Leboffee and Burton E. Pierce 2011. A photographic Atlas for the Microbiology Laboratory 4th edition, Marton Publishing Company
4. Hans G. Schlegel, 2012. General Microbiology, 7th edition
5. Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
6. Tortora, G.J., B.R. Funke and C.L. Case, 2009. Microbiology- An Introduction, 9th edition
7. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

22 MAT 111 ELEMENTARY MATHEMATICS (2+0)

Course objectives:

1. Improving the mathematical knowledge of students who have come from a science background

2. Imparting higher secondary level mathematics so that they can understand mathematical formulas applicable for other courses
3. Interlinking mathematics with science

Course outcome:

1. Device formulas for straight lines
2. Comprehend the use of Slope-Intercept
3. Apply the knowledge gained in designing fields
4. Acquire interest to utilize calculus in agriculture
5. Integrate product of functions and define matrices and determinants
6. Link mathematics with agricultural engineering

Unit I- Algebra

Permutation and Combination -meaning of nPr and nCr (simple problems). Matrices- Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3^{rd} order by adjoint method, Properties of determinants up to 3^{rd} order and their evaluation.

Unit II-Analytical geometry in 2D

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 straight lines, Angles between two straight lines, Parallel lines, Perpendicular lines.

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) .

Unit III- 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. Partial differentiation with first and second order -Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x_1, x_2)$ (Simple problems based on it).

Unit –IV-Integral calculus

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

Unit V-Mathematical models

Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

Lecture schedule:

1. Permutation and Combination -meaning of nPr and nCr .
2. Simple problems in Permutation and Combination.
3. Matrices- Definition of Matrices- Types of Matrices- Addition, Subtraction, Multiplication, Transpose
4. Problems in Addition, Subtraction, Multiplication and Transpose of a matrix
5. Determinants-Properties of determinants -up to 3^{rd} order evaluation and inverse up to 3^{rd} order by adjoint method.
6. Problems in determinants and Inverse up to 3^{rd} order by adjoint method.
7. 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.
8. Problems in Straight lines using 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.
9. Forms of equation of Line-Slope-intercept form -Slope one point form - Two point form - Intercept form.
10. Problems in Slope-intercept form of equation of line, Slope-point form of equation of line, two point forms of equation of line, Intercept form of equation of line.
11. Normal form of equation of line- General form of equation of line- Point of intersection of two straight lines.
12. Problems in Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines.
13. Angles between two straight lines- Parallel lines- Perpendicular lines- Angle of bisectors between two lines.
14. Problems in Angles between two straight lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines.
15. 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) .
16. Problems in 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) .
- 17. Mid Semester Examination**
18. Differential Calculus - Definition of function, limit and continuity- Simple problems on limit and continuity.
19. Simple problems in limit and continuity.

20. Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle-Derivatives of sum, difference, product and quotient of two functions- Differentiation using functions of function rule (Simple problem based on it)
21. Problems in differentiation of x^n , e^x , $\sin x$ & $\cos x$, derivatives of sum, difference, product, quotient of two functions and differentiation of functions of functions.
22. Logarithmic differentiation (Simple problem based on it)- Differentiation by substitution method and simple problems based on it- Differentiation of Inverse Trigonometric functions
23. Simple problem based on Logarithmic differentiation and differentiation by substitution method.
24. Maxima and Minima of the functions of the form $y=f(x)$ and $y=f(x_1, x_2)$ (Simple problems based on it).
25. Problems in Maxima and Minima of the functions of the form $y=f(x)$ and $y=f(x_1, x_2)$
26. Integral Calculus - Integration of simple functions and Product of two functions- Definite Integral (simple problems based on it)
27. Problems in integration of simple functions and product of two functions using integration by parts-Definite Integral.
28. Integration by substitution method- Area under simple well-known curves (simple problems based on it).
29. Integration by substitution method-Problems in Area under simple well-known curves
30. Agricultural systems - Mathematical models - classification of mathematical models- Linear model.
31. Problems in fitting linear models to experimental data
32. Quadratic and Exponential models- applications of mathematical models in agriculture.
33. Problems in fitting Quadratic models to experimental data.
34. Problems in fitting Exponential models to experimental data.

References books

1. Harikishan. 2006. *Coordinate Geometry of two dimensions*. Delhi: Atlantic Publisher. pp. 1-137
2. Manickavasagam, P. T. K. & Narayanan. S 1997. *Calculus*. Vol I Madras: Viswanathan Publications. pp. 1-433
3. Mehta, B. C. & G. M. K. Madnani. 2008. (9th ed.). *Mathematics for Economists*. New Delhi: Sultan Chand & Sons. pp.1 - 731
4. Sharma, A. K. 2004. *Textbook of Matrix*. New Delhi: Discovery Publishing House. pp. 1-333

Web references

1. www.mathsisfun.com
2. www.mathinsight.org
3. <https://youtu.be/WEUL1v1Mxv0>
4. <https://youtu.be/SSyZYWDX0Mo>
5. <https://youtu.be/IS2vyb3Fps8>
6. <https://youtu.be/lvLpNG1Ncg>
7. https://youtu.be/Wm5a_Sa2GNY
8. <https://youtu.be/Dsi7x-A89Mw>

**2022 Batch
Semester III**

S. No	Course Code	Course Title	Credit Hours	Total Credits
26.	22 AGR 201	Crop Production Technology I (Kharif Crops)	1+1	2
27.	22 AGR 202	Principles of Weed Management	1+1	2
28.	22 AEN 201	Fundamentals of Entomology	2+1	3
29.	22 PBG 201	Fundamentals of Genetics	2+1	3
30.	22 AEC 201	Farm Management, Production and Resource Economics	1+1	2
31.	22 FMP 211	Farm Machinery and Power	1+1	2
32.	22 HOR211	Production Technology for Fruit and Plantation Crops	1+1	2
33.	22 PAT 201	Fundamentals of Plant Pathology	2+1	3
34.	22 STA 211	Statistical Methods	1+1	2
35.	22 AMP 201	Livestock and Poultry Management	2+1	3
36.	22 AGR 203	Study Tour*	0+1*	1*
Total			14+11	25
37.	22 NSS/ NCC 101	NSS or NCC	0+1#	1#
38.	22 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV *Non- gradial Course

Semester III

22AGR 201 CROP PRODUCTION TECHNOLOGY – I (*Kharif crops*) (1+1)

Course objective:

- Imparting the fundamentals of crop production technology of *kharif* crops
- Demonstrating practical applications of crop production
- Providing knowledge on the importance and practices followed in growing *kharif* crops

Course outcome: At the end of the course the student should be able to

- Comprehend the fundamentals of crop production of cereals
- Decide on the crops, fertilizers and irrigation measures for production of pulses
- Plan for sustainable crop production of oilseeds
- Explain the techniques involved in crop production of fibre and forage crops
- Correlate parameters involved in crop cultivation and practice *kharif* crop cultivation

THEORY

Unit I- Cereals

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rice and Maize (from land preparation to harvest) and yield.

Unit II- Millets

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Sorghum, Pearl millet, Small millets - Finger millet, Foxtail millet, little millet, Kodo millet, Barnyard millet and Proso millet

Unit III- Pulses

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Redgram, Blackgram, Greengram and Cowpea

Unit IV- Oilseeds (Kharif)

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Groundnut, sesame and Soybean.

Unit V- Fibre and forage

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Cotton, jute, fodder sorghum and cumbunapier

PRACTICAL

Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria. Practicing various nursery types and main field preparation for rice crop. Nursery and main field preparation for important millets, pulses and oilseeds. Acquiring skill in different seed treatment techniques in important kharif crops. Estimation of plant population per unit area for important kharif crops. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals and millets. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses and oilseeds. Acquiring skill in using seed drill for sowing operations. Acquiring skill in foliar nutrition for important field crops. Observations on growth parameters of cereals and millets. Observations on growth parameters of pulses and oilseeds. Study of yield parameters and estimation of yield in cereals and millets. Study of yield parameters and estimation of yield in pulses and oilseeds. Working out cost and returns of important cereals, millets, pulses and oilseeds crops. Visit to farmer's field / research stations to study the cultivation techniques of cereal, millets, pulses, cotton and oilseeds. Visit to nearby Agricultural Research Station / Farmer's field.

Lecture schedule:

1. Importance and area, production and productivity of major cereals and millets of India and Tamil Nadu.
2. Importance and area, production and productivity of pulses and oilseeds crops of India and Tamil Nadu.
3. Rice - Origin - geographic distribution - economic importance - varieties - soil and climatic requirement.
4. Rice - cultural practices - yield - economic benefits.
5. Special type of Rice cultivation – SRI - and Hybrid rice cultivation.
6. Maize - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
7. Sorghum and Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

8. Finger millet and Minor millets - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
9. **Mid Semester Examination**
10. Pigeonpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
11. Greengram, Blackgram and Cowpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield - Agronomy of rice fallow pulses.
12. Groundnut - Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices yield and economics.
13. Sesame and Soybean - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
14. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
15. Jute- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
16. Fodder sorghum- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
17. Cumbunapier- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.

Practical schedule:

1. Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria.
2. Practicing various nursery types and main field preparation for rice crop.
3. Nursery and main field preparation for important millets, pulses and oilseeds.
4. Acquiring skill in different seed treatment techniques in important kharif crops.
5. Estimation of plant population per unit area for important kharif crops.
6. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals and millets.
7. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses and oilseeds.
8. Acquiring skill in using seed drill for sowing operations.
9. Acquiring skill in foliar nutrition for important field crops.
10. Observations on growth parameters of cereals and millets.
11. Observations on growth parameters of pulses and oilseeds.
12. Study of yield parameters and estimation of yield in cereals and millets.
13. Study of yield parameters and estimation of yield in pulses and oilseeds.
14. Working out cost and returns of important cereals, millets, pulses and oilseeds crops.
15. Visit to farmer's field / research stations to study the cultivation techniques of cereal, millets, pulses, cotton and oilseeds.
16. Visit to nearby Agricultural Research Station / Farmer's field.
17. **Final Practical Examination.**

Text books:

1. Chidda Singh, Prem Singh and Rajbir Singh. 2018. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co Pvt.Ltd; 2nd edition. New Delhi.
2. Rajendra Prasad. 2016. Textbook of Field Crops Production (Volume 1 & 2). Indian Council of Agricultural Research (ICAR), New Delhi.
3. Mukund Joshi., 2015. Text Book of Field Crops. PHI Learning Private limited. New Delhi.
4. Reddy. S.R. 2014. Principles of Crop Production. Kalyani Publishers, Ludhiana.
5. Ahlawat,I.P.S., Om Prakash and G.S. Saini. 2010. Scientific Crop Production in India. Rama publishing House, Meerut.

Reference books:

1. Crop Production Guide. 2020. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
2. Reddy, S.R. 2012. Agronomy of field crops. Kalyani publishers, New Delhi.
3. Singh. S.S. 2015. Crop management under irrigated and rainfed conditions. Kalyani Publishers, New Delhi.
4. Srinivasan Jeyaraman. 2018. Field crops production and management (Volume I & 2). Oxford and IBH Publishers. India.
5. Yellamanda Reddy, T. and G.H. Sankara Reddy. 2017. Principles of Agronomy, Kalyani publishers, Ludhiana.

Web references

1. www.crida.org
2. www.cgiar.org
3. www.tnau.ac.in/agriporal
4. www.rkmp.irri.org.
5. <https://www.agrimoon.com/wp-content/uploads/Introduction-to-major-field-crops.pdf>

22AGR 202 PRINCIPLES OF WEED MANAGEMENT (1+1)

Course objective: The course is aimed at

- Identifying major weeds affecting farming ecosystems
- Imparting knowledge on organic and inorganic herbicides
- Introducing solutions to manage herbicide resistance

Course outcome: At the end of the course the student should be able to

- Gain knowledge on weeds affecting ecosystems
- Explain the mode of action of herbicides
- Understand the role of allelochemicals and the applications of bio-herbicides
- Analyse herbicide compatibility
- Cite ways of overcoming herbicide resistance
- Recommend weed management strategies

THEORY:

Unit I- Introduction to weeds

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination - Weed biology and ecology - Weed seed dormancy - Weed seed bank - Crop weed association - Crop weed competition and allelopathy effect.

Unit II- Weed control methods

Concepts of weed prevention, control and eradication - Methods of weed control: physical, cultural, chemical and biological methods - Non chemical weed management - Integrated weed management (IWM).

Unit III- Herbicides

Herbicides: Classification, characteristics, formulations, methods of application, advantages and equipment's – Adjuvants – Herbicide mixture - Advantages and limitation of herbicide usage in India.

Unit IV- Herbicide selectivity

Selectivity of herbicides; Herbicide absorption and translocation - Compatibility of herbicides and other agro inputs - Mode of action of herbicides and their selectivity - Herbicide residue management - Persistence and degradation of herbicides in soil and plants - Herbicide resistant weeds - Herbicide resistant GM crops.

Unit V- Weed management in crops

Weed management in major field and horticultural crops - weed shift - weed control in non-cropped areas - Parasitic, aquatic and problematic weeds and their control.

PRACTICAL:

Identification, classification and characterization of terrestrial weeds, aquatic weeds and parasitic weeds. Weed survey and weed vegetation analysis - density, frequency, SDR and IVI. Study on biology of nut sedge and Bermuda grass, parthenium and celosia. Practicing skill development on cultural and non-chemical weed management. Identification, classification and characterization of herbicides. Practicing skill development on herbicide application techniques. Practicing skill development on spray equipment 's and spray fluid calibration. Practicing skill development on herbicide weed management in lowland, upland and rainfed ecosystems. Calculation of herbicide quantity and recommendation for different eco systems. Study on phytotoxicity symptoms of herbicides in different crops. Herbicide residue determination by bioassay techniques. Herbicide residue determination by volumetric, spectro-photometric methods and chromatographic methods. Economic analysis of different weed management methods in crops and cropping systems. Visit to Problem and parasitic weed infestation areas/ herbicide industries

Lecture schedule:

1. Weeds - Definition, classification and characteristics, harmful and beneficial effect of weeds.
2. Weed biology and ecological adaptation to different agro ecosystems.
3. Classification and characteristics of weeds of different agro ecosystems-lowland weeds, irrigated upland and rainfed land weeds.
4. Classification and characteristics of weeds - Aquatic, parasitic and obnoxious weeds.
5. Life cycle of weeds, weed migration, weed seed distribution,
6. Dormancy, germination, establishment and perennation of weeds in different ecosystems.

7. Crop weed interactions - Critical crop weed competition, competitive and allelopathic effects of weeds and crops.
8. Principles and methods of weed management: Preventive, cultural, mechanical.

9. Mid-Semester Examination

10. Principles and methods of weed management: chemical, biological and alternate methods.
11. Classification and characteristics of herbicides and herbicide formulations - History and Development.
12. Herbicide Use Efficiency - Adjuvants, herbicide protectants and antidotes - Herbicide and herbicide mixtures in India - Interaction with moisture, fertilizer and other agrochemicals.
13. Mode of action of herbicides and their selectivity - Mechanism of action of herbicides and their selectivity.
14. Herbicide persistence and degradation in plants and soils-Herbicide residue and management.
15. Herbicide resistant weeds and their impact on weed management.
16. IWM in crops and cropping systems-Agricultural Crops, Horticultural Crops.
17. Weed shift: Causes and management options for weed shift in crop production.

Practical schedule:

1. Identification, classification and characterization of terrestrial weeds
2. Identification, classification and characterization of aquatic weeds
3. Identification, classification and characterization of problem and parasitic weeds
4. Weed survey and weed vegetation analysis - density, frequency, SDR and IVI
5. Study on biology of nut sedge and Bermuda grass, parthenium and celosia
6. Practicing skill development on cultural and non-chemical weed management
7. Identification, classification and characterization of herbicides
8. Practicing skill development on herbicide application techniques
9. Practicing skill development on spray equipment 's and spray fluid calibration
10. Practicing skill development on herbicide weed management in lowland, upland and rainfed ecosystems
11. Calculation of herbicide quantity and recommendation for different eco systems
12. Study on phyto-toxicity symptoms of herbicides in different crops
13. Herbicide residue determination by bioassay techniques
14. Herbicide residue determination by volumetric, spectro-photometric methods and chromatographic methods.
15. Economic analysis of different weed management methods in crops and cropping systems
16. Visit to Problem and parasitic weed infestation areas/ herbicide industries
17. **Final Practical Examination**

Reference books

1. Das, T.K. 2008. Weed Science - Basics and Applications. Jain Brothers, New Delhi
2. Gupta, O.P. 2007. Weed Management - Principles and Practices. Agrobios.
3. Jayakumar, R. and R. Jagannathan, R. 2003. Weed Science Principles, Kalyani Publishers, Ludhiana.

4. Rao, V.S. 2000. Principles of Weed Science. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 555p.
5. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1997. All about Weed Control. Kalyani Publishers, New Delhi.
6. Walia, U.S. 2003. Weed Management. Kalyani Publishers, Ludhiana

Web references

1. <http://erec.ifas.ufl.edu/weeds/powerpoints/Basic%20Principles%20of%20Weed%20Management.pdf>.
2. <http://www.agrisk.umn.edu/cache/ARL02964.htm>
3. <http://www.eolss.net/sample-chapters/c10/E1-05A-31-00.pdf>
4. <http://www.fao.org/docrep/006/y5031e/y5031e00.htm#Contents>
5. <http://www.fao.org/docrep/006/y5031e/y5031e0j.htm>
6. <http://www.omafra.gov.on.ca/english/crops/pub811/12crop.htm>

22PBG 201 FUNDAMENTALS OF GENETICS (2+1)

Course objective:

- Paraphrase the history and evolution of genetics and cytogenetics
- Understand the Chromosome behaviour and effects of their irregularities
- Explain Mendel's principles of heredity
- Recognize the importance of genetics in crop improvement

Course outcome:

- Describe the architecture of the chromosome and its functions.
- Interpret the relationship between genotype and phenotype.
- Apply the principles of chromosome transmission to predict patterns of inheritance.
- Analyse the modern concept of genetics and mutation
- Evaluate scientific data using the rules of probability

THEORY

UNIT I- Cytology and cytogenetics

Definition of genetics, heredity, inheritance, cytology, cytogenetics. History of genetics. Cell division – mitosis- meiosis and their significance – Gametogenesis and syngamy in Plants. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere. Structural and numerical variations in chromosome and their implications. Use of haploids, dihaploids and doubled haploids in Genetics. Special types of chromosomes.

UNIT II- Mendelian genetics and heredity

Heredity's Fundamental Characteristics; Pre and Post Mendelian concepts of heredity; Mendelian principles of heredity. Chromosomal theory of inheritance. Mendel's experiments and laws of inheritance - Law of Segregation, Law of Independent Assortment and Law of Dominance. Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1), ii.) Recessive epistasis (9:3:4), iii.) Duplicate and additive epistasis (9:6:1), iv.) Duplicate dominant epistasis (15:1), v) Duplicate recessive epistasis (9:7), vi.) Dominant and recessive epistasis (13:3). Pleiotropy, threshold characters, co-dominance, penetrance and expressivity. Non - Mendelian inheritance – cytoplasmic inheritance.

UNIT III- Quantitative inheritance, linkage and crossing over

Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Linkage and genetic mapping, Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments, single cross over, multiple cross over, two-point cross, three-point cross, map distances, gene order, interference and co-efficient of coincidence.

UNIT IV- Sex determination and elements of biometry

Sex determination and sex linkage, sex limited and sex influenced traits. Sample and Sampling, Collection and Representation of Data, Measures of Central Tendency - Mean, Median and Mode. Measures of Dispersion - Variance and Standard deviation. Test of Hypothesis - Chi square Test. Probability - Definition and rules.

UNIT V- Modern concepts of genetics and mutation

Gene concept: Gene structure, function and regulation. Transcription and translational mechanism of genetic material - protein synthesis. Lac and Trp operons. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Genetic disorders. Nature, structure & replication of genetic material.

PRACTICAL

Study of Microscopy. Study of cell structure and function. Preparation of Slide for Mitosis study. Preparation of Slide for Meiosis study. Monohybrid Ratio and its Modification. Dihybrid Ratio and its Modification. Study of Trihybrid Ratio and back cross methods. Experiments on probability and Chi-square test. Gene Interaction. Estimation of Linkage: Two Point Test Cross. Estimation of Linkage: Three Point Test Cross. 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. Multiple alleles and polygenic inheritance. Studies on sex linked inheritance in Humans and Drosophila.

Lecture schedule

1. Definition of genetics, heredity, inheritance, cytology, cytogenetic; Brief history of developments in genetics and cytogenetics.
2. Physical basis of heredity: Structure and function of cell and cell organelles –
3. Differences between Prokaryotes and Eukaryotes. Cell division – mitosis
4. Cell division - meiosis and their significance
5. Gametogenesis and syngamy in Plants-identical and fraternal twins
6. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram
7. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes -polytene, lampbrush, B chromosomes, ring and isochromosomes.
8. Chromosomal aberration: Variation in chromosome structure –deletion, duplication, inversion and translocation – genetic and cytological implications.
9. Chromosomal aberration: Variation in chromosome number– euploid, aneuploid, types of aneuploids and their origin; Klinefelter syndrome and Turner syndrome.
10. Polyploid- autoand allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, Brassica

11. Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutation theory.
12. Mendel's experiments and laws of inheritance. Rediscovery of Mendel's work
13. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid.
14. Chromosomal theory of inheritance. Allelic interactions –Dominance vs recessive, complete dominance, codominance, incomplete dominance, threshold characters
15. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio –i.) Dominant epistasis (12:3:1)
16. Recessive epistasis (9:3:4) Duplicate and additive epistasis (9:6:1). iv.) Duplicate dominant epistasis (15:1)
17. **Mid Semester Examination**
18. Duplicate recessive epistasis (9:7) vi.)Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i)to (vi).
19. Lethalgenes, Pleiotrophy, penetrance and expressivity, Multiplealleles, bloodgroupinhumans, coat colourin rabbits, selfincompatibility in plants; pseudo alleles,isoalleles.
20. Quantitativeinheritance–Multiplefactorhypothesis– NilssonEhleexperimentonwheatkernelcolour.
21. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers;
22. Linkage - coupling and repulsion; Experiment on Bateson and Punnet
23. Chromosomaltheoryoflinkage ofMorgan–Complete andincomplete linkage,Linkage group.
24. Crossingover– significance of crossingover; cytologicalprooffor crossingover- Stern's experiment; Factors controlling crossing over.
25. Strength oflinkage and recombination; Twopointandthree pointtest cross.
26. Double cross over, interference and coincidence; genetic map, physical map.
27. Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - differenttypes – sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Sex determination in plants – Melandrium, papaya, maize.
28. Genic balance theory of Bridges - Gynandromorphs
29. Sexlinked inheritance– criss cross inheritance –reciprocal difference; holandric genes; sex influenced and sex limited inheritance - Genetic disorders
30. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - cytoplasmic male sterility in maize, kappa particles of paramecium
31. DNA, the genetic material –Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material– Frankel, Conrat and Singer experiment.

32. Structure of DNA – Watson and Crick model Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication. RNA types - mRNA, tRNA, rRNA – Protein synthesis
33. Regulation of gene expression – Operon model of Jacob and Monod – Lac and Trp operons. Cistron, muton and recon.
34. Mutation – characteristics of mutation – micro and macro mutation – CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Practical schedule

1. Study of Microscopy.
2. Study of cell structure and function.
3. Preparation of Slide for Mitosis study.
4. Preparation of Slide for Meiosis study.
5. Monohybrid Ratio and its Modification.
6. Dihybrid Ratio and its Modification.
7. Study of Trihybrid Ratio and back cross methods.
8. Experiments on probability and Chi-square test.
9. Gene Interaction.
10. Estimation of Linkage: Two Point Test Cross.
11. Estimation of Linkage: Three Point Test Cross.
12. Simple interaction of genes-comb character in fowls; Dominant epistasis.
13. Recessive epistasis, Duplicate and additive epistasis.
14. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
15. Multiple alleles and polygenic inheritance.
16. Studies on sex linked inheritance in Humans and Drosophila.
- 17. Final Practical examination.**

Text books

1. Gupta P.K. 2007. Cytogenetics. Meerut: Rastogi Publications.
2. Verma, P.S. and Agarwal V.K. 2007. Genetics. S. Chand and Company Ltd., New Delhi.
3. Russel, P.J. 2000. Fundamentals of genetics. Addison Wesley Longman Publishers, USA.
4. Singh, B.D. 2004. Fundamentals of genetics. Chennai: Kalyani Publishers.
5. Pundhansingh, 2014. Elements of Genetics. Kalyani Publishers.

Reference books

1. Anthony J.F. Griffiths, William M. Gelbart, Richard C. Lewontin & Jeffrey H. Miller. 2002. Modern Genetic Analysis (Second Edition). United States: W. H. Freeman.
2. Benjamin Lewin. 2007. Genes IX. Oxford: Oxford University Press.
3. Daniel Sundararaj, Thulasidas, G. & Stephen Dorairaj, M. 1997. Introduction to Cytogenetics and Plant Breeding. Chennai: Popular Book Depot.
4. Singh, R.J. 2002. Plant cytogenetics. USA: CRC Press.

5. Gardner E. J., Simmons M. J., & Peter Snustad, D. 2015. Principles of Genetics. USA: John Wiley and Sons.
6. Satguru Prasad. (2018). Elements of Biostatistics. Rastogi Publication

Web-references

1. <https://www.cliffsnotes.com/study-guides/biology/biology/classical-mendelian-genetics/principles-of-genetics>
2. <https://www.jax.org/education-and-learning/clinical-and-continuing-education/ccep-non-cancer-resources/core-principles-in-genetics-2004>
3. https://www2.palomar.edu/anthro/mendel/mendel_1.htm
4. <https://www.youtube.com/watch?v=2ycwGQUjmJY&list=PLKIDmFiIyAkT0rhgMzSvGmqQz5IicCMs>

22AEN 201 FUNDAMENTALS OF ENTOMOLOGY (2+1)

Course objective:

- To define entomology and list the contributions of entomologist
- To compare insects with other arthropods of animal kingdom
- To describe insect morphology and anatomy
- To organise insects into different taxonomic categories

Course outcome: Through this course students should be able to

- Recall the basics of entomology and history of entomology in India
- Discuss the position of insects in the animal kingdom
- Explain insect morphology and anatomy
- Appraise insect taxonomy and systematics and analyse different characters of insect orders

THEORY

Unit I- Introduction to entomology and insect morphology

History of Entomology in India. factors responsible for insect dominance, introduction and classification of phylum arthropoda and class insecta, 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.

Unit II- Insect morphology and anatomy

Metamorphosis and diapause in insects. Types of eggs, larvae and pupae. Major sensory organs – Photoreceptors (simple and compound eyes), chemoreceptors and Mechanoreceptors. Structure and functions of digestive system, excretory system, circulatory system and respiratory system of insects

Unit III- Insect anatomy

Structure and functions of nervous, and reproductive system, in insects. Types of reproduction. Glandular system in insects

Unit IV- Insect taxonomy and systematics – apterygote and exopterygote orders

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, and emphasis of families of agricultural importance. Apterygote orders and Exopterygote orders: Ephemeroptera, Odonata, Plecoptera, Grilloblatodia, Orthoptera (Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae), Phasmida, Dermaptera, Embioptera, Dictyoptera (Mantidae, Blattidae), Isoptera, Zoraptera, Psocoptera, Mallophaga, Siphonculata, Hemiptera (Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae), Thysanoptera

Unit V- Endopterygote orders

Classification of Pterygote orders of insects with special emphasis to orders and families of Agricultural importance like Neuroptera (Chrysopidae); Lepidoptera (Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae); Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae); Hymenoptera: (Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae).

PRACTICAL

External features of Grasshopper/cockroach. Methods of collection and preservation of insects including immature stages. Types of insect antennae. Types of insect mouthparts. Types of insect legs. Types of insect Wing venation, types of wings and wing coupling apparatus. Types of insect eggs, larvae and pupae. Dissection of digestive system in insects. Dissection of male and female reproductive systems in insects. Dissection of nervous system in insects. Dissection of Circulatory system in insects. Dissection of respiratory system in insects. Study of taxonomic characters of orders Lepidoptera, Coleoptera, Hemiptera, Diptera, Orthoptera, Dictyoptera, Isoptera, Odonata, Thysanoptera, Neuroptera and Hymenoptera.

Lecture schedule:

1. Study of insects and their importance in Agriculture.
2. History of Entomology in India
3. Position of insects in the Animal Kingdom and relationship with members of Arthropoda.
4. Insect dominance: structural, morphological and physiological factors responsible for dominance.
5. Insect body wall: its structure and function
6. Moulting process in insects.
7. Structure of insect head, its orientation appendages and functions.
8. Structure of insect thorax, appendages and their functions.
9. Structure of insect abdomen, abdominal appendages and their functions.
10. Metamorphosis and diapause in insects.
11. Types of egg, larvae and pupae.
12. Major sensory organs — types of sensilla – photoreceptors (simple and compound eyes), chemoreceptors and mechanoreceptors.
13. Digestive system in insects – structure of alimentary canal, modifications in certain groups, enzymes, digestion and absorption of nutrients.

14. Excretory system in insects – malpighian tubules – accessory excretory organs – physiology of excretion.
15. Circulatory system in insects – haemocoel and dorsal vessel – circulation of blood – composition of haemolymph – blood plasma – haemocytes and their functions.
16. Respiratory system in insects – structure of trachea – tracheoles – types of respiratory system – types of spiracles – respiration in aquatic and endoparasitic insects.
17. **Mid Semester Examination**
18. Nervous system in insects – structure of neuron – central nervous system – conduction of nerve impulses – axonic and synoptic transmission.
19. Male and female reproductive systems in insects – their structures – types of reproduction – oviparous, viviparous, paedogenesis, polyembryony and parthenogenesis.
20. Structure of exocrine glands and their location and simple function – effect on metamorphosis and reproduction.
21. Structure of endocrine glands and their location and simple function – effect on metamorphosis and reproduction.
22. Classification and nomenclature of insects.
23. Important characters of Apterygota
24. Important characters of Exopterygote orders: Ephemeroptera, Odonata, Plecoptera, Grylloblattid.
25. Important characters of Exopterygote orders: Phasmida, Dermaptera, Embioptera,
26. Important characters of Exopterygote orders – Orthoptera and Dictyoptera
27. Important characters of Exopterygote orders – Isoptera, Zoraptera,
28. Important characters of Exopterygote orders - Psocoptera, Mallophaga, Siphonculata
29. Important characters of Exopterygote orders – Hemiptera and Thysanoptera
30. Important characters of Endopterygota order- Neuroptera
31. Important characters of Endopterygota order– Lepidoptera and families of agricultural importance with significant characters.
32. Important characters of Endopterygota orders – Coleoptera and families of agricultural importance with significant characters.
33. Important characters of Endopterygota order- Diptera and families of agricultural importance with significant characters.
34. Important characters of Endopterygota order- Hymenoptera and families of agricultural importance with significant characters.

Practical schedule:

1. External features of Grasshopper/cockroach
2. Methods of collection and preservation of insects including immature stages
3. Types of insect antennae
4. Types of insect mouthparts
5. Types of insect legs
6. Types of insect Wing venation, types of wings and wing coupling apparatus
7. Types of insect eggs, larvae and pupae

8. Dissection of digestive system in insects
9. Dissection of male and female reproductive systems in insects
10. Dissection of nervous system in insects
11. Dissection of Circulatory system in insects
12. Dissection of respiratory system in insects
13. Study of taxonomic characters of orders Lepidoptera and Coleoptera
14. Study of taxonomic characters of orders Hemiptera and Diptera
15. Study of taxonomic characters of orders Orthoptera, Dictyoptera Isoptera and Odonata
16. Study of taxonomic characters of orders Thysanoptera, Neuroptera and Hymenoptera
17. **Final Practical Examination.**

Text books

1. Shanthi. M., Senguttuvan. T., Suresh. K., Kavitha. Z. 2020. Text book on Fundamental Entomology. Agrobios (India).
2. Ragumoorthi K.N., Balasubramani. V., Srinivasan. M. R., Natarajan N. 2017. Insecta: An Introduction..A.E. Publications.

Reference books

1. Chapman, R.F. 1981. The Insects: Structure and function. Edward Arnold (Publishers) Ltd, London, 919p.
2. Snodgrass, R.E. 2001. Principles of Insect Morphology. CBS Publishers and Distributors, New Delhi
3. Richards, O.W. and. Davies. R.G. 1977. Imm's general text book of entomology, Vol.1&2, Chapman and Hall Publication, London, 1345p.
4. Gullan, P.J. and Cranston, P.S. 2001. The insects- An outline of entomology, II edition, Chapman & Hall, Madras, 491p.

Web references:

1. <https://genent.cals.ncsu.edu/bug-bytes/>
2. <https://genent.cals.ncsu.edu/>
3. <https://genent.cals.ncsu.edu/insect-identification/thumbnail-view/>
4. <http://ecoursesonline.iasri.res.in/course/view.php?id=142>

22AEC 201 FARM MANAGEMENT, PRODUCTION, AND RESOURCE ECONOMICS (1+1)

Course objective:

- To impart knowledge on risks in agricultural production and management of resources.

Course outcomes:

- Explain the importance of farm management in agriculture
- Comprehend the benefits and costs involved in farm management
- Analyze farm business
- Devise plans to overcome risks and manage farm resources

- Manage a farm

THEORY

Unit 1- Production economics and farm management - nature and scope

Meaning and concept of farm management, objectives, and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms. Types of farming: Specialized, Diversified, and Mixed farming–Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Cooperative Farming.

Unit 2- Factor – product, factor – factor and product – product relationships

Principles of farm management: Concept of production function and its characteristics and its type, use of production function in decision-making on a farm. Factor-Product relationship. Meaning, Definition – Laws of Returns. Meaning and concept of cost, types of costs, cost curves – and their inter-relationship-shutdown and break-even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family Labor income and farm business income. Economies of Scale–Economies of Size Determination of Optimum Input and Output – Physical and Economic Optimum. Factor – Factor relationship: Least Cost Combination of inputs; Product – Product relationship: Optimum Combination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

Unit 3- Farm planning and budgeting

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 4- Risk and uncertainty in agriculture production

Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies, Crop / livestock/ machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit 5- Resource economics

Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources - Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights: Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities: meaning and types - positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions; Important tissues in economics and management of common property resources of land, water, pasture and forest resources.

PRACTICAL

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 crops – Estimation of costs and returns of livestock products. Preparation of farm plan and budget, farm records and accounts and profit and loss accounts. Break – even analysis- Graphical solution to Linear Programming problem. Collection and analysis of data on various resources in India.

Lecture schedule

1. Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms.
2. Types of farming: Specialized, Diversified, and Mixed farming– Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.
3. Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm
4. Factor- Product relationship: Meaning, Definition – Laws of Returns: Classical production function and its characteristics.
5. Meaning and concept of cost, types of costs, cost curves – and their inter-relationship - shutdown and break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family Labor income and farm business income.
6. Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.
7. Factor – Factor relationship: Least Cost Combination of inputs
8. Product – Product relationship: Optimum Combination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

9. Mid Semester Examination

10. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.
11. 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.
12. 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.
13. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies.
14. Crop / livestock/machinery insurance. Weather based crop insurance - Features and determinants of compensations.
15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources.
16. Natural Resources Issues – Scarcity of resources – Factors mitigating scarcity – Property

- Rights – Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities: meaning and types - positive and negative externalities in agriculture,
17. Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical schedule

1. Preparation of farm layout. Determination of cost of fencing of a farm.
2. Computation of depreciation and cost of farm assets: Valuation of assets by different methods
3. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
4. Determination of most profitable level of inputs use in a farm production process.
5. Determination of least cost combination of inputs.
6. Selection of most profitable enterprise combination
7. Application of cost principles including CACP concepts in the estimation of cost of cultivation and cost of production of agricultural crops.
8. Estimation of cost of cultivation and cost of production of perennial crops /horticultural crops.
9. Estimation of cost of returns of livestock products.
10. Preparation of farm plan and budget.
11. Farm records and accounts: Usefulness, types of farm records: farm production records and farm financial records.
12. Preparation of Cash flow statement
13. Preparation and Analysis of Net worth Statement and Profit and Loss statement
14. Estimation of Break – even analysis.
15. Graphical solution to Linear Programming problem
16. Collection and analysis of data on various resources in India
17. Final Practical Examination

Text books

1. Johl, S, S., & Kapoor, T, R., 2009. Fundamentals of Farm Business Management. New Delhi, Kalyani Publishers. pp.1-255.
2. Mohanty, S, K., 2007. Fundamentals of Entrepreneurship. New Delhi: Prentice Hall India Ltd. pp.1-272
3. Panda, S, C., 2007. Farm Management and Agricultural Marketing. India, Ludhiana: Kalyani Publishers. pp. 10-150.
4. Raju, V, T., 2017. Economics of Farm Production and Management. New Delhi: Oxford & IBH Publishing. pp.1-207

Reference books

1. Debertin, D, L., 2012. Agricultural Production Economics. New York: Create Space Independent Publishing Platform. pp. 1-98.
2. Sankayan, P, L., 1983. Introduction to Farm Management. New Delhi: Tata McGraw Hill Publishing Company Ltd. pp. 1-86.

Web – references

1. www.ediindia.org
2. www.iie.nic.in
3. www.msme.gov.in
4. www.niesbudtraining.org
5. www.nimsme.org
6. www.nsic.co.in
7. www.nabard.org
8. www.uky.edu/~deberti/agprod5.pdf
9. www.hillagric.ac.in/edu/coa/AgriEcoExtEduRSocio/lectures/AgEcon122FSM.pdf

22FMP 211 FARM MACHINERY AND POWER (1+1)

Course objective

The course aims to enable the students to understand the basic principles and parts of internal combustion engine and different tillage, sowing, intercultural, plant protection equipment ,working principles of threshers, harvesting of field and horticultural crops

Course outcomes

- To understand the working principle of different systems and parts of internal combustion engines.
- To equip the students with technical knowledge and skills required for the operation of Tillage, Sowing and intercultural and plant protection machinery needed for agricultural farms.
- To train the students with skills required for the operation, maintenance and evaluation of harvesting, threshing machinery needed for agricultural farms.

THEORY

Unit I- Farm power and IC engines

Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of IC engines, comparison of two stroke and four stroke cycle engines , Study of different components of IC engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply.

Unit-II- Tractor and functional components

Hydraulic control system of a tractor, Familiarization with Power transmission system clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement.

Unit –III- Tillage implements

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture.

Unit-IV- Sowing and intercultural implements

Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, implement for intercultural operations.

Unit-V- Plant protection and harvesting equipments

Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

PRACTICAL

Study of different components of I.C. engine - To study air cleaning and cooling system of engine - Familiarization with clutch – Transmission - Differential and final drive of a tractor- Familiarization with lubrication and fuel supply system of engine - Familiarization with brake – Steering -Hydraulic control system of engine - Learning of tractor driving - Familiarization with operation of power tiller- Implements for hill agriculture - Familiarization with different types of primary and secondary tillage implements – Mould board plough - Disc plough and disc harrow - Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration - Planters and transplanter- Familiarization with different types of sprayers and dusters – Familiarization with different inter-cultivation equipment- Familiarization with harvesting and threshing machinery.

Lecture schedule

1. Farm power in India - sources of farm power and their use in agriculture
2. Working principles of IC Engines-Two stroke and Four stroke engines - applications – comparison-Engine terminology.
3. Components of IC engine and systems of IC engine – air cleaning, cooling, lubricating and fuel supply systems.
4. Tractors- types - transmission system- clutch, gearbox, differential and final drive - hydraulic system.
5. Cost analysis of tractor with attached implement.
6. Tillage, objectives, types –ploughing methods. Primary tillage-mould board plough, disc plough, chisel plough and sub soil plough - components and functions, types, advantages and disadvantages
7. Secondary tillage equipment– cultivators, harrows, levelers, and forming equipment– rotovators –puddlers –manure trawlers and cage wheels, Implements for Hill agriculture.
8. Sowing methods - seed drills and planters- seed cum fertilizer drills - components and functions-Calibration.

9. Mid Semester Examination

10. Paddy transplanters, types, working principle, field and nursery requirements
11. Implements for inter cultural operations –cultivators, sweep, junior hoe, manual weeders and power operated weeders for wetland and garden land
12. Sprayers and their functions, classification, manually operated sprayers, terminology, Nozzle types.
13. Power operated sprayers – Tractor operated boom sprayer, Knapsack mist blower cum duster – Tall tree sprayer-dusters, types and uses.
14. Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery
15. Threshing of crop, thresher and its principles of operation - threshing losses.
16. Harvesting equipment– reapers - mowers and combine harvesters –types, construction and operation-Balers.

17. Harvesting machinery for groundnut, tuber crops, Cotton and sugarcane

Practical schedule

1. Study of working of two and four stroke IC Engines and their systems with solved problems.
2. Study of Tractor clutch, gearbox, differential and final drive. Study of brake, steering and hydraulic control.
3. Learning driving of tractor and power tiller
4. Study of tractors and power tillers – their operation and maintenance
5. Study of mould board plough, - methods of ploughing- with solved problems.
6. Disc plough and sub soiler and their components- Hitching and adjustment of plough - field operation of different tractor drawn primary tillage machinery.
7. Study of cultivator, disc arrows, Rotavator, bund former, ridger, leveler and puddling implements and their operation.
8. Study of seed drills, planters and seed-cum-fertilizer drills and their components and metering mechanisms -calibration- simple problems on calibration.
9. Study and operation of machinery for rice cultivation –puddling implements- rotary puddlers and cage wheels, tray seeder for rice nursery, transplanters -types operation and maintenance- Drum seeder, cono weeder, power weeder and finger type weeder.
10. Study of different inter- cultivation equipment for uplands -manual, animal drawn, power operated -tractor and power tiller operated -field operation
11. Study of plant protection equipment– manually operated sprayers and dusters, knapsack mist blower cum duster, tractor operated sprayers- their operation, adjustment, calibration and safety requirements
12. Study of tools for Hill agriculture and horticultural crops – propagation tools, vegetable transplanter, harvesting tools –lawn mower, hole diggers, tree climber, shredders for crop residue.
13. Threshing machinery for paddy and identification of its components- different threshing drums - calculation of efficiency and losses.
14. Study of paddy reaper and paddy combine-their systems, method of operation and adjustment.
15. Study of harvesters for root crops - turmeric and tapioca and groundnut diggers
16. Problems on cost of operation of tractor operated machinery.

17. Final Practical Examination

Text books

1. Senthilkumar, T., R. Kavitha and V.M.Duraisamy 2015. A Text Book of Farm Machinery, Thannambikkai Publications, Coimbatore . ISBN: 978-9381102305
2. Jagadishwar Sahay, 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi. ISBN: 978-8180140440

Reference books

1. Ojha, T.P and A.M. Michael. 2005. Principles of Agricultural Engineering Vol-I. Jain Brothers, New Delhi. ISBN: 978-8186321638.
2. Nakra C.P 1970. Farm Machinery and Equipment,,: Dhanpat Rai Publishing Company Ltd, New Delhi ISBN: 978-8187433231.

3. Jain, S.C. and C.R.Rai. Farm Tractor and maintenance and repair. Standard Publishers, 1705-B, Naisarak., Delhi- 110006
4. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi
5. S.C. Jain & Grace Philip, Farm Machinery- An approach, Standard publishers Delhi

Web references

1. <https://www.agroengineering.org>
2. <https://www.sciencedirect.com › journal › journal-of-agricultural-engineering>.
3. <https://publons.com › journal › journal-of-agricultural-engineering-and-technology>
4. <https://www.agriculturejournals.cz>
5. <https://ecourses.icar.gov.in/>
6. <https://nptel.ac.in/courses>
7. <https://ciae.nic.in>
8. <https://cmeri.res.in>

22HOR 211 PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS (1+1)

Course objective:

- To impart knowledge on basic cultural practices of Fruits and Plantation crops.
- To insist on modern and advanced techniques to increase the yield and production.
- To learn about the economic estimation of commercial Horticultural crops.

Course outcome:

- The student gains a thorough knowledge on basic and advance production technology.
- Familiarize on basic pruning, training and special techniques of fruits and plantation crops.
- Acquaintance on commercial oriented cultural practices.

THEORY

Unit I- Production status of fruit and plantation crops

Importance and scope of fruit and plantation crop industry in India – Nutritional value of fruit crops- Classification of fruit crops - Area, production, productivity and export potential of fruit and plantation crops.

UNIT II- Crop production techniques in tropical fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra high density planting - cropping systems - after care - training and pruning - water, nutrient and weed management –fertiligation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- value addition.

Fruit crops: mango, banana, papaya, guava, sapota

UNIT III- Crop production techniques in subtropical fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra high density planting - cropping systems - after care - training and pruning - water, nutrient and weed management – fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition.

Fruit crops: citrus, grape, litchi, pineapple, pomegranate, jackfruit and minor fruits

UNIT IV- Crop production techniques temperate fruit crops

Climate and soil requirements –varieties–propagation and use of rootstocks –planting density and systems of planting -High density and ultra high density planting -cropping systems - after care - training and pruning - water, nutrient and weed management –fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition.

Fruit crops: apple, pear, peach, strawberry, nut crops.

UNIT V- Crop production techniques in palms and plantation crops

Climate and soil requirements - varieties - propagation - nursery management - planting and - planting systems - cropping systems - after care - water, nutrient and weed management - intercropping - multi- tier cropping system - mulching- special horticultural practices - maturity indices, harvest and yield - pests and diseases - processing - value addition.

Palms: Coconut, Areca nut, Oil palm and Palmyra

Climate and soil requirements - varieties - propagation - nursery management - planting and - planting systems - cropping systems - after care - water, nutrient and weed management - intercropping - multi- tier cropping system - mulching- special horticultural practices - maturity indices, harvest and yield - pests and diseases - processing - value addition.

Plantation crops: Tea, Coffee, Cocoa, Cashew, Rubber

PRACTICAL

Propagation methods for fruit crops - description and identification of varieties - preparation of plant bio regulators & their uses – nutrient deficiency and disorders of fruit crops - fertilizers- application - pests and diseases- micro propagation in fruit crops- Visit to commercial orchard. Fruit crops: Mango, banana, papaya, guava, sapota, grapes, citrus (Mandarin and acid lime), pomegranate and jackfruit

Propagation methods for plantation crops - description and identification of plantation crops- preparation of plant bio regulators & their uses - nutritional disorders of plantation crops - fertilizers- application - pests and diseases- cost economics of plantation crops. Visit to plantations and plantation industries. Palms and plantation crops: Coconut, Areca nut, Cashew, Tea, Coffee, Rubber and Cocoa

Lecture schedule:

1. Importance and scope of fruit and plantation crop industry in India – nutritional value of fruit crops
2. Classification of fruit crops – area, production, productivity and export potential of fruit and plantation crops
3. Climate and soil – varieties - propagation methods - planting and cropping systems - after care-training and pruning- top working - water, nutrient and weed management- canopy management - plant growth regulation - important disorders-maturity indices and harvest - post harvest management of Mango
4. Climate and soil – varieties - propagation methods - planting and cropping systems - after care-water and nutrient management – fertigation - Weed control - Plant growth regulation -important disorders-maturity indices and harvest-post harvest management of Banana
5. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - crop regulation- important disorders – maturity indices and harvest - post harvest management of Papaya, Guava and Sapota
6. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - crop regulation – nutrient deficiencies and important disorders-maturity indices and harvest- post harvest management of Citrus (Sweet orange, Mandarin and Acid Lime)
7. Climate and soil – varieties - propagation methods - planting and cropping systems-after care – systems of training and pruning and bud forecasting - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of **Grapes**
8. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - plant growth regulation- important disorders – maturity indices and harvest - post harvest management of Pineapple and Litchi
- 9. Mid Semester Examination**
10. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - training and pruning - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of Pomegranate, Jackfruit and minor fruits
11. Climate and soil – varieties - propagation methods - planting and cropping systems - after care-training and pruning - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest- post harvest management of Apple and Pear
12. Climate and soil – varieties - propagation methods - planting and cropping systems - after care-training and pruning - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of Peach and Strawberry, nut crops
13. Climate and soil requirements -varieties-propagation-nursery management-planting systems planting density -nutrient, water and weed management - intercropping at various ages of plantation -multitier cropping - shade management - nutritional disorders - maturity indices - harvest and yield-pests and diseases -grading -processing and value addition of Coconut Areca nut and Cocoa .

14. Climate and soil requirements - varieties - propagation - nursery management - planting and planting density - HDP - UHDP - nutrient, water and weed management - cover cropping - tapping - use of plant growth regulators - top working - maturity indices- harvest and yield , latex yield and processing - pests and diseases - grading - processing and value addition Rubber and Cashew .
15. Climate and soil requirements- varieties – propagation - nursery management - planting density and systems of planting - nutrient, water and weed management - mulching - cropping systems - shade regulation - training and pruning - role of growth regulators - nutritional disorders - maturity indices - harvest and yield - pests and diseases - grading - processing and value addition of Tea.
16. Climate and soil requirements-varieties-propagation-nursery management- planting density and systems of planting - nutrient, water and weed management - mulching - cropping systems - shade regulation - training and pruning - role of growth regulators - nutritional disorders - maturity indices - harvest and yield - pests and diseases - grading - processing and value addition of Coffee.
17. Climate and soil requirements-varieties-propagation-nursery management- planting density and systems of planting - nutrient, water and weed management - mulching - cropping systems - shade regulation - training and pruning - role of growth regulators - nutritional disorders - maturity indices - harvest and yield - pests and diseases - grading - processing and value addition of Oil palm and Palmyra.

Practical schedule

1. Propagation techniques, selection of planting material, varieties, important cultural practices for Mango
2. Propagation techniques, selection of planting material, varieties, important cultural practices for Banana
3. Propagation techniques, selection of planting material, varieties, important cultural practices for Papaya
4. Propagation techniques, selection of planting material, varieties, important cultural practices for Guava
5. Propagation techniques, selection of planting material, varieties, important cultural practices for Sapota
6. Propagation techniques, selection of planting material, varieties, important cultural practices for Grapes
7. Propagation techniques, selection of planting material, varieties, important cultural practices for Citrus (Mandarin and Acid lime)
8. Propagation techniques, selection of planting material, varieties, important cultural practices for Pomegranate
9. Propagation techniques, selection of planting material, varieties, important cultural practices for Jackfruit
10. Preparation and application of PGR's for propagation.
11. Micro propagation, protocol for mass multiplication and hardening of fruit crops.
12. Identification and description of varieties- mother palm and seed nut selection- nursery

practices- seedling selection – fertilizers - application - nutritional disorders - pests and diseases of Coconut

13. Identification and description of varieties- mother palm and seed nut selection- nursery practices- seedling selection – fertilizers - application - nutritional disorders - pests and diseases of Arecanut and Cocoa
14. Identification and description of varieties - nursery practices – training and pruning - pests and diseases –processing of Tea and Coffee.
15. Identification and description of varieties, clones - bud wood nursery practices - propagation techniques - top working – preparation of plant bio regulators and its uses- pests and diseases - processing of Rubber and Cashew
16. Visit to commercial orchard and plantation industries.
17. **Final Practical Examination.**

Reference books

1. N Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops, IBH Publishing Co. Pvt. Ltd., New Delhi.
2. M Kavino, V Jegadeeswari, R M Vijayakumar and S Balakrishnn, 2019. Production Technology for Fruits and Plantation Crops, Narendra Publishing

E – references

1. <http://www.jhortscib.com>
2. <http://journal.ashspublications.org>
3. <http://www.actahort.org/>
4. <http://www.aphorticulture.com/crops.htm>
5. <http://cpcri.nic.in/>

22PAT 201 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Course objective:

- Detailed study and identification of plant diseases caused by fungal, bacterial and viral pathogens.

Course outcome:

- To study about different plant diseases caused by biotic factors.
- To study morphology, symptoms, life cycle, reproductive and resting structures of Fungal, bacterial and viral pathogens causing plant disease.
- To study the mode of interaction between plant and pathogens.
- To identify the plant diseases and their causes.

THEORY

Unit I - Plant pathogenic organisms

Introduction- Definition, History of plant pathology, Economic importance of plant diseases. Terms and concepts of Plant Pathology. Classification of plant disease, Factors affecting disease development. Plant Pathogenic organisms: Protozoa, Phytonomonas, Chromista, Fungi, Bacteria,

Candidatus phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites.

Unit II – Pathogenesis

Pathogenesis, Host pathogen interaction. Mode of infection, pre-penetration, penetration and post penetration, Role of enzymes and toxins on disease development, Plant defense mechanisms. Effect of pathogen on physiological functions of the plants.

Unit III - General characters and taxonomy of protozoa, chromista and fungi

General characters definition of fungus, somatic structures, types of fungal thalli, fungal tissues, Resting spores, modifications of thallus, reproduction (asexual and sexual) and symptoms caused by plant pathogenic fungi. Nomenclature: Binomial system of nomenclature, rules of nomenclature, classification of fungi. divisions, sub-divisions, orders and classes. Kingdom: Protozoa, Phylum: *Plasmodiophoromycota*, *Plasmodiophora brassicae*., Kingdom: Chromista, Phylum: Oomycota; *Pythium*, *Phytophthora*, *Sclerospora*, *Peronosclerospora* and *Albugo* Kingdom: Fungi; Phylum: *Chytridiomycota*- *Synchytrium*; Phylum: *Zygomycota*; *Mucor*, *Rhizopus*

Unit IV - General characters and taxonomy of fungi - ascomycota and basidiomycota

Phylum: Ascomycota and Basidiomycota *Taphrina*, *Capnodium*, *Mycosphaerella*, *Helminthosporium*, *Macrophomina*, *Venturia*, *Lewia*, *Sclerotium*, *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Claviceps*, *Glomerella*, *Magnaporthe* *Gibberella*, *Verticillium*, *Puccinia*, *Uromyces*, *Ustilago*, *Tilletia*, *Ustilaginoidea*. *Hemelia*, *Rhizoctonia*, *Exobasidium*, *Ganoderma*, *Agaricus*, *Pleurotus* and *Calocybe*.

Unit V - Bacteria, phytoplasma, virus, viroid, algae, phanerogams, and abiotic disorders

General characters and symptoms- phytopathogenic bacteria, *Candidatus Phytoplasma*, Spiroplasma, Fastidious vascular bacteria, viruses, viroids, algae, Phanerogams – Abiotic disorders.

PRACTICAL

Working principle and uses of various laboratory tools and equipment's. Fungi- definition. Study of different morphological structures and fruiting bodies of fungi. Study of symptoms of various plant diseases caused by fungi, bacteria, virus, viroids, algae, phytoplasma, etc. Important characters of representative fungal genera of Oomycota- *Sclerospora*, *Plasmopara* and *Albugo*, *Plasmodiophoromycota* and Oomycota- *Pythium* and *Phytophthora*, *Zygomycota*-*Rhizopus*, *Mucor*, Ascomycota.-*Taphrina*, *Capnodium*, *Cercospora*, *Botryodiplodia*, *Drechslera* and *Alternaria*, Ascomycota.-*Eurotium*, *Penicillium*, *Fusarium*, *Claviceps* and *Verticillium*, Ascomycota.- *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uninula*, *Podosphaera* and *Sphaerootheca*, Ascomycota.-*Colletotrichum*, *Pestalotia*, *Pyricularia*, *Sarocladium* and *Macrosporium*, Basidiomycota- *Puccinia*, *Uromyces* and *Hemileia*, Basidiomycota- *Ustilago*, *Spacelotheca*, *Tolyposporium* and *Exobasidium*. Study of bacterial diseases –leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot. Symptoms and vectors of viral diseases mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunched top. Transmission of plant viruses. Plant phanerogamic parasites. Field visit

Lecture schedule

1. Plant Pathology - Introduction, definition, and history

2. Terms and concepts of plant pathology.
3. Classification of plant diseases and factors affecting disease development.
4. Plant Pathogenic organisms: Protozoa, Chromista, Fungi, Bacteria, and Phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites.
5. Host pathogen interaction, Mode of infection, pre-penetration, penetration and post penetration
6. Survival and dispersal of plant pathogens
7. Effect of Pathogen on physiological functions of the plants
8. Role of enzymes
9. Role of toxins
10. General characters of fungi
11. Different morphological structures of fungi
12. Mode of nutrition in fungi
13. Asexual Reproduction in fungi
14. Sexual Reproduction in fungi
15. Parasitism in fungi, Mode of nutrition
16. Classification of *Plasmodiophoromycota*- *Plasmodiophora brassicae*
17. **Mid Semester Examination**
18. Classification of *Chromista*- Oomycota; *Pythium*, *Phytophthora*, *Sclerospora*, *Peronosclerospora* and *Albugo*
19. Classification, general characters symptoms and life cycle of *Chytridiomycota*-*Synchytrium*
20. Classification, general characters symptoms and life cycle of *Zygomycota* - *Mucor*, *Rhizopus*
21. Classification, general characters symptoms and life cycle of *Taphrina*, *Capnodium*, *Mycosphaerella*, *Helminthosporium*, *Macrophomina*, *Venturia*,
22. Classification, general characters symptoms and life cycle of *Ascomycota* *Lewia*, *Sclerotium*, *Eurotium*, *Talaromyces*
23. Classification, general characters symptoms and life cycle of *Ascomycota* *Erysiphe*, *Leveillula* and *Phyllactina*
24. Classification, general characters symptoms and life cycle of *Ascomycota* *Claviceps*, *Glomerella*, *Magnaporthe* *Gibberella*, *Verticillium*, *Ustilaginoidea*.
25. Classification, general characters symptoms and life cycle of *Basidiomycota*- *Puccinia*, *Uromyces*, *Ustilago*, *Tilletia*,
26. Classification, general characters symptoms and life cycle of *Basidiomycota*- *Agaricus*, *Pleurotus* and *Calocybe*.
27. Classification, general characters symptoms and life cycle of *Basidiomycota* -*Rhizoctonia*, *Exobasidium*, *Ganoderma*,
28. Classification of bacteria, General characters of bacteria and their symptoms.
29. Phytoplasma, spiroplasma, fastidious vascular bacteria and their symptoms.
30. General characters and Properties of virus
31. Symptoms of viruses.
32. General characters and symptoms of viroids

33. General characters and symptoms of Phanerogamic parasites and algae.
34. Abiotic factors and their symptoms.

Practical schedule

1. Working principle and uses of various laboratory tools and equipment's.
2. Fungi- definition. Study of different morphological structures and fruiting bodies of fungi.
3. Study of symptoms of various plant diseases caused by fungi, bacteria, virus, viroids, algae, phytoplasma, etc.
4. Important characters of representative fungal genera of *Oomycota*- *Sclerospora*, *Plasmopara* and *Albugo*
5. Important characters of representative fungal genera of *Plasmodiophoromycota* and *Oomycota*- *Pythium* and *Phytophthora*
6. Important characters of representative fungal genera *Zygomycota*-*Rhizopus*, *Mucor*
7. Important characters of representative fungal genera of *Ascomycota*-*Taphrina*, *Capnodium*, *Cercospora*, *Botryodiplodia*, *Drechslera* and *Alternaria*
8. Important characters of representative fungal genera of *Ascomycota*-*Eurotium*, *Penicillium*, *Fusarium*, *Claviceps* and *Verticillium*
9. Important characters of representative fungal genera of *Ascomycota*- *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uninula*, *Podosphaera* and *Sphaerotheca*
10. Important characters of representative fungal genera of *Ascomycota*-*Colletotrichum*, *Pestalotia*, *Pyricularia*, *Sarocladium* and *Macrosporium*
11. Important characters of representative fungal genera of *Basidiomycota*- *Puccinia*, *Uromyces* and *Hemileia*
12. Important characters of representative fungal genera of *Basidiomycota*- *Ustilago*, *Spacelotheca*, *Tolyposporium* and *Exobasidium*.
13. . Study of bacterial diseases –leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
14. Symptoms and vectors of viral diseases mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top. Transmission of plant viruses.
15. Plant phanerogamic parasites.
16. Field visit
17. **Final Practical Examination**

Note: Students should submit fifty well preserved disease specimens

Text books

1. Agrios, G.N. 2005. *Plant Pathology* (5th Ed). New York: Academic Press. pp. 1-922.
2. Alice, D., & Jeyalakshmi, C. (2014). *Plant Pathology*. Coimbatore: A.E Publications. pp. 1-375.
3. Dube, H.C. 2013. *An introduction to Fungi*. India: Scientific publisher. pp. 1-603.
4. Singh, R.P. 2012. *Plant pathology*. India: Kalyani publishers. pp. 1-724.

Reference books

1. John Webster & Ronald Weber. 2007. *Introduction to fungi*. UK: Cambridge University Press. pp. 1-841.
2. Kirk, P.M. et al. 2008. *Ainsworth and Bisby's Dictionary of the Fungi* (10th ed.). Oxon, U.K: C.A.B International. pp.1-771.
3. Paul et al. 2009. *Bergey's Manual of Systematic Bacteriology*. New York: Springer-Verlag.
4. Richard N. Strange. 2003. *Introduction of Plant Pathology*. London: John Wiley & Sons Ltd. pp.1-480.

Web-references

1. <http://www.biologydiscussion.com>
2. www.mycology.net
3. www.bspp.org.uk
4. <https://www.microscopemaster.com/fungi>
5. <https://talk.ictvonline.org/taxonomy/>
6. www.apsnet.org/edcenter
7. www.Tolweb.org
8. <http://www.hillagric.ac.in/edu/coa/ppath/lectures.htm>
9. <http://ecoursesonline.iasri.res.in/course/view.php?id=143>
10. www.ucmp.berkeley.edu/fungi
11. www.ictv.org
12. www.vivo.library.cornell.edu
13. <https://www.youtube.com/c/MTutorEdu/search?query=plant+pathology>
14. <https://www.youtube.com/channel/UCsqovy3LIp-dB8pMxU2VZ7A>

22STA 211 STATISTICAL METHODS (1+1)

Course objective:

The purpose of learning this course is to understand the fundamental concepts and skills. To calculate mathematical models applicable to field trials and to apply sampling theory in all problems of agricultural sciences.

Course outcome:

- Define the basics of probability and statistics
- Choose the model and analyze the system using random variables
- Apply the testing of hypothesis
- Apply the statistical models in the field
- Explain the techniques related in sampling
- Identify the fundamental difference between discrete and continuous distribution

THEORY

Unit I- Descriptive statistics

Basic concepts – statistics – variable – types and sources of data – classification and tabulation of data. Diagrammatic and graphical representation of data – simple, multiple, component and percentage bar diagrams, pie diagram – frequency polygon, frequency curve and histogram.

Construction of frequency distribution tables. Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode – merits and demerits. Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, and coefficient of variation – skewness and kurtosis – merits and demerits.

Unit II- Probability distributions and sampling theory

Probability – basic concepts – additive and multiplicative laws (without proof). Probability distributions – Discrete distributions: Binomial and Poisson. Continuous distribution: Normal distribution – definitions and properties. Sampling theory – population – sample – parameter and statistic – sampling distribution – sampling vs complete enumeration – Types of sampling – simple random sampling – selection of simple random sample using random number tables.

Unit III- Testing of hypotheses

Null and alternative hypothesis – types of errors – critical region and level of significance – degrees of freedom. Large sample test – single proportion and difference between two proportions – single mean and difference between two means. Small sample tests – F-test – t-test for testing the significance of single mean – independent t test and paired t test – chi square test for goodness of fit – chi square test for testing the association of attributes by $m \times n$ contingency table – 2×2 contingency table – Yates' correction for continuity.

Unit IV- Correlation and regression

Correlation – Scatter diagram – Karl Pearson's correlation coefficient definition – computation – types of correlation and properties. Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient.

Unit V- Analysis of variance and experimental designs

Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD) – lay out, analysis, merits and demerits of the above mentioned designs.

PRACTICAL

Formation of frequency distribution tables – Diagrammatic and graphical representation. Computation of different measures of central tendency and computation of various measures of dispersion for raw and grouped data – calculation of coefficient of variation (CV) – measures of skewness and kurtosis. Simple problems in Binomial distribution, Poisson and Normal distribution – Selection of simple random sampling. Large sample test for single proportion and difference between two proportions and Large sample test for single mean and difference between two means. t-test for single mean – t-test for testing the significance of two means for independent and paired samples – chi square test for goodness of fit and test for independence of two attributes in a contingency table – Yates correction for continuity – calculation of the correlation coefficient – fitting of simple linear regression equation – One way and two way ANOVA – completely randomized design (CRD) – randomized block design (RBD) – Latin square design (LSD).

Lecture schedule

1. Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode –Merits and demerits
2. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation - Skewness and kurtosis
3. Diagrammatic representation of data; One, Two and Three dimensional diagrams with applications. Graphical representation of data; Histogram, frequency polygon, frequency curve, ogives.
4. Sampling theory – population – sample – parameter and statistic – sampling distribution - sampling vs complete enumeration –Types of sampling - simple random sampling selection using random numbers Stratified - Systematic sampling
5. Probability distributions – Discrete distributions: Bernoulli
6. Binomial and Poisson distribution,
7. Continuous distribution: Normal distribution
8. Null and alternative hypothesis – types of errors - critical region and tests of significance - Large sample test – single mean and difference between two means.
9. **Mid-Semester Examination**
10. Single proportion and difference between two proportions
11. Small sample tests – F-test - t-test for testing the significance of single mean
12. Independent and paired t test
13. Chi square test for testing the association of $r \times c$ contingency table
14. Correlation – Scatter diagram - Karl Pearson's correlation coefficient – Spearman's rank Correlation - computation and properties
15. Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient.
16. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs
17. Completely Randomized Design (CRD) – Randomized Block Design (RBD)

Practical schedule

1. Computation of arithmetic mean, geometric mean, harmonic mean, median and mode
2. Computation of range, standard deviation, variance, coefficient of variance
3. Histogram, frequency polygon, frequency curve, ogives.
4. Selection of sample using simple random sampling method, Simple problems in Bernoulli distribution
5. Simple problems in Binomial distribution and Poisson distribution
6. Simple problems in Normal distribution
7. Large sample test – test for single proportion and difference between two proportions
8. Large sample test – test for single mean and difference between two means
9. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only)
10. Paired t-test
11. Chi square test

12. Computation of Karl Pearson's correlation coefficient
13. Fitting of simple linear regression equation y on x – correlation and regression
14. Analysis of Completely Randomised Design (CRD) – for equal replications only
15. Analysis of Randomised Block Design (RBD) and FRBD
16. Analysis of Split plot design and Latin Square Design (LSD)
17. **Final Practical Examination**

Text books

1. Chandel S. R. S. 2014. *A Handbook of Agricultural Statistics*. Kanpur: Achal Prakashan Mandir. pp. 1-87
2. Gupta, S.P. 2004. *Statistical Method*. New Delhi: Sultan chand and sons. pp. 1-1476.
3. Nageswara Rao, G. 2007. *Statistics for Agricultural Sciences*. Hyderabad: B.S. Publications. pp. 1- 512
4. Panse, V.G. & Sukhatme, P. V. 1954. *Statistical Methods for Agricultural Workers*. India: Indian Council of Agricultural Research. pp. 1- 361
5. Vittal P. R. 2012. *Mathematical Statistics*. Chennai: Margham Publications. pp. 1 – 950

References books

1. Agrawal B.L. 2005. *Basic Statistics*. New Delhi: New age International Ltd. pp. 1- 656
2. Dhamu, K.P. & Ramamoorthy, K. 2009. *Fundamentals of Agricultural Statistics*. India: Scientific Publishers. pp. 1- 130
3. Gupta, S.P. 1978. *Elementary Statistical Method*. New Delhi: Sultan chand and sons. pp. 1-438
4. Kailasam, G. & Gangaiselvi, R. 2010. *Applied Statistics*. New Delhi: Kalyani Publishers. pp. 1 -200
5. Vijay K. Rohatgi, Ehsanes Saleh A.K.M.D. 2008. *An Introduction to Probability and Statistics*, (2nd ed.). New Jersey: John Wiley and sons Inc. pp.1 - 631

Web references

1. www.statisticshowto.com
2. www.mathisfun.com
3. www.mathinsight.org
4. <http://www.statistics.com/resources/glossary/>
5. www.statsoft.com
6. http://www.iasri.res.in/ebook/EB_SMAR/index.html
7. www.statsci.org/jourlist.html

22AMP 201 LIVESTOCK AND POULTRY MANAGEMENT (2+1)

Course objective:

- Explain the contributions of different types of livestock and Poultry
- Summarize Animal Population and rearing system in livestock and Poultry
- Outline the information on diversified Poultry
- Explain different livestock management systems
- Describe feed formulation and nutritional management in livestock and poultry

- Describe the management and bio security measures

Course outcome:

- Illustrate skills on different rearing system of livestock
- Explain the management of different age group animals
- Describe the poultry sector
- Demonstrate animal handling
- Discuss clean milk production and Milk processing methods
- Outline entrepreneurship skills

THEORY

Unit I- Introduction to livestock management

Significance of Livestock and Poultry in Indian Economy – Livestock and Poultry census – Different livestock development programs of Government of India and Tamil Nadu-Variety systems of livestock production extensive – semi intensive -intensive- mixed-Integrated and specialized farms.

Unit II- Dairy cattle management

Important White and Black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - Cross breeding- Upgrading - Economic traits of cattle –Culling - Estrus Cycle – Artificial Insemination –Introduction to Embryo transfer–Housing –Space requirement calf and adult stock –System and types of housing - Feeding and Management of Calf, Heifer, Pregnant, Milch animal and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder–Total Mixed Ration – composition of concentrate mixture for different stage - Milking methods - Clean milk production – Factors affecting milk composition – Common diseases of cattle – classification – symptoms - preventing and control measures.

Unit III- Sheep and goat management

Breeds –Sheep and goat classification —Economic traits - system of rearing -Housing Management–Floor spacerequirement-CareandManagementofyoungandadultstock–Nutrition–FeedandfoddersofSmall ruminants – Flushing - Common diseases – prevention and control.

Unit IV- Management of swine

Classification of breeds –Economic traits -Housing -Nutrition – creep feeding -Care and Management of Adult and Young Stock - Common disease- prevention and control.

Unit V- Poultry management

Classification of breeds - Commercial Strains of broilers and layers – Housing – brooding – deep litter and cage system – care and Management of broilers and layers -Nutrition of Chick, grower, Layer and broiler– Incubation and Hatching of Eggs -Common Diseases -Control and prevention.

PRACTICAL

Study of external parts of Livestock - Identification of livestock and poultry-Tattooing-ear tags-wing and leg bands-Common restraining methods-Disbudding (or) Dehorning-Different methods of castration-Dentition Study of type design of animal and poultry houses-Selection of dairy cow and work bullock-Determination of specific gravity, fat percentage and total solids of milk-Demonstration of cream separation,-Identification of feeds and fodder- Economics Dairy, Goat and Swine farming - Study of external parts of Fowl - Preparation of Brooder House - Brooder

management-Identification of layer and non layer- Debeaking, delousing and deworming of poultry-Vaccination schedule for broiler and layer-Dressing of broiler chicken - Economics of Broiler and Layer Farming – Visit to a modern Dairy and commercial layer and broiler farms - Demonstration of incubator and setter.

Lecture schedule:

1. Significance of livestock and poultry in Indian economy-livestock and poultry census. Different livestock development programmes of Government of India and Tamil Nadu.
2. Various systems of livestock production-extensive– semi intensive, intensive-mixed integrated and specialized farms.
3. Definition of breed-classification of indigenous white and black cattle-breed characteristics of Tamil Nadu cattle breeds and Indian breeds.
4. Breed-characteristicsofexoticcattle-JerseyandHolsteinFriesian–IndianBuffaloes-Murrah, Surti and Toda.
5. Breeding-cross breeding-upgrading-economic traits of cattle-culling importance and methods.
6. Estrous cycle – signs of estrous – artificial insemination-merits and demerits-Principles and outline of embryo transfer.
7. Housing management farm site selection and floors pace requirement for calves, heifer, milch animal and work bullocks.
8. Systems of housing-single row system-double row system- head to head and tail to tail- merits and demerits - Type design of house.
9. Care and management of new born calf and heifers.
10. Care and management of pregnant animal and lactating animals.
11. Care and management of dry cows and work bullock.
12. Nutrition- definition- ration- balanced ration-desirable characteristics of a ration. Classification of feed stuffs-concentrate and roughage-comparison, Total Mixed Ration.
13. Model composition of concentrate mixture of young and adult stock-age wise feed and fodder requirement-Importance of green fodder.
14. Milking methods-clean milk production-factors affecting milk yield and composition.
15. Diseases-classification-viral, bacterial and metabolic-general control and preventive measures.
16. Viral diseases-foot and mouth disease, bacterial diseases, anthrax, hemorrhagic septicemia- black quarter - metabolic-tympanites, acidosis, ketosis and milk fever.
17. **Mid Semester Examination**
18. Sheep and goat farming-classification of breeds of Indian and exotic origin – economic traits.
19. Systems of rearing housing management- type design-floor diagram-space requirement for adult and young stock.
20. Care and management of ram, ewe and lamb-nutrition- feeds and fodder for small ruminants.
21. Care and management of buck, doe and kid- nutrition- flushing.

22. Common ailments of sheep and goat-sheep pox-foot and mouth-blue tongue- PPR-enterotoxaemia Ecto and endo parasites.
23. Swine husbandry –Common breeds of exotic origin-Large White Yorkshire, Landrace and Duroc - economic traits- housing of Swine.
24. Care and management of sow, boar and piglets-nutrition- creep feeding.
25. Disease prevention and control of swine diseases –hog cholera, foot and mouth, ecto and endo parasites.
26. Classification of breeds - commercial strains of layer and broiler.
27. Care and management of Chicks-brooder management.
28. Systems of housing-deep litter and cage system-floor space requirement-common litter material litter management-merits and demerits.
29. Care and management of Grower and Layers- vaccination schedule.
30. Care and management of broilers –vaccination schedule.
31. Incubation and hatching of eggs.
32. Nutrition-feed formulation-composition of chick, grower, layer broiler- starter and Finisher mash Feed Conversion Ratio /dozen egg or kg of meat production.
33. Classification of disease –viral– bacterial- protozoan- causative organisms, symptoms and prevention – viral diseases- Ranikhet – IBD-avian flu.
34. Bacterial disease-E.coli-coryza-salmonellosis-protozoan–coccidiosis-causative organism, symptoms and preventive measures. Management of dead birds and manure.

Practical schedule

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, Dehorning, Castration and Dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock
7. Determination of specific gravity, fat %, total solids, solids not fat
8. Demonstration of cream separation
9. Identification of feed & fodder
10. Economics of dairy, goat and swine Farming
11. Study of external parts of owl. Preparation of brooder house
12. Identification of layer and non-layer
13. Debeaking, delousing, deworming of poultry Vaccination schedule for broiler and layer
14. Demonstration of dressing of broiler. Economics of layer and broiler farming
15. Visit to a modern dairy and commercial layer and broiler farms
16. Demonstration of incubator and setter

17. Final Practical examination

Text book

1. CAR. 2002. *Handbook of Animal Husbandry* (4th ed). New Delhi: ICAR. pp.1-1549.
2. G.C. Banerjee. 2013. *A Text Book of Animal Husbandry* (8th ed). New Delhi : Oxford and IBH Publishing Company Private Limited. pp.1-1079

3. Lesson, S and Summers, J.D. 2001. *A text book of Scott Nutrition of the chicken* (4th ed). Canada: University books. pp.1-586
4. Reddy, D.V. 2001. *Principles of animal nutrition and feed technology* (2nd ed). Oxford and New Delhi: IBH Publishing Company Private Limited. pp.1-425

Reference books

1. Sastry, N.S.R and Thomas, C.K. 2005. *Livestock Production Management*. (3rd ed). Ludhiana: Kalyani Publishers. pp.1-850
2. Gopalakrishnan, C.A., and Lal, D.M.M. 1992. *Livestock and Poultry Enterprises for Rural Development*. Ghaziabad, Uttar Pradesh: Vikas Publications Private Limited. pp.1-1096
3. Sreenivasiah, P.V. 2006. *Scientific Poultry Production* (3rd ed). Lucknow: International Book Distributing Co. pp- 1-1487.

Web-references

1. <https://www.drvt.in/p/e-books.html>
2. <https://www.coursera.org/lecture/livestock-farming/1-3-farming-101-the-basics-of-livestock-production-wfhyL>
3. <http://www.tanuv.ac.in/e-learning/objectivities.html>
4. <https://ecourses.icar.gov.in/>

Study tour (0+1)

The students will undertake the short tour during third semester for seven days covering KVK's, Research stations and ICAR institutes in the southern part of Tamil Nadu. The study tour will provide an exposure to the students to know about the soil, climatic conditions and cropping patterns in the respective agro-climatic zones. The students will also have first-hand information on latest technologies on various crops and allied activities.

2022 Batch

Semester III

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	22 AGR 201	Crop Production Technology I (Kharif Crops)	1+1	2
2.	22 AGR 202	Principles of Weed Management	1+1	2
3.	22 AEN 201	Fundamentals of Entomology	2+1	3
4.	22 PBG 201	Fundamentals of Genetics	2+1	3
5.	22 AEC 201	Farm Management, Production and Resource Economics		1+1
6.	22 FMP 211	Farm Machinery and Power	1+1	2
7.	22 HOR211	Production Technology for Fruit and Plantation Crops	1+1	2
8.	22 PAT 201	Fundamentals of Plant Pathology	2+1	3
9.	22 STA 211	Statistical Methods	1+1	2
10.	22 AMP 201	Livestock and Poultry Management	2+1	3
11.	22 AGR 203	Study Tour*	0+1*	1*
Total	14+11	25		
12.	22 NSS/ NCC 101	NSS or NCC	0+1#	1#
13.	22 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV *Non- gradial Course

Semester III

22AGR 201 CROP PRODUCTION TECHNOLOGY – I (Kharif crops) (1+1)

Course objective:

- Imparting the fundamentals of crop production technology of kharif crops
- Demonstrating practical applications of crop production
- Providing knowledge on the importance and practices followed in growing kharif crops

Course outcome: At the end of the course the student should be able to

- Comprehend the fundamentals of crop production of cereals
- Decide on the crops, fertilizers and irrigation measures for production of pulses
- Plan for sustainable crop production of oilseeds
- Explain the techniques involved in crop production of fibre and forage crops
- Correlate parameters involved in crop cultivation and practice kharif crop cultivation

THEORY

Unit I- Cereals

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rice and Maize (from land preparation to harvest) and yield.

Unit II- Millets

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Sorghum, Pearl millet, Small millets - Finger millet, Foxtail millet, little millet, Kodo millet, Barnyard millet and Proso millet

Unit III- Pulses

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Redgram, Blackgram, Greengram and Cowpea

Unit IV- Oilseeds (Kharif)

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Groundnut, sesame and Soybean.

Unit V- Fibre and forage

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Cotton, jute, fodder sorghum and cummunapier

PRACTICAL

Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria. Practicing various nursery types and main field preparation for rice crop. Nursery and main field preparation for important millets, pulses and oilseeds. Acquiring skill in different seed treatment techniques in important kharif crops. Estimation of plant population per unit area for important kharif crops. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals and millets. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses and oilseeds. Acquiring skill in using seed drill for sowing operations. Acquiring skill in foliar nutrition for important field crops. Observations on growth parameters of cereals and millets. Observations on growth parameters of pulses and oilseeds. Study of yield parameters and estimation of

yield in cereals and millets. Study of yield parameters and estimation of yield in pulses and oilseeds. Working out cost and returns of important cereals, millets, pulses and oilseeds crops. Visit to farmer's field / research stations to study the cultivation techniques of cereal, millets, pulses, cotton and oilseeds. Visit to nearby Agricultural Research Station / Farmer's field.

Lecture schedule:

1. Importance and area, production and productivity of major cereals and millets of India and Tamil Nadu.
2. Importance and area, production and productivity of pulses and oilseeds crops of India and Tamil Nadu.
3. Rice - Origin - geographic distribution - economic importance - varieties - soil and climatic requirement.
4. Rice - cultural practices - yield - economic benefits.
5. Special type of Rice cultivation – SRI - and Hybrid rice cultivation.
6. Maize - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
7. Sorghum and Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
8. Finger millet and Minor millets - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
9. Mid Semester Examination
10. Pigeonpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
11. Greengram, Blackgram and Cowpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield - Agronomy of rice fallow pulses.
12. Groundnut - Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices yield and economics.
13. Sesame and Soybean - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
14. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.

15. Jute- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
16. Fodder sorghum- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
17. Cumbunapier- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.

Practical schedule:

1. Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria.
2. Practicing various nursery types and main field preparation for rice crop.
3. Nursery and main field preparation for important millets, pulses and oilseeds.
4. Acquiring skill in different seed treatment techniques in important kharif crops.
5. Estimation of plant population per unit area for important kharif crops.
6. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals and millets.
7. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses and oilseeds.
8. Acquiring skill in using seed drill for sowing operations.
9. Acquiring skill in foliar nutrition for important field crops.
10. Observations on growth parameters of cereals and millets.
11. Observations on growth parameters of pulses and oilseeds.
12. Study of yield parameters and estimation of yield in cereals and millets.
13. Study of yield parameters and estimation of yield in pulses and oilseeds.
14. Working out cost and returns of important cereals, millets, pulses and oilseeds crops.
15. Visit to farmer's field / research stations to study the cultivation techniques of cereal, millets, pulses, cotton and oilseeds.
16. Visit to nearby Agricultural Research Station / Farmer's field.
17. Final Practical Examination.

Text books:

1. Chidda Singh, Prem Singh and Rajbir Singh. 2018. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co Pvt.Ltd; 2nd edition. New Delhi.
2. Rajendra Prasad. 2016. Textbook of Field Crops Production (Volume 1 & 2). Indian Council of Agricultural Research (ICAR), New Delhi.
3. Mukund Joshi., 2015. Text Book of Field Crops. PHI Learning Private limited. New Delhi.
4. Reddy. S.R. 2014. Principles of Crop Production. Kalyani Publishers, Ludhiana.
5. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 2010. Scientific Crop Production in India. Rama publishing House, Meerut.

Reference books:

1. Crop Production Guide. 2020. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
2. Reddy, S.R. 2012. Agronomy of field crops. Kalyani publishers, New Delhi.
3. Singh. S.S. 2015. Crop management under irrigated and rainfed conditions. Kalyani Publishers, New Delhi.
4. Srinivasan Jeyaraman. 2018. Field crops production and management (Volume I & 2). Oxford and IBH Publishers. India.
5. Yellamanda Reddy, T. and G.H. Sankara Reddy. 2017. Principles of Agronomy, Kalyani publishers, Ludhiana.

Web references

1. www.crida.org
2. www.cgiar.org
3. www.tnau.ac.in/agriporal
4. www.rkmp.irri.org.
5. <https://www.agrimoon.com/wp-content/uploads/Introduction-to-major-field-crops.pdf>

22AGR 202 PRINCIPLES OF WEED MANAGEMENT (1+1)

Course objective: The course is aimed at

- Identifying major weeds affecting farming ecosystems

- Imparting knowledge on organic and inorganic herbicides
- Introducing solutions to manage herbicide resistance

Course outcome: At the end of the course the student should be able to

- Gain knowledge on weeds affecting ecosystems
- Explain the mode of action of herbicides
- Understand the role of allelochemicals and the applications of bio-herbicides
- Analyse herbicide compatibility
- Cite ways of overcoming herbicide resistance
- Recommend weed management strategies

THEORY:

Unit I- Introduction to weeds

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination - Weed biology and ecology - Weed seed dormancy - Weed seed bank - Crop weed association - Crop weed competition and allelopathy effect.

Unit II- Weed control methods

Concepts of weed prevention, control and eradication - Methods of weed control: physical, cultural, chemical and biological methods - Non chemical weed management - Integrated weed management (IWM).

Unit III- Herbicides

Herbicides: Classification, characteristics, formulations, methods of application, advantages and equipment's – Adjuvants – Herbicide mixture - Advantages and limitation of herbicide usage in India.

Unit IV- Herbicide selectivity

Selectivity of herbicides; Herbicide absorption and translocation - Compatibility of herbicides and other agro inputs - Mode of action of herbicides and their selectivity - Herbicide residue management - Persistence and degradation of herbicides in soil and plants - Herbicide resistant weeds - Herbicide resistant GM crops.

Unit V- Weed management in crops

Weed management in major field and horticultural crops - weed shift - weed control in non-cropped areas - Parasitic, aquatic and problematic weeds and their control.

PRACTICAL:

Identification, classification and characterization of terrestrial weeds, aquatic weeds and parasitic weeds. Weed survey and weed vegetation analysis - density, frequency, SDR and IVI. Study on biology of nut sedge and Bermuda grass, parthenium and celosia. Practicing skill development on cultural and non-chemical weed management. Identification, classification and characterization of herbicides. Practicing skill development on herbicide application techniques. Practicing skill development on spray equipment 's and spray fluid calibration. Practicing skill development on herbicide weed management in lowland, upland and rainfed ecosystems. Calculation of herbicide quantity and recommendation for different eco systems. Study on phyto-toxicity symptoms of herbicides in different crops. Herbicide residue determination by bioassay techniques. Herbicide residue determination by volumetric, spectro-photometric methods and chromatographic methods. Economic analysis of different weed management methods in crops and cropping systems. Visit to Problem and parasitic weed infestation areas/ herbicide industries

Lecture schedule:

1. Weeds - Definition, classification and characteristics, harmful and beneficial effect of weeds.
2. Weed biology and ecological adaptation to different agro ecosystems.
3. Classification and characteristics of weeds of different agro ecosystems-lowland weeds, irrigated upland and rainfed land weeds.
4. Classification and characteristics of weeds - Aquatic, parasitic and obnoxious weeds.
5. Life cycle of weeds, weed migration, weed seed distribution,
6. Dormancy, germination, establishment and perennation of weeds in different ecosystems.
7. Crop weed interactions - Critical crop weed competition, competitive and allelopathic effects of weeds and crops.
8. Principles and methods of weed management: Preventive, cultural, mechanical.
9. Mid-Semester Examination
10. Principles and methods of weed management: chemical, biological and alternate methods.
11. Classification and characteristics of herbicides and herbicide formulations - History and Development.
12. Herbicide Use Efficiency - Adjuvants, herbicide protectants and antidotes - Herbicide and herbicide mixtures in India - Interaction with moisture, fertilizer and other agrochemicals.

13. Mode of action of herbicides and their selectivity - Mechanism of action of herbicides and their selectivity.
14. Herbicide persistence and degradation in plants and soils-Herbicide residue and management.
15. Herbicide resistant weeds and their impact on weed management.
16. IWM in crops and cropping systems-Agricultural Crops, Horticultural Crops.
17. Weed shift: Causes and management options for weed shift in crop production.

Practical schedule:

1. Identification, classification and characterization of terrestrial weeds
2. Identification, classification and characterization of aquatic weeds
3. Identification, classification and characterization of problem and parasitic weeds
4. Weed survey and weed vegetation analysis - density, frequency, SDR and IVI
5. Study on biology of nut sedge and Bermuda grass, parthenium and celosia
6. Practicing skill development on cultural and non-chemical weed management
7. Identification, classification and characterization of herbicides
8. Practicing skill development on herbicide application techniques
9. Practicing skill development on spray equipment 's and spray fluid calibration
10. Practicing skill development on herbicide weed management in lowland, upland and rainfed ecosystems
11. Calculation of herbicide quantity and recommendation for different eco systems
12. Study on phyto-toxicity symptoms of herbicides in different crops
13. Herbicide residue determination by bioassay techniques
14. Herbicide residue determination by volumetric, spectro-photometric methods and chromatographic methods.
15. Economic analysis of different weed management methods in crops and cropping systems
16. Visit to Problem and parasitic weed infestation areas/ herbicide industries
17. Final Practical Examination

Reference books

1. Das, T.K. 2008. Weed Science - Basics and Applications. Jain Brothers, New Delhi
2. Gupta, O.P. 2007. Weed Management - Principles and Practices. Agrobios.
3. Jayakumar, R. and R. Jagannathan, R. 2003. Weed Science Principles, Kalyani Publishers, Ludhiana.
4. Rao, V.S. 2000. Principles of Weed Science. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 555p.
5. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1997. All about Weed Control. Kalyani Publishers, New Delhi.
6. Walia, U.S. 2003. Weed Management. Kalyani Publishers, Ludhiana

Web references

1. <http://erec.ifas.ufl.edu/weeds/powerpoints/Basic%20Principles%20of%20Weed%20Management.pdf>.
2. <http://www.agrisk.umn.edu/cache/ARL02964.htm>
3. <http://www.eolss.net/sample-chapters/c10/E1-05A-31-00.pdf>
4. <http://www.fao.org/docrep/006/y5031e/y5031e00.htm#Contents>
5. <http://www.fao.org/docrep/006/y5031e/y5031e0j.htm>
6. <http://www.omafra.gov.on.ca/english/crops/pub811/12crop.htm>

22PBG 201 FUNDAMENTALS OF GENETICS (2+1)

Course objective:

- Paraphrase the history and evolution of genetics and cytogenetics
- Understand the Chromosome behaviour and effects of their irregularities
- Explain Mendel's principles of heredity
- Recognize the importance of genetics in crop improvement

Course outcome:

- Describe the architecture of the chromosome and its functions.
- Interpret the relationship between genotype and phenotype.
- Apply the principles of chromosome transmission to predict patterns of inheritance.
- Analysis the modern concept of genetics and mutation
- Evaluate scientific data using the rules of probability

THEORY

UNIT I- Cytology and cytogenetics

Definition of genetics, heredity, inheritance, cytology, cytogenetics. History of genetics. Cell division – mitosis- meiosis and their significance – Gametogenesis and syngamy in Plants. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere. Structural and numerical variations in chromosome and their implications. Use of haploids, dihaploids and doubled haploids in Genetics. Special types of chromosomes.

UNIT II- Mendelian genetics and heredity

Heredity's Fundamental Characteristics; Pre and Post Mendelian concepts of heredity; Mendelian principles of heredity. Chromosomal theory of inheritance. Mendel's experiments and laws of inheritance - Law of Segregation, Law of Independent Assortment and Law of Dominance. Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1), ii.) Recessive epistasis (9:3:4), iii.) Duplicate and additive epistasis (9:6:1), iv.) Duplicate dominant epistasis (15:1), v) Duplicate recessive epistasis (9:7), vi.) Dominant and recessive epistasis (13:3). Pleiotropy, threshold characters, co-dominance, penetrance and expressivity. Non - Mendelian inheritance – cytoplasmic inheritance.

UNIT III- Quantitative inheritance, linkage and crossing over

Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Linkage and genetic mapping, Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments, single cross over, multiple cross over, two-point cross, three-point cross, map distances, gene order, interference and co-efficient of coincidence.

UNIT IV- Sex determination and elements of biometry

Sex determination and sex linkage, sex limited and sex influenced traits. Sample and Sampling, Collection and Representation of Data, Measures of Central Tendency - Mean, Median and Mode. Measures of

Dispersion - Variance and Standard deviation. Test of Hypothesis - Chi square Test. Probability - Definition and rules.

UNIT V- Modern concepts of genetics and mutation

Gene concept: Gene structure, function and regulation. Transcription and translational mechanism of genetic material - protein synthesis. Lac and Trp operons. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Genetic disorders. Nature, structure & replication of genetic material.

PRACTICAL

Study of Microscopy. Study of cell structure and function. Preparation of Slide for Mitosis study. Preparation of Slide for Meiosis study. Monohybrid Ratio and its Modification. Dihybrid Ratio and its Modification. Study of Trihybrid Ratio and back cross methods. Experiments on probability and Chi-square test. Gene Interaction. Estimation of Linkage: Two Point Test Cross. Estimation of Linkage: Three Point Test Cross. 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. Multiple alleles and polygenic inheritance. Studies on sex linked inheritance in Humans and Drosophila.

Lecture schedule

1. Definition of genetics, heredity, inheritance, cytology, cytogenetic; Brief history of developments in genetics and cytogenetics.
2. Physical basis of heredity: Structure and function of cell and cell organelles –
3. Differences between Prokaryotes and Eukaryotes. Cell division – mitosis
4. Cell division - meiosis and their significance
5. Gametogenesis and syngamy in Plants-identical and fraternal twins
6. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram
7. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes -polytene, lampbrush, B chromosomes, ring and isochromosomes.
8. Chromosomal aberration: Variation in chromosome structure –deletion, duplication, inversion and translocation – genetic and cytological implications.
9. Chromosomal aberration: Variation in chromosome number– euploid, aneuploid, types of aneuploids and their origin; Klinefelter syndrome and Turner syndrome.
10. Polyploid- auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, Brassica

11. Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutation theory.
12. Mendel's experiments and laws of inheritance. Rediscovery of Mendel's work
13. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid.
14. Chromosomal theory of inheritance. Allelic interactions –Dominance vs recessive, complete dominance, codominance, incomplete dominance, threshold characters
15. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio –i.) Dominant epistasis (12:3:1)
16. Recessive epistasis (9:3:4) Duplicate and additive epistasis (9:6:1). iv.) Duplicate dominant epistasis (15:1)
17. Mid Semester Examination
18. Duplicate recessive epistasis (9:7) vi.)Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i)to (vi).
19. Lethalgenes, Pleiotrophy, penetrance and expressivity, Multiplealleles, bloodgroupinhuma ns, coat colourin rabbits, selfincompatibility in plants; pseudo alleles,isoalleles.
20. Quantitativeinheritance–Multiplefactorhypothesis–NilssonEhleexperimentonwheatkernelcolour.
21. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers;
22. Linkage - coupling and repulsion; Experiment on Bateson and Punnet
23. Chromosomaltheoryoflinkage ofMorgan–Complete andincomplete linkage,Linkage group.
24. Crossingover– significance of crossingover; cytologicalprooffor crossingover- Stern's experiment; Factors controlling crossing over.
25. Strength oflinkage and recombination; Twopointandthree pointtest cross.
26. Double cross over, interference and coincidence; genetic map, physical map.
27. Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - differenttypes – sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Sex determination in plants – Melandrium, papaya, maize.
28. Genic balance theory of Bridges - Gynandromorphs

29. Sexlinked inheritance– criss cross inheritance –reciprocal difference; holandric genes; sex influenced and sex limited inheritance - Genetic disorders
30. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - cytoplasmic male sterility in maize, kappa particles of paramecium
31. DNA, the genetic material –Griffith’s experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material– Frankel, Conrat and Singer experiment.
32. Structure of DNA – Watson and Crick model Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication. RNA types -mRNA, tRNA, rRNA –Protein synthesis
33. Regulation of gene expression – Operon model of Jacob and Monod – Lac and Trp operons. Cistron, muton and recon.
34. Mutation – characteristics of mutation – micro and macro mutation – CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Practical schedule

1. Study of Microscopy.
2. Study of cell structure and function.
3. Preparation of Slide for Mitosis study.
4. Preparation of Slide for Meiosis study.
5. Monohybrid Ratio and its Modification.
6. Dihybrid Ratio and its Modification.
7. Study of Trihybrid Ratio and back cross methods.
8. Experiments on probability and Chi-square test.
9. Gene Interaction.
10. Estimation of Linkage: Two Point Test Cross.
11. Estimation of Linkage: Three Point Test Cross.
12. Simple interaction of genes-comb character in fowls; Dominant epistasis.
13. Recessive epistasis, Duplicate and additive epistasis.
14. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.

15. Multiple alleles and polygenic inheritance.
16. Studies on sex linked inheritance in Humans and Drosophila.
17. Final Practical examination.

Text books

1. Gupta P.K. 2007. Cytogenetics. Meerut: Rastogi Publications.
2. Verma, P.S. and Agarwal V.K. 2007. Genetics. S. Chand and Company Ltd., New Delhi.
3. Russel, P.J. 2000. Fundamentals of genetics. Addison Wesley Longman Publishers, USA.
4. Singh, B.D. 2004. Fundamentals of genetics. Chennai: Kalyani Publishers.
5. Pundhansingh, 2014. Elements of Genetics. Kalyani Publishers.

Reference books

1. Anthony J.F. Griffiths, William M. Gelbart, Richard C. Lewontin & Jeffrey H. Miller. 2002. Modern Genetic Analysis (Second Edition). United States: W. H. Freeman.
2. Benjamin Lewin. 2007. Genes IX. Oxford: Oxford University Press.
3. Daniel Sundararaj, Thulasidas, G. & Stephen Dorairaj, M. 1997. Introduction to Cytogenetics and Plant Breeding. Chennai: Popular Book Depot.
4. Singh, R.J. 2002. Plant cytogenetics. USA: CRC Press.
5. Gardner E. J., Simmons M. J., & Peter Snustad, D. 2015. Principles of Genetics. USA: John Wiley and sons.
6. Satguru Prasad. (2018). Elements of Biostatistics. Rastogi Publication

Web-references

1. <https://www.cliffsnotes.com/study-guides/biology/biology/classical-mendelian-genetics/principles-of-genetics>
2. <https://www.jax.org/education-and-learning/clinical-and-continuing-education/ccep-non-cancer-resources/core-principles-in-genetics-2004>
3. https://www2.palomar.edu/anthro/mendel/mendel_1.htm
4. <https://www.youtube.com/watch?v=2ycwGQUjmJY&list=PLKIDmF-ilyAkT0rhgMzSvGmqQz5licCMs>

Course objective:

- To define entomology and list the contributions of entomologist
- To compare insects with other arthropods of animal kingdom
- To describe insect morphology and anatomy
- To organise insects into different taxonomic categories

Course outcome: Through this course students should be able to

- Recall the basics of entomology and history of entomology in India
- Discuss the position of insects in the animal kingdom
- Explain insect morphology and anatomy
- Appraise insect taxonomy and systematics and analyse different characters of insect orders

THEORY

Unit I- Introduction to entomology and insect morphology

History of Entomology in India. factors responsible for insect dominance, introduction and classification of phylum arthropoda and class insecta, 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.

Unit II- Insect morphology and anatomy

Metamorphosis and diapause in insects. Types of eggs, larvae and pupae. Major sensory organs – Photoreceptors (simple and compound eyes), chemoreceptors and Mechanoreceptors. Structure and functions of digestive system, excretory system, circulatory system and respiratory system of insects

Unit III- Insect anatomy

Structure and functions of nervous, and reproductive system, in insects. Types of reproduction. Glandular system in insects

Unit IV- Insect taxonomy and systematics – apterygote and exopterygote orders

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, and emphasis of families of agricultural importance. Apteriygote orders and Exopterygote orders: Ephemeroptera, Odonata, Plecoptera, Grilloblatodia, Orthoptera (Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae), Phasmida, Dermaptera, Embioptera, Dictyoptera (Mantidae, Blattidae), Isoptera,

Zoraptera, Psocoptera, Mallophaga, Siphonculata, Hemiptera (Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae), Thysanoptera

Unit V- Endopterygote orders

Classification of Pterygote orders of insects with special emphasis to orders and families of Agricultural importance like Neuroptera (Chrysopidae); Lepidoptera (Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae); Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae); Hymenoptera: (Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae).

PRACTICAL

External features of Grasshopper/cockroach. Methods of collection and preservation of insects including immature stages. Types of insect antennae. Types of insect mouthparts. Types of insect legs. Types of insect Wing venation, types of wings and wing coupling apparatus. Types of insect eggs, larvae and pupae. Dissection of digestive system in insects. Dissection of male and female reproductive systems in insects. Dissection of nervous system in insects. Dissection of Circulatory system in insects. Dissection of respiratory system in insects. Study of taxonomic characters of orders Lepidoptera, Coleoptera, Hemiptera, Diptera, Orthoptera, Dictyoptera, Isoptera, Odonata, Thysanoptera, Neuroptera and Hymenoptera.

Lecture schedule:

1. Study of insects and their importance in Agriculture.
2. History of Entomology in India
3. Position of insects in the Animal Kingdom and relationship with members of Arthropoda.
4. Insect dominance: structural, morphological and physiological factors responsible for dominance.
5. Insect body wall: its structure and function
6. Moulting process in insects.
7. Structure of insect head, its orientation appendages and functions.
8. Structure of insect thorax, appendages and their functions.
9. Structure of insect abdomen, abdominal appendages and their functions.

10. Metamorphosis and diapause in insects.
11. Types of egg, larvae and pupae.
12. Major sensory organs — types of sensilla — photoreceptors (simple and compound eyes), chemoreceptors and mechanoreceptors.
13. Digestive system in insects — structure of alimentary canal, modifications in certain groups, enzymes, digestion and absorption of nutrients.
14. Excretory system in insects — malpighian tubules — accessory excretory organs — physiology of excretion.
15. Circulatory system in insects — haemocoel and dorsal vessel — circulation of blood — composition of haemolymph — blood plasma — haemocytes and their functions.
16. Respiratory system in insects — structure of trachea — tracheoles — types of respiratory system — types of spiracles — respiration in aquatic and endoparasitic insects.
17. Mid Semester Examination
18. Nervous system in insects — structure of neuron — central nervous system — conduction of nerve impulses — axonic and synoptic transmission.
19. Male and female reproductive systems in insects — their structures — types of reproduction — oviparous, viviparous, paedogenesis, polyembryony and parthenogenesis.
20. Structure of exocrine glands and their location and simple function — effect on metamorphosis and reproduction.
21. Structure of endocrine glands and their location and simple function — effect on metamorphosis and reproduction.
22. Classification and nomenclature of insects.
23. Important characters of Apterygota
24. Important characters of Exopterygote orders: Ephemeroptera, Odonata, Plecoptera, Grylloblattid.
25. Important characters of Exopterygote orders: Phasmida, Dermaptera, Embioptera,
26. Important characters of Exopterygote orders — Orthoptera and Dictyoptera
27. Important characters of Exopterygote orders — Isoptera, Zoraptera,
28. Important characters of Exopterygote orders - Psocoptera, Mallophaga, Siphonculata
29. Important characters of Exopterygote orders — Hemiptera and Thysanoptera

30. Important characters of Endopterygota order- Neuroptera
31. Important characters of Endopterygota order– Lepidoptera and families of agricultural importance with significant characters.
32. Important characters of Endopterygota orders – Coleoptera and families of agricultural importance with significant characters.
33. Important characters of Endopterygota order- Diptera and families of agricultural importance with significant characters.
34. Important characters of Endopterygota order- Hymenoptera and families of agricultural importance with significant characters.

Practical schedule:

1. External features of Grasshopper/cockroach
2. Methods of collection and preservation of insects including immature stages
3. Types of insect antennae
4. Types of insect mouthparts
5. Types of insect legs
6. Types of insect Wing venation, types of wings and wing coupling apparatus
7. Types of insect eggs, larvae and pupae
8. Dissection of digestive system in insects
9. Dissection of male and female reproductive systems in insects
10. Dissection of nervous system in insects
11. Dissection of Circulatory system in insects
12. Dissection of respiratory system in insects
13. Study of taxonomic characters of orders Lepidoptera and Coleoptera
14. Study of taxonomic characters of orders Hemiptera and Diptera
15. Study of taxonomic characters of orders Orthoptera, Dictyoptera Isoptera and Odonata
16. Study of taxonomic characters of orders Thysanoptera, Neuroptera and Hymenoptera
17. Final Practical Examination.

Text books

1. Shanthi. M., Senguttuvan. T., Suresh. K., Kavitha. Z. 2020. Text book on Fundamental Entomology. Agrobios (India).
2. Ragumoorthi K.N., Balasubramani. V., Srinivasan. M. R., Natarajan N. 2017. Insecta: An Introduction..A.E. Publications.

Reference books

1. Chapman, R.F. 1981. The Insects: Structure and function. Edward Arnold (Publishers) Ltd, London, 919p.
2. Snodgrass, R.E. 2001. Principles of Insect Morphology. CBS Publishers and Distributors, New Delhi
3. Richards, O.W. and. Davies. R.G. 1977. Imm's general text book of entomology, Vol.1&2, Chapman and Hall Publication, London, 1345p.
4. Gullan, P.J. and Cranston, P.S. 2001. The insects- An outline of entomology, II edition, Chapman & Hall, Madras, 491p.

Web references:

1. <https://genent.cals.ncsu.edu/bug-bytes/>
2. <https://genent.cals.ncsu.edu/>
3. <https://genent.cals.ncsu.edu/insect-identification/thumbnail-view/>
4. <http://ecoursesonline.iasri.res.in/course/view.php?id=142>

22AEC 201 FARM MANAGEMENT, PRODUCTION, AND RESOURCE ECONOMICS (1+1)

Course objective:

- To impart knowledge on risks in agricultural production and management of resources.

Course outcomes:

- Explain the importance of farm management in agriculture
- Comprehend the benefits and costs involved in farm management
- Analyze farm business

- Devise plans to overcome risks and manage farm resources
- Manage a farm

THEORY

Unit 1- Production economics and farm management - nature and scope

Meaning and concept of farm management, objectives, and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms. Types of farming: Specialized, Diversified, and Mixed farming—Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Cooperative Farming.

Unit 2- Factor – product, factor – factor and product – product relationships

Principles of farm management: Concept of production function and its characteristics and its type, use of production function in decision-making on a farm. Factor-Product relationship. Meaning, Definition – Laws of Returns. Meaning and concept of cost, types of costs, cost curves –and their inter-relationship- shutdown and break-even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family Labor income and farm business income. Economies of Scale– Economies of Size Determination of Optimum Input and Output – Physical and Economic Optimum. Factor – Factor relationship: Least Cost Combination of inputs; Product – Product relationship: Optimum Combination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

Unit 3- Farm planning and budgeting

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 4- Risk and uncertainty in agriculture production

Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies, Crop / livestock/ machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit 5- Resource economics

Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources -Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights: Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities: meaning and types - positive and negative

externalities in agriculture, Inefficiency and welfare loss, solutions; Important tissues in economics and management of common property resources of land, water, pasture and forest resources.

PRACTICAL

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 crops – Estimation of costs and returns of livestock products. Preparation of farm plan and budget, farm records and accounts and profit and loss accounts. Break – even analysis- Graphical solution to Linear Programming problem. Collection and analysis of data on various resources in India.

Lecture schedule

1. Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms.
2. Types of farming: Specialized, Diversified, and Mixed farming– Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.
3. Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm
4. Factor- Product relationship: Meaning, Definition – Laws of Returns: Classical production function and its characteristics.
5. Meaning and concept of cost, types of costs, cost curves – and their inter-relationship - shutdown and break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family Labor income and farm business income.
6. Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.
7. Factor – Factor relationship: Least Cost Combination of inputs
8. Product – Product relationship: Optimum Combination of Products – Principle of Equi –Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.
9. Mid Semester Examination
10. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.

11. 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.
12. 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.
13. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies.
14. Crop / livestock/machinery insurance. Weather based crop insurance - Features and determinants of compensations.
15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources.
16. Natural Resources Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights – Common Property Resources (CPRs): meaning and characteristics of CPRs –Externalities: meaning and types - positive and negative externalities in agriculture,
17. Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical schedule

1. Preparation of farm layout. Determination of cost of fencing of a farm.
2. Computation of depreciation and cost of farm assets: Valuation of assets by different methods
3. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
4. Determination of most profitable level of inputs use in a farm production process.
5. Determination of least cost combination of inputs.
6. Selection of most profitable enterprise combination
7. Application of cost principles including CACP concepts in the estimation of cost of cultivation and cost of production of agricultural crops.
8. Estimation of cost of cultivation and cost of production of perennial crops /horticultural crops.
9. Estimation of cost of returns of livestock products.
10. Preparation of farm plan and budget.
11. Farm records and accounts: Usefulness, types of farm records: farm production records and farm financial records.

12. Preparation of Cash flow statement
13. Preparation and Analysis of Net worth Statement and Profit and Loss statement
14. Estimation of Break – even analysis.
15. Graphical solution to Linear Programming problem
16. Collection and analysis of data on various resources in India
17. Final Practical Examination

Text books

1. Johl, S, S., & Kapoor, T, R., 2009. Fundamentals of Farm Business Management. New Delhi, Kalyani Publishers. pp.1-255.
2. Mohanty, S, K., 2007. Fundamentals of Entrepreneurship. New Delhi: Prentice Hall India Ltd. pp.1-272
3. Panda, S, C., 2007. Farm Management and Agricultural Marketing. India, Ludhiana: Kalyani Publishers. pp. 10-150.
4. Raju, V, T., 2017. Economics of Farm Production and Management. New Delhi: Oxford & IBH Publishing. pp.1-207

Reference books

1. Debertin, D, L., 2012. Agricultural Production Economics. New York: Create Space Independent Publishing Platform. pp. 1-98.
2. Sankayan, P, L., 1983. Introduction to Farm Management. New Delhi: Tata McGraw Hill Publishing Company Ltd. pp. 1-86.

Web – references

1. www.ediindia.org
2. www.iie.nic.in
3. www.msme.gov.in
4. www.niesbudtraining.org
5. www.nimsme.org
6. www.nsic.co.in

7. www.nabard.org
8. www.uky.edu/~deberti/agprod5.pdf
9. www.hillagric.ac.in/edu/coa/AgriEcoExtEduRSocio/lectures/AgEcon122FSM.pdf

22FMP 211 FARM MACHINERY AND POWER (1+1)

Course objective

The course aims to enable the students to understand the basic principles and parts of internal combustion engine and different tillage, sowing, intercultural, plant protection equipment, working principles of threshers, harvesting of field and horticultural crops

Course outcomes

- To understand the working principle of different systems and parts of internal combustion engines.
- To equip the students with technical knowledge and skills required for the operation of Tillage, Sowing and intercultural and plant protection machinery needed for agricultural farms.
- To train the students with skills required for the operation, maintenance and evaluation of harvesting, threshing machinery needed for agricultural farms.

THEORY

Unit I- Farm power and IC engines

Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of IC engines, comparison of two stroke and four stroke cycle engines, Study of different components of IC engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply.

Unit-II- Tractor and functional components

Hydraulic control system of a tractor, Familiarization with Power transmission system clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement.

Unit –III- Tillage implements

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture.

Unit-IV- Sowing and intercultural implements

Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, implement for intercultural operations.

Unit-V- Plant protection and harvesting equipments

Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

PRACTICAL

Study of different components of I.C. engine - To study air cleaning and cooling system of engine - Familiarization with clutch – Transmission - Differential and final drive of a tractor- Familiarization with lubrication and fuel supply system of engine - Familiarization with brake – Steering -Hydraulic control system of engine - Learning of tractor driving - Familiarization with operation of power tiller- Implements for hill agriculture - Familiarization with different types of primary and secondary tillage implements – Mould board plough - Disc plough and disc harrow -Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration - Planters and transplanter- Familiarization with different types of sprayers and dusters –Familiarization with different inter-cultivation equipment- Familiarization with harvesting and threshing machinery.

Lecture schedule

1. Farm power in India - sources of farm power and their use in agriculture
2. Working principles of IC Engines-Two stroke and Four stroke engines - applications – comparison- Engine terminology.
3. Components of IC engine and systems of IC engine – air cleaning, cooling, lubricating and fuel supply systems.
4. Tractors- types - transmission system- clutch, gearbox, differential and final drive - hydraulic system.
5. Cost analysis of tractor with attached implement.
6. Tillage, objectives, types –ploughing methods. Primary tillage-mould board plough, disc plough, chisel plough and sub soil plough - components and functions, types, advantages and disadvantages
7. Secondary tillage equipment– cultivators, harrows, levelers, and forming equipment– rotovators – puddlers –manure trammers and cage wheels, Implements for Hill agriculture.
8. Sowing methods - seed drills and planters- seed cum fertilizer drills - components and functions- Calibration.
9. Mid Semester Examination
10. Paddy transplanters, types, working principle, field and nursery requirements

11. Implements for inter cultural operations –cultivators, sweep, junior hoe, manual weeders and power operated weeders for wetland and garden land
12. Sprayers and their functions, classification, manually operated sprayers, terminology, Nozzle types.
13. Power operated sprayers – Tractor operated boom sprayer, Knapsack mist blower cum duster – Tall tree sprayer-dusters, types and uses.
14. Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery
15. Threshing of crop, thresher and its principles of operation - threshing losses.
16. Harvesting equipment– reapers - mowers and combine harvesters –types, construction and operation-Balers.
17. Harvesting machinery for groundnut, tuber crops, Cotton and sugarcane

Practical schedule

1. Study of working of two and four stroke engines and their systems with solved problems.
2. Study of Tractor clutch, gearbox, differential and final drive. Study of brake, steering and hydraulic control.
3. Learning driving of tractor and power tiller
4. Study of tractors and power tillers – their operation and maintenance
5. Study of mould board plough, - methods of ploughing- with solved problems.
6. Disc plough and sub soiler and their components- Hitching and adjustment of plough - field operation of different tractor drawn primary tillage machinery.
7. Study of cultivator, disc arrows, Rotavator, bund former, ridger, leveler and puddling implements and their operation.
8. Study of seed drills, planters and seed-cum-fertilizer drills and their components and metering mechanisms -calibration- simple problems on calibration.
9. Study and operation of machinery for rice cultivation –puddling implements- rotary puddlers and cage wheels, tray seeder for rice nursery, transplanters -types operation and maintenance- Drum seeder, cono weeder, power weeder and finger type weeder.
10. Study of different inter- cultivation equipment for uplands -manual, animal drawn, power operated - tractor and power tiller operated -field operation

11. Study of plant protection equipment– manually operated sprayers and dusters, knapsack mist blower cum duster, tractor operated sprayers- their operation, adjustment, calibration and safety requirements
12. Study of tools for Hill agriculture and horticultural crops – propagation tools, vegetable transplanter, harvesting tools –lawn mower, hole diggers, tree climber, shredders for crop residue.
13. Threshing machinery for paddy and identification of its components- different threshing drums - calculation of efficiency and losses.
14. Study of paddy reaper and paddy combine-their systems, method of operation and adjustment.
15. Study of harvesters for root crops - turmeric and tapioca and groundnut diggers
16. Problems on cost of operation of tractor operated machinery.
17. Final Practical Examination

Text books

1. Senthilkumar, T., R. Kavitha and V.M.Duraisamy 2015. A Text Book of Farm Machinery, Thannambikkai Publications, Coimbatore . ISBN: 978-9381102305
2. Jagadishwar Sahay, 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi. ISBN: 978-8180140440

Reference books

1. Ojha, T.P and A.M. Michael. 2005. Principles of Agricultural Engineering Vol-I. Jain Brothers, New Delhi. ISBN: 978-8186321638.
2. Nakra C.P 1970. Farm Machinery and Equipment,,: Dhanpat Rai Publishing Company Ltd, New Delhi ISBN: 978-8187433231.
3. Jain, S.C. and C.R.Rai. Farm Tractor and maintenance and repair. Standard Publishers, 1705-B, Naisarak,. Delhi- 110006
4. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi
5. S.C. Jain & Grace Philip, Farm Machinery- An approach, Standard publishers Delhi

Web references

1. <https://www.agroengineering.org>
2. <https://www.sciencedirect.com › journal › journal-of-agricultural-engineering>.
3. <https://publons.com › journal › journal-of-agricultural-engineering-and-technology>
4. <https://www.agriculturejournals.cz>

5. <https://ecourses.icar.gov.in/>
6. <https://nptel.ac.in/courses>
7. <https://ciae.nic.in>
8. <https://cmeri.res.in>

22HOR 211 PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS (1+1)

Course objective:

- To impart knowledge on basic cultural practices of Fruits and Plantation crops.
- To insist on modern and advanced techniques to increase the yield and production.
- To learn about the economic estimation of commercial Horticultural crops.

Course outcome:

- The student gains a thorough knowledge on basic and advance production technology.
- Familiarize on basic pruning, training and special techniques of fruits and plantation crops.
- Acquaintance on commercial oriented cultural practices.

THEORY

Unit I- Production status of fruit and plantation crops

Importance and scope of fruit and plantation crop industry in India – Nutritional value of fruit crops- Classification of fruit crops - Area, production, productivity and export potential of fruit and plantation crops.

UNIT II- Crop production techniques in tropical fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra high density planting - cropping systems - after care - training and pruning - water, nutrient and weed management –fertiligation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- value addition.

Fruit crops: mango, banana, papaya, guava, sapota

UNIT III- Crop production techniques in subtropical fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra high density planting - cropping systems - after care -

training and pruning - water, nutrient and weed management – fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition.

Fruit crops: citrus, grape, litchi, pineapple, pomegranate, jackfruit and minor fruits

UNIT IV- Crop production techniques temperate fruit crops

Climate and soil requirements –varieties–propagation and use of rootstocks –planting density and systems of planting -High density and ultra high density planting -cropping systems - after care - training and pruning - water, nutrient and weed management –fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition.

Fruit crops: apple, pear, peach, strawberry, nut crops.

UNIT V- Crop production techniques in palms and plantation crops

Climate and soil requirements - varieties - propagation - nursery management - planting and - planting systems - cropping systems - after care - water, nutrient and weed management - intercropping - multi-tier cropping system - mulching- special horticultural practices - maturity indices, harvest and yield - pests and diseases - processing - value addition.

Palms: Coconut, Areca nut, Oil palm and Palmyra

Climate and soil requirements - varieties - propagation - nursery management - planting and - planting systems - cropping systems - after care - water, nutrient and weed management - intercropping - multi-tier cropping system - mulching- special horticultural practices - maturity indices, harvest and yield - pests and diseases - processing - value addition.

Plantation crops: Tea, Coffee, Cocoa, Cashew, Rubber

PRACTICAL

Propagation methods for fruit crops - description and identification of varieties - preparation of plant bio regulators & their uses – nutrient deficiency and disorders of fruit crops - fertilizers- application - pests and diseases- micro propagation in fruit crops- Visit to commercial orchard. Fruit crops: Mango, banana, papaya, guava, sapota, grapes, citrus (Mandarin and acid lime), pomegranate and jackfruit

Propagation methods for plantation crops - description and identification of plantation crops- preparation of plant bio regulators & their uses - nutritional disorders of plantation crops - fertilizers- application - pests and diseases- cost economics of plantation crops. Visit to plantations and plantation industries. Palms and plantation crops: Coconut, Areca nut, Cashew, Tea, Coffee, Rubber and Cocoa

Lecture schedule:

1. Importance and scope of fruit and plantation crop industry in India – nutritional value of fruit crops

2. Classification of fruit crops – area, production, productivity and export potential of fruit and plantation crops
3. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning- top working - water, nutrient and weed management- canopy management - plant growth regulation - important disorders–maturity indices and harvest - post harvest management of Mango
4. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- water and nutrient management – fertigation - Weed control - Plant growth regulation - important disorders –maturity indices and harvest- post harvest management of Banana
5. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - crop regulation- important disorders – maturity indices and harvest - post harvest management of Papaya, Guava and Sapota
6. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - crop regulation – nutrient deficiencies and important disorders–maturity indices and harvest- post harvest management of Citrus (Sweet orange, Mandarin and Acid Lime)
7. Climate and soil – varieties - propagation methods - planting and cropping systems-after care – systems of training and pruning and bud forecasting - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of Grapes
8. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - plant growth regulation- important disorders – maturity indices and harvest - post harvest management of Pineapple and Litchi
9. Mid Semester Examination
10. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - training and pruning - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of Pomegranate, Jackfruit and minor fruits
11. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest- post harvest management of Apple and Pear
12. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning - water, nutrient and weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of Peach and Strawberry, nut crops
13. Climate and soil requirements -varieties-propagation-nursery management-planting systems planting density -nutrient, water and weed management - intercropping at various ages of plantation -

multitier cropping - shade management - nutritional disorders - maturity indices -harvest and yield-
pests and diseases -grading - processing and value addition of Coconut Areca nut and Cocoa .

14. Climate and soil requirements - varieties - propagation - nursery management - planting and
planting density - HDP - UHDP - nutrient, water and weed management - cover cropping - tapping - use
of plant growth regulators - top working - maturity indices- harvest and yield , latex yield and processing
- pests and diseases - grading - processing and value addition Rubber and Cashew .

15. Climate and soil requirements- varieties – propagation - nursery management - planting density
and systems of planting - nutrient, water and weed management - mulching - cropping systems - shade
regulation - training and pruning - role of growth regulators - nutritional disorders - maturity indices -
harvest and yield - pests and diseases - grading - processing and value addition of Tea.

16. Climate and soil requirements-varieties-propagation-nursery management- planting density and
systems of planting - nutrient, water and weed management - mulching - cropping systems - shade
regulation - training and pruning - role of growth regulators - nutritional disorders - maturity indices -
harvest and yield - pests and diseases - grading - processing and value addition of Coffee.

17. Climate and soil requirements-varieties-propagation-nursery management- planting density and
systems of planting - nutrient, water and weed management - mulching - cropping systems - shade
regulation - training and pruning - role of growth regulators - nutritional disorders - maturity indices -
harvest and yield - pests and diseases - grading - processing and value addition of Oil palm and Palmyra.

Practical schedule

1. Propagation techniques, selection of planting material, varieties, important cultural practices for Mango
2. Propagation techniques, selection of planting material, varieties, important cultural practices for Banana
3. Propagation techniques, selection of planting material, varieties, important cultural practices for Papaya
4. Propagation techniques, selection of planting material, varieties, important cultural practices for Guava
5. Propagation techniques, selection of planting material, varieties, important cultural practices for Sapota
6. Propagation techniques, selection of planting material, varieties, important cultural practices for Grapes
7. Propagation techniques, selection of planting material, varieties, important cultural practices for Citrus (Mandarin and Acid lime)

8. Propagation techniques, selection of planting material, varieties, important cultural practices for Pomegranate
9. Propagation techniques, selection of planting material, varieties, important cultural practices for Jackfruit
10. Preparation and application of PGR's for propagation.
11. Micro propagation, protocol for mass multiplication and hardening of fruit crops.
12. Identification and description of varieties- mother palm and seed nut selection- nursery practices- seedling selection – fertilizers - application - nutritional disorders - pests and diseases of Coconut
13. Identification and description of varieties- mother palm and seed nut selection- nursery practices- seedling selection – fertilizers - application - nutritional disorders - pests and diseases of Arecanut and Cocoa
14. Identification and description of varieties - nursery practices – training and pruning - pests and diseases – processing of Tea and Coffee.
15. Identification and description of varieties, clones - bud wood nursery practices - propagation techniques - top working – preparation of plant bio regulators and its uses- pests and diseases - processing of Rubber and Cashew
16. Visit to commercial orchard and plantation industries.
17. Final Practical Examination.

Reference books

1. N Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops, IBH Publishing Co. Pvt. Ltd., New Delhi.
2. M Kavino, V Jegadeeswari, R M Vijayakumar and S Balakrishnn, 2019. Production Technology for Fruits and Plantation Crops, Narendra Publishing

E – references

1. <http://www.jhortscib.com>
2. <http://journal.ashspublications.org>
3. <http://www.actahort.org/>
4. <http://www.aphorticulture.com/crops.htm>
5. <http://cpcri.nic.in/>

22PAT 201 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Course objective:

- Detailed study and identification of plant diseases caused by fungal, bacterial and viral pathogens.

Course outcome:

- To study about different plant diseases caused by biotic factors.
- To study morphology, symptoms, life cycle, reproductive and resting structures of Fungal, bacterial and viral pathogens causing plant disease.
- To study the mode of interaction between plant and pathogens.
- To identify the plant diseases and their causes.

THEORY

Unit I - Plant pathogenic organisms

Introduction- Definition, History of plant pathology, Economic importance of plant diseases. Terms and concepts of Plant Pathology. Classification of plant disease, Factors affecting disease development. Plant Pathogenic organisms: Protozoa, Phytomonas, Chromista, Fungi, Bacteria, Candidatus phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites.

Unit II – Pathogenesis

Pathogenesis, Host pathogen interaction. Mode of infection, pre-penetration, penetration and post penetration, Role of enzymes and toxins on disease development, Plant defense mechanisms. Effect of pathogen on physiological functions of the plants.

Unit III - General characters and taxonomy of protozoa, chromista and fungi

General characters definition of fungus, somatic structures, types of fungal thalli, fungal tissues, Resting spores, modifications of thallus, reproduction (asexual and sexual) and symptoms caused by plant pathogenic fungi. Nomenclature: Binomial system of nomenclature, rules of nomenclature, classification of fungi. divisions, sub-divisions, orders and classes. Kingdom: Protozoa, Phylum: Plasmodiophoromycota, Plasmodiophora brassicae., Kingdom: Chromista, Phylum: Oomycota; Pythium, Phytophthora, Sclerospora, Peronosclerospora and Albugo Kingdom: Fungi; Phylum: Chytridiomycota-Synchytrium; Phylum: Zygomycota; Mucor, Rhizopus

Unit IV - General characters and taxonomy of fungi - ascomycota and basidiomycota

Phylum: Ascomycota and Basidiomycota Taphrina, Capnodium, Mycosphaerella, Helminthosporium, Macrophomina, Venturia, Lewia, Sclerotium, Eurotium, Talaromyces, Erysiphe, Leveillula, Claviceps,

Glomerella, Magnaporthe Gibberella, Verticillium, Puccinia, Uromyces, Ustilago, Tilletia, Ustilaginoidea. Hemelia, Rhizoctonia, Exobasidium, Ganoderma, Agaricus, Pleurotus and Calocybe.

Unit V - Bacteria, phytoplasma, virus, viroid, algae, phanerogams, and abiotic disorders

General characters and symptoms- phytopathogenic bacteria, Candidatus Phytoplasma, Spiroplasma, Fastidious vascular bacteria, viruses, viroids, algae, Phanerogams – Abiotic disorders.

PRACTICAL

Working principle and uses of various laboratory tools and equipment's. Fungi- definition. Study of different morphological structures and fruiting bodies of fungi. Study of symptoms of various plant diseases caused by fungi, bacteria, virus, viroids, algae, phytoplasma, etc. Important characters of representative fungal genera of Oomycota- Sclerospora, Plasmopara and Albugo, Plasmodiophoromycota and Oomycota- Pythium and Phytophthora, Zygomycota-Rhizopus, Mucor, Ascomycota.-Taphrina, Capnodium, Cercospora, Botryodiplodia, Drechslera and Alternaria, Ascomycota.- Eurotium, Penicillium, Fusarium, Claviceps and Verticillium, Ascomycota.- Erysiphe, Leveillula, Phyllactina, Uninula, Podosphaera and Sphaerootheca, Ascomycota.-Colletotrichum, Pestalotia, Pyricularia, Sarocladium and Macrosporium, Basidiomycota- Puccinia, Uromyces and Hemileia, Basidiomycota- Ustilago, Spacelotheca, Tolyposporium and Exobasidium. Study of bacterial diseases –leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot. Symptoms and vectors of viral diseases mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top. Transmission of plant viruses. Plant phanerogamic parasites. Field visit

Lecture schedule

1. Plant Pathology - Introduction, definition, and history
2. Terms and concepts of plant pathology.
3. Classification of plant diseases and factors affecting disease development.
4. Plant Pathogenic organisms: Protozoa, Chromista, Fungi, Bacteria, and Phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites.
5. Host pathogen interaction, Mode of infection, pre-penetration, penetration and post penetration
6. Survival and dispersal of plant pathogens
7. Effect of Pathogen on physiological functions of the plants
8. Role of enzymes
9. Role of toxins
10. General characters of fungi

11. Different morphological structures of fungi
12. Mode of nutrition in fungi
13. Asexual Reproduction in fungi
14. Sexual Reproduction in fungi
15. Parasitism in fungi, Mode of nutrition
16. Classification of Plasmodiophoromycota- Plasmodiophora brassicae
17. Mid Semester Examination
18. Classification of Chromista- Oomycota; Pythium, Phytophthora, Sclerospora, Peronosclerospora and Albugo
19. Classification, general characters symptoms and life cycle of Chytridiomycota-Synchytrium
20. Classification, general characters symptoms and life cycle of Zygomycota - Mucor, Rhizopus
21. Classification, general characters symptoms and life cycle of Taphrina, Capnodium, Mycosphaerella, Helminthosporium, Macrophomina, Venturia,
22. Classification, general characters symptoms and life cycle of Ascomycota Lewia, Sclerotium, Eurotium, Talaromyces
23. Classification, general characters symptoms and life cycle of Ascomycota Erysiphe, Leveillula and Phyllactina
24. Classification, general characters symptoms and life cycle of Ascomycota Claviceps, Glomerella, Magnaporthe Gibberella, Verticillium, Ustilaginoidea.
25. Classification, general characters symptoms and life cycle of Basidiomycota- Puccinia, Uromyces, Ustilago, Tilletia,
26. Classification, general characters symptoms and life cycle of Basidiomycota- Agaricus, Pleurotus and Calocybe.
27. Classification, general characters symptoms and life cycle of Basidiomycota -Rhizoctonia, Exobasidium, Ganoderma,
28. Classification of bacteria, General characters of bacteria and their symptoms.
29. Phytoplasma, spiroplasma, fastidious vascular bacteria and their symptoms.
30. General characters and Properties of virus
31. Symptoms of viruses.

32. General characters and symptoms of viroids
33. General characters and symptoms of Phanerogamic parasites and algae.
34. Abiotic factors and their symptoms.

Practical schedule

1. Working principle and uses of various laboratory tools and equipment's.
2. Fungi- definition. Study of different morphological structures and fruiting bodies of fungi.
3. Study of symptoms of various plant diseases caused by fungi, bacteria, virus, viroids, algae, phytoplasma, etc.
4. Important characters of representative fungal genera of Oomycota- Sclerospora, Plasmopara and Albugo
5. Important characters of representative fungal genera of Plasmodiophoromycota and Oomycota- Pythium and Phytophthora
6. Important characters of representative fungal genera Zygomycota-Rhizopus, Mucor
7. Important characters of representative fungal genera of Ascomycota.-Taphrina, Capnodium, Cercospora, Botryodiplodia, Drechslera and Alternaria
8. Important characters of representative fungal genera of Ascomycota.-Eurotium, Penicillium, Fusarium, Claviceps and Verticillium
9. Important characters of representative fungal genera of Ascomycota.- Erysiphe, Leveillula, Phyllactinia, Uninula, Podosphaera and Sphaerotheca
10. Important characters of representative fungal genera of Ascomycota.-Colletotrichum, Pestalotia, Pyricularia, Sarocladium and Macrosporium
11. Important characters of representative fungal genera of Basidiomycota- Puccinia, Uromyces and Hemileia
12. Important characters of representative fungal genera of Basidiomycota- Ustilago, Spacelotheca, Tolyposporium and Exobasidium.
13. . Study of bacterial diseases –leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
14. Symptoms and vectors of viral diseases mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top. Transmission of plant viruses.
15. Plant phanerogamic parasites.

16. Field visit
17. Final Practical Examination

Note: Students should submit fifty well preserved disease specimens

Text books

1. Agrios, G.N. 2005. Plant Pathology (5th Ed). New York: Academic Press. pp. 1-922.
2. Alice, D., & Jeyalakshmi, C. (2014). Plant Pathology. Coimbatore: A.E Publications. pp. 1-375.
3. Dube, H.C. 2013. An introduction to Fungi. India: Scientific publisher. pp. 1-603.
4. Singh, R.P. 2012. Plant pathology. India: Kalyani publishers. pp. 1-724.

Reference books

1. John Webster & Ronald Weber. 2007. Introduction to fungi. UK: Cambridge University Press. pp. 1-841.
2. Kirk, P.M. et al. 2008. Ainsworth and Bisby's Dictionary of the Fungi (10th ed.). Oxon, U.K: C.A.B International. pp.1-771.
3. Paul et al. 2009. Bergey's Manual of Systematic Bacteriology. New York: Springer-Verlag.
4. Richard N. Strange. 2003. Introduction of Plant Pathology. London: John Wiley & Sons Ltd. pp.1-480.

Web-references

1. <http://www.biologydiscussion.com>
2. www.mycology.net
3. www.bspp.org.uk
4. <https://www.microscopemaster.com/fungi>
5. <https://talk.ictvonline.org/taxonomy/>
6. www.apsnet.org/edcenter
7. www.Tolweb.org
8. <http://www.hillagric.ac.in/edu/coa/ppath/lectures.htm>
9. <http://ecoursesonline.iasri.res.in/course/view.php?id=143>

10. www.ucmp.berkeley.edu/fungi
11. www.ictv.org
12. www.vivo.library.cornell.edu.
13. <https://www.youtube.com/c/MTutorEdu/search?query=plant+pathology>.
14. <https://www.youtube.com/channel/UCsqovy3Llp-dB8pMxU2VZ7A>

22STA 211 STATISTICAL METHODS (1+1)

Course objective:

The purpose of learning this course is to understand the fundamental concepts and skills. To calculate mathematical models applicable to field trials and to apply sampling theory in all problems of agricultural sciences.

Course outcome:

- Define the basics of probability and statistics
- Choose the model and analyze the system using random variables
- Apply the testing of hypothesis
- Apply the statistical models in the field
- Explain the techniques related in sampling
- Identify the fundamental difference between discrete and continuous distribution

THEORY

Unit I- Descriptive statistics

Basic concepts – statistics – variable – types and sources of data – classification and tabulation of data. Diagrammatic and graphical representation of data – simple, multiple, component and percentage bar diagrams, pie diagram – frequency polygon, frequency curve and histogram. Construction of frequency distribution tables. Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode – merits and demerits. Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, and coefficient of variation – skewness and kurtosis – merits and demerits.

Unit II- Probability distributions and sampling theory

Probability – basic concepts – additive and multiplicative laws (without proof). Probability distributions – Discrete distributions: Binomial and Poisson. Continuous distribution: Normal distribution – definitions and properties. Sampling theory – population – sample – parameter and statistic – sampling distribution – sampling vs complete enumeration – Types of sampling – simple random sampling – selection of simple random sample using random number tables.

Unit III- Testing of hypotheses

Null and alternative hypothesis – types of errors – critical region and level of significance – degrees of freedom. Large sample test – single proportion and difference between two proportions – single mean and difference between two means. Small sample tests – F-test – t-test for testing the significance of single mean – independent t test and paired t test – chi square test for goodness of fit – chi square test for testing the association of attributes by m x n contingency table – 2 x 2 contingency table – Yates' correction for continuity.

Unit IV- Correlation and regression

Correlation – Scatter diagram – Karl Pearson's correlation coefficient definition – computation – types of correlation and properties. Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient.

Unit V- Analysis of variance and experimental designs

Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD) – lay out, analysis, merits and demerits of the above mentioned designs.

PRACTICAL

Formation of frequency distribution tables – Diagrammatic and graphical representation. Computation of different measures of central tendency and computation of various measures of dispersion for raw and grouped data – calculation of coefficient of variation (CV) – measures of skewness and kurtosis. Simple problems in Binomial distribution, Poisson and Normal distribution – Selection of simple random sampling. Large sample test for single proportion and difference between two proportions and Large sample test for single mean and difference between two means. t-test for single mean – t-test for testing the significance of two means for independent and paired samples – chi square test for goodness of fit and test for independence of two attributes in a contingency table – Yates correction for continuity – calculation of the correlation coefficient – fitting of simple linear regression equation – One way and two way ANOVA – completely randomized design (CRD) – randomized block design (RBD) – Latin square design (LSD).

Lecture schedule

1. Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode –Merits and demerits
2. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation - Skewness and kurtosis
3. Diagrammatic representation of data; One, Two and Three dimensional diagrams with applications. Graphical representation of data; Histogram, frequency polygon, frequency curve, ogives.
4. Sampling theory – population – sample – parameter and statistic – sampling distribution - sampling vs complete enumeration –Types of sampling - simple random sampling selection using random numbers Stratified - Systematic sampling
5. Probability distributions – Discrete distributions: Bernoulli
6. Binomial and Poisson distribution,
7. Continuous distribution: Normal distribution
8. Null and alternative hypothesis – types of errors - critical region and tests of significance - Large sample test – single mean and difference between two means.
9. Mid-Semester Examination
10. Single proportion and difference between two proportions
11. Small sample tests – F-test - t-test for testing the significance of single mean
12. Independent and paired t test
13. Chi square test for testing the association of $r \times c$ contingency table
14. Correlation – Scatter diagram - Karl Pearson's correlation coefficient – Spearman's rank Correlation - computation and properties
15. Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient.
16. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs
17. Completely Randomized Design (CRD) – Randomized Block Design (RBD)

Practical schedule

1. Computation of arithmetic mean, geometric mean, harmonic mean, median and mode
2. Computation of range, standard deviation, variance, coefficient of variance

3. Histogram, frequency polygon, frequency curve, ogives.
4. Selection of sample using simple random sampling method, Simple problems in Bernoulli distribution
5. Simple problems in Binomial distribution and Poisson distribution
6. Simple problems in Normal distribution
7. Large sample test – test for single proportion and difference between two proportions
8. Large sample test – test for single mean and difference between two means
9. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only)
10. Paired t-test
11. Chi square test
12. Computation of Karl Pearson's correlation coefficient
13. Fitting of simple linear regression equation y on x – correlation and regression
14. Analysis of Completely Randomised Design (CRD) – for equal replications only
15. Analysis of Randomised Block Design (RBD) and FRBD
16. Analysis of Split plot design and Latin Square Design (LSD)
17. Final Practical Examination

Text books

1. Chandel S. R. S. 2014. A Handbook of Agricultural Statistics. Kanpur: Achal Prakashan Mandir. pp. 1-87
2. Gupta, S.P. 2004. Statistical Method. New Delhi: Sultan chand and sons. pp. 1-1476.
3. Nageswara Rao, G. 2007. Statistics for Agricultural Sciences. Hyderabad: B.S. Publications. pp. 1-512
4. Panse, V.G. & Sukhatme, P. V. 1954. Statistical Methods for Agricultural Workers. India: Indian Council of Agricultural Research. pp. 1- 361
5. Vittal P. R. 2012. Mathematical Statistics. Chennai: Margham Publications. pp. 1 – 950

References books

1. Agrawal B.L. 2005. Basic Statistics. New Delhi: New age International Ltd. pp. 1- 656
2. Dhamu, K.P. & Ramamoorthy, K. 2009. Fundamentals of Agricultural Statistics. India: Scientific Publishers. pp. 1- 130
3. Gupta, S.P. 1978. Elementary Statistical Method. New Delhi: Sultan chand and sons. pp. 1-438
4. Kailasam, G. & Gangaiselvi, R.2010. Applied Statistics. New Delhi: Kalyani Publishers. pp. 1 -200
5. Vijay K. Rohatgi, Ehsanes Saleh A.K.M.D. 2008. An Introduction to Probability and Statistics, (2nd ed.). New Jersey: John Wiley and sons Inc. pp.1 - 631

Web references

1. www.statisticshowto.com
2. www.mathisfun.com
3. www.mathinsight.org
4. <http://www.statistics.com/resources/glossary/>
5. www.statsoft.com
6. http://www.iasri.res.in/ebook/EB_SMAR/index.html
7. www.statsci.org/jourlist.html

22AMP 201 LIVESTOCK AND POULTRY MANAGEMENT (2+1)

Course objective:

- Explain the contributions of different types of livestock and Poultry
- Summarize Animal Population and rearing system in livestock and Poultry
- Outline the information on diversified Poultry
- Explain different livestock management systems
- Describe feed formulation and nutritional management in livestock and poultry
- Describe the management and bio security measures

Course outcome:

- Illustrate skills on different rearing system of livestock

- Explain the management of different age group animals
- Describe the poultry sector
- Demonstrate animal handling
- Discuss clean milk production and Milk processing methods
- Outline entrepreneurship skills

THEORY

Unit I- Introduction to livestock management

Significance of Livestock and Poultry in Indian Economy – Livestock and Poultry census – Different livestock development programs of Government of India and Tamil Nadu-Variety systems of livestock production extensive – semi intensive -intensive- mixed-Integrated and specialized farms.

Unit II- Dairy cattle management

Important White and Black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - Cross breeding- Upgrading - Economic traits of cattle –Culling - Estrus Cycle – Artificial Insemination –Introduction to Embryo transfer–Housing –Space requirement calf and adult stock – System and types of housing - Feeding and Management of Calf, Heifer, Pregnant, Milch animal and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder–Total Mixed Ration – composition of concentrate mixture for different stage - Milking methods - Clean milk production – Factors affecting milk composition – Common diseases of cattle – classification – symptoms - preventing and control measures.

Unit III- Sheep and goat management

Breeds –Sheep and goat classification —Economic traits - system of rearing -Housing Management– Floor space requirement-Care and Management of young and adult stock–Nutrition–Feed and fodders of Small ruminants – Flushing - Common diseases – prevention and control.

Unit IV- Management of swine

Classification of breeds –Economic traits -Housing -Nutrition – creep feeding -Care and Management of Adult and Young Stock - Common disease- prevention and control.

Unit V- Poultry management

Classification of breeds - Commercial Strains of broilers and layers – Housing – brooding – deep litter and cage system – care and Management of broilers and layers -Nutrition of Chick, grower, Layer and broiler– Incubation and Hatching of Eggs -Common Diseases -Control and prevention.

PRACTICAL

Study of external parts of Livestock - Identification of livestock and poultry-Tattooing-ear tags-wing and leg bands-Common restraining methods-Disbudding (or) Dehorning-Different methods of castration-Dentition Study of type design of animal and poultry houses-Selection of dairy cow and work bullock-Determination of specific gravity, fat percentage and total solids of milk- Demonstration of cream separation,-Identification of feeds and fodder- Economics Dairy, Goat and Swine farming - Study of external parts of Fowl - Preparation of Brooder House - Brooder management-Identification of layer and non layer- Debeaking, delousing and deworming of poultry-Vaccination schedule for broiler and layer-Dressing of broiler chicken - Economics of Broiler and Layer Farming – Visit to a modern Dairy and commercial layer and broiler farms - Demonstration of incubator and setter.

Lecture schedule:

1. Significance of livestock and poultry in Indian economy-livestock and poultry census. Different livestock development programmes of Government of India and Tamil Nadu.
2. Various systems of livestock production-extensive– semi intensive, intensive-mixed integrated and specialized farms.
3. Definition of breed-classification of indigenous white and black cattle-breed characteristics of Tamil Nadu cattle breeds and Indian breeds.
4. Breed-characteristicsofexoticcattle-JerseyandHolsteinFriesian–IndianBuffaloes-Murrah, Surti and Toda.
5. Breeding-cross breeding-upgrading-economic traits of cattle-culling importance and methods.
6. Estrous cycle – signs of estrous – artificial insemination-merits and demerits-Principles and outline of embryo transfer.
7. Housing management farm site selection and floors pace requirement for calves, heifer, milch animal and work bullocks.
8. Systems of housing-single row system-double row system- head to head and tail to tail-merits and demerits - Type design of house.
9. Care and management of new born calf and heifers.
10. Care and management of pregnant animal and lactating animals.
11. Care and management of dry cows and work bullock.
12. Nutrition- definition- ration- balanced ration-desirable characteristics of a ration. Classification of feed stuffs-concentrate and roughage-comparison, Total Mixed Ration.
13. Model composition of concentrate mixture of young and adult stock-age wise feed and fodder requirement-Importance of green fodder.

14. Milking methods-clean milk production-factors affecting milk yield and composition.
15. Diseases-classification-viral, bacterial and metabolic-general control and preventive measures.
16. Viral diseases-foot and mouth disease, bacterial diseases, anthrax, hemorrhagic septicemia-black quarter - metabolic-tympanites, acidosis, ketosis and milk fever.
17. Mid Semester Examination
18. Sheep and goat farming-classification of breeds of Indian and exotic origin – economic traits.
19. Systems of rearing housing management- type design-floor diagram-space requirement for adult and young stock.
20. Care and management of ram, ewe and lamb-nutrition- feeds and fodder for small ruminants.
21. Care and management of buck, doe and kid- nutrition- flushing.
22. Common ailments of sheep and goat-sheep pox-foot and mouth-blue tongue- PPR-enterotoxaemia Ecto and endo parasites.
23. Swine husbandry –Common breeds of exotic origin-Large White Yorkshire, Landrace and Duroc - economic traits- housing of Swine.
24. Care and management of sow, boar and piglets-nutrition- creep feeding.
25. Disease prevention and control of swine diseases –hog cholera, foot and mouth, ecto and endo parasites.
26. Classification of breeds - commercial strains of layer and broiler.
27. Care and management of Chicks-brooder management.
28. Systems of housing-deep litter and cage system-floor space requirement-common litter material litter management-merits and demerits.
29. Care and management of Grower and Layers- vaccination schedule.
30. Care and management of broilers –vaccination schedule.
31. Incubation and hatching of eggs.
32. Nutrition-feed formulation-composition of chick, grower, layer broiler- starter and Finisher mash Feed Conversion Ratio /dozen egg or kg of meat production.
33. Classification of disease –viral– bacterial- protozoan- causative organisms, symptoms and prevention – viral diseases- Ranikhet – IBD-avian flu.
34. Bacterial disease-E.coli-coryza-salmonellosis-protozoan–coccidiosis-casulative organism, symptoms and preventive measures. Management of dead birds and manure.

Practical schedule

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, Dehorning, Castration and Dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock
7. Determination of specific gravity, fat %, total solids, solids not fat
8. Demonstration of cream separation
9. Identification of feed & fodder
10. Economics of dairy, goat and swine Farming
11. Study of external parts of owl. Preparation of brooder house
12. Identification of layer and non-layer
13. Debeaking, delousing, deworming of poultry Vaccination schedule for broiler and layer
14. Demonstration of dressing of broiler. Economics of layer and broiler farming
15. Visit to a modern dairy and commercial layer and broiler farms
16. Demonstration of incubator and setter
17. Final Practical examination

Text book

1. CAR. 2002. Handbook of Animal Husbandry (4th ed). New Delhi: ICAR. pp.1-1549.
2. G.C. Banerjee. 2013. A Text Book of Animal Husbandry (8th ed). New Delhi : Oxford and IBH Publishing Company Private Limited. pp.1-1079
3. Lesson, S and Summers, J.D. 2001. A text book of Scott Nutrition of the chicken (4th ed). Canada: University books. pp.1-586
4. Reddy, D.V. 2001. Principles of animal nutrition and feed technology (2nd ed). Oxford and New Delhi: IBH Publishing Company Private Limited. pp.1-425

Reference books

1. Sastry, N.S.R and Thomas, C.K. 2005. Livestock Production Management. (3rd ed). Ludhiana: Kalyani Publishers.pp.1-850
2. Gopalakrishnan, C.A., and Lal, D.M.M. 1992. Livestock and Poultry Enterprises for Rural Development. Ghaziabad, Uttar Pradesh: Vikas Publications Private Limited.pp.1-1096
3. Sreenivasaiah, P.V. 2006. Scientific Poultry Production (3rd ed).Lucknow :International Book Distributing Co. pp- 1-1487.

Web-references

1. <https://www.drvet.in/p/e-books.html>
2. <https://www.coursera.org/lecture/livestock-farming/1-3-farming-101-the-basics-of-livestock-production-wfhyl>
3. <http://www.tanuv.ac.in/e-learning/objectivities.html>
4. <https://ecourses.icar.gov.in/>

Study tour (0+1)

The students will undertake the short tour during third semester for seven days covering KVK's, Research stations and ICAR institutes in the southern part of Tamil Nadu. The study tour will provide an exposure to the students to know about the soil, climatic conditions and cropping patterns in the respective agro-climatic zones. The students will also have first-hand information on latest technologies on various crops and allied activities.

2022 batch Semester VI

S. No	Course Code	Course Title	Credit Hours	Total Credits
21.	22 AGR 303	Practical Crop Production II (Rabi Crops)	0+1	1
22.	22 AGR 304	Principles of Organic farming	1+1	2
23.	22 PBG 302	Crop Improvement	2+1	3
24.	22 AEC 302	Agricultural Finance and Co-operation	2+1	3
25.	22 PAT 302	Diseases of Field and Horticultural Crops and their Management II	2+1	3
26.	22 ABT 301	Plant Biotechnology	2+1	3
27.	22 RSG 301	Geo-informatics, Nanotechnology and Precision Farming	1+1	2
28.	22 ARM 302	Intellectual Property Rights	1+0	1
29.	22 ENS 301	Environmental Studies and Disaster Management	2+1	3
30.	22 ELC ***	Elective Course III	2+1	3
		Total	15+9	24

2022 batch - Semester VI
22AGR 303 PRACTICAL CROP PRODUCTION – II (*Rabi* crops) (0+1)

Course objective:

- Planning and practicing cultivation of *rabi* crops
- Imparting knowledge on integrated nutrient pest and disease management
- Sharing knowledge on marketing of produce and calculating cost benefit ratio.

Course outcome:

- Plan and decide on growing a suitable *rabi* crop
- Decide on the best cropping system that can be followed for a *rabi* season
- Recommend package of practices for growing *rabi* crops
- Practice *rabi* crop production through integrated management
- Calculate cost benefit ratio based on cultivation and marketing expenses of a crop

Practical Schedule for Irrigated dry crop (Eg. Sunflower):

Ecosystem - Climate and weather – Seasons, soil and varieties of Tamil Nadu and India - Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing - Weed management and practicing pre- emergence application of herbicides - Thinning and gap filling - Estimation of plant population - Top dressing - Weed management - Water management - Pest management - Observation on nutrient and weeds - Recording growth, yield attributes and yield - Harvesting, threshing and cleaning the produce - Cost of cultivation and economics

- Each student will be allotted a minimum land area of 100/200 m². He / she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed treatment, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.
- Any irrigated dry *rabi* crop (sunflower / Peas / Chickpea)

Practical schedule:

1. Study of importance, origin, distribution and botany of Sunflower.
2. Study of cropping systems, seasons and varieties of sunflower in Tamil Nadu and India
3. Selection of field and main field preparation for sunflower
4. Acquiring skill in seed treatment and sowing practices of sunflower
5. Practicing of application of manures and fertilizers for sunflower
6. Study of water management practices for sunflower
7. Study of weeds and weed management in sunflower
8. Estimation of plant population and acquiring skill in gap filling and thinning

9. Mid-Semester Examination

10. Observation on nutritional deficiency symptoms and corrective measures
11. Recording growth parameters and assessing dry matter production
12. Acquiring skill in artificial pollination in sunflower
13. Observation of insect pests and diseases and their management
14. Estimation of yield and yield parameters in sunflower
15. Harvesting, threshing and cleaning, seed storage, seed dormancy and utilization of sunflower
16. Working out cost of cultivation and economics

17. Final Practical Examination

Text books

1. Rajendra Prasad. 2016. Textbook of Field Crops Production (Volume 1). Indian Council of Agricultural Research (ICAR), New Delhi.
2. Mukund Joshi., 2015. Text Book of Field Crops. PHI Learning Private limited. New Delhi.
3. Reddy, S.R. 2012. Agronomy of field crops. Kalyani publishers, New Delhi.
4. Singh. S.S. 2015. Crop management under irrigated and rainfed conditions. Kalyani Publishers, New Delhi.
5. Annadurai, K. and B. Chandrasekaran. 2009. A Text Book Of Rice Science. Scientific Publishers

Reference books

1. Crop Production Guide. 2020. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
2. Srinivasan Jeyaraman. 2018. Field crops production and management (Volume I). Oxford and IBH Publishers. India.
3. Yellamanda Reddy, T. and G.H. Sankara Reddy. 2017. Principles of Agronomy, Kalyani publishers, Ludhiana.
4. Reddy. S.R. 2014. Principles of Crop Production. Kalyani Publishers, Ludhiana.
5. Ahlawat, I.P.S., O. Prakash and G.S. Saini. 1998. Scientific Crop Production in India. Rama Publishing House, Meerut.

Web references

1. www.tnau.ac.in/agriportal
2. www.fao.org/ag/ca
3. <https://www.agrimoon.com/wp-content/uploads/Introduction-to-major-field-crops.pdf>

22AGR 304 PRINCIPLES OF ORGANIC FARMING (1+1)**Course objective:**

- Imparting knowledge on the scope and concepts of organic farming in India.
- Discussing on indigenous weed, pest, disease and nutrient management for organic farming.
- Educating students on the certification and marketing of organic farm produces

Course outcome:

- Analyse the scope of organic farming
- Recommended varieties suitable for organic farming
- Comprehend management practices suitable for organic farming
- Understand processing and marketing of organic products.
- Develop entrepreneur skills and ideas to practice organic farming

THEORY**UNIT - I COMPONENTS AND PRINCIPLES OF ORGANIC FARMING**

Organic farming: Definition - Scope - principles and concepts - 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

Organic sources of nutrients - manures and other inputs - on farm and off farm sources - organic waste recycling - methods - Soil and crop management - inter cropping, crop rotation, green manures, cover crops, mulching - bio fertilizers.

UNIT - III NON - CHEMICAL WEED AND PEST DISEASE MANAGEMENT

Non-chemical weed management methods: preventive, physical, cultural, mechanical and biological measures - Bio-intensive pest and disease management.

UNIT - IV INDIGENOUS TECHNICAL KNOWLEDGE (ITK)

Indigenous Technical Knowledge (ITK) in organic agriculture - scientific rationale - soil, nutrient, weed, water, management - prospects and problems in organic farming.

UNIT - V CERTIFICATION AND MARKETING

Organic certification - NPOP guidelines - Certification agencies in India - crop production standards - Quality considerations - labeling and accreditation process - marketing and export opportunities.

PRACTICALS

Resource inventory of organic farm. Raising and incorporation of green manure - seed treatment and rising of field crop. Practice on preparatory cultivation; soil and water conservation methods. Recycling techniques; bio-composting and vermicomposting. Quantification of nutrients and application of manures and bio-fertilizers. Organic crop production, weed, pest and diseases management. Grading, packaging and post-harvest management. Exposure visit to an organic farm to learn ITK based preparations, bio-control agent production units, organic market outlets and organic certification agencies / Directorate of Organic Certification, Tamil Nadu.

Lecture schedule:

1. Organic farming; definition - prospects - principles and concepts - History and genesis of organic farming in World and India: Present status in World, India and Tamil Nadu.
2. Introduction to bio - diversity; importance and measures to preserve bio - diversity.
3. Pre-requisites and basic steps for organic farming; conversion to organic farming - planning and processes in practices - IFS approach - Integration of animal components.
4. Organic carbon; status and improvement strategies - conservative tillage systems.
5. Sources of organic manures - plant, animal and microbial origin - on - farm resources; FYM, green manures, crop residues, poultry manure, sheep and goat manures, biogas slurry and vermicompost.
6. Off-farm resources; coir pith, press mud, oilcakes, flyash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.
7. Organic waste recycling methods and techniques - composting, vermicomposting, *in situ* composting - system approach.
8. Soil and crop management in organic farming; Inter cropping and companion planting, crop rotation green manures and cover crops, mulching.
9. **Mid-Semester Examination**
10. Weeds - Ecology - habitat management of weeds - Non - chemical weed management methods; preventive, physical, cultural, use of tools and implements and biological measures - good crop husbandry practices.
11. Integrated pest and diseases management - bio control agents, bio rational pesticides; minerals, botanicals, soaps, trap crops, bird perches, and traditional preparations - sanitation.
12. Indigenous technical knowledge (ITK) in organic agriculture - rationale and principles - general, indigenous practices for soil, nutrient, weed, water pest and disease management in farming - ITK's in farmers practice.
13. Benefits and problems in organic farming.
14. Organic farming; Promotional activities; role of government and NGO's - action plan - policy considerations.
15. Economic evaluation of organic production systems - cost - benefit analysis and comparison with conventional systems.

16. Organic certification - procedures - certification agencies in India - labeling, marketing and export opportunities.
17. Crop production standards - NPOP guidelines - principles, recommendations and standards - Quality considerations - assessment methods - premium and export opportunities.

Practical schedule:

1. Resource inventory of organic farm- Soil sampling and analysis for organic carbon and pesticide residues / contaminants.
2. Raising of green manures (Sunn hemp / Daincha / Fodder cowpea).
3. Incorporation of green manure - seed treatment and rising of field crop (Rice / Maize / Cowpea / Cotton / Gingelly).
4. Hands on practice on preparatory cultivation; soil and water conservation methods.
5. Hands on experience on recycling techniques; bio-composting and vermicomposting.
6. Quantification of nutrients from organic sources and application of manures and bio-fertilizers.
7. Exposure visit to an organic farm to learn ITK based preparations.
8. Organic crop production and weed management.
9. Skill development in composting farm residues.
10. Organic crop production and pest management.
11. Exposure visit to bio-control agent (*Pseudomonas*, *Trichoderma* etc.,) production units.
12. Organic crop production and diseases management.
13. Skill development in vermicompost preparation.
14. Hands on training on grading, packaging and post-harvest management.
15. Exposure visit to organic market out lets.
16. Exposure visit to organic certification agencies / Directorate of Organic Certification, Tamil Nadu.
17. **Final Practical Examination.**

Text books:

1. Bansal, M. 2020. Basics of organic farming. CBS publishers and distributors pvt. Ltd., New Delhi.
2. Maliwal, P.L. 2020. Principles of organic farming. Scientific Publishers (India).
3. Reddy, S.R. 2017. Principles of organic farming. Kalyani publishers, India
4. Lampkin, N., M. Measures and S. Padel. 2014 Organic Farm Management Handbook. University of Wales, Aberystwyth.
5. Arun. K. Sharma. 2011. Handbook of Organic farming. Agrobios (India), Jodhpur.
6. Palaniappan S.P and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.

Reference books:

1. Dushyant Gehlot. 2010. Organic farming: Components and management. Agrobios (India), Jodhpur.
2. Barker, A.V. 2010. Science and Technology of Organic Farming. CRC Press.
3. Gehlot, D. 2010. Organic Farming- Components and Management. Agrobios (India), Jodhpur.
4. Panda, S.C. 2012. Principles and Practices of Organic Farming. Agrobios (India), Jodhpur.
5. Peter Fossel. 2014. Organic Farming: How to Raise, Certify, and Market Organic Crops and Livestock. Reprint edition, Voyageur Press, USA.

6. Masanobu Fukuoka, Larry Korn, Wendell Berry and Frances Moore Lappe. 2009. The One-Straw Revolution: An Introduction to Natural Farming. NYRB Classics, New York.

Web references:

1. www.ifoam.org
2. www.apeda.org
3. www.cowindia.org
4. www.ncof.org
5. www.earthfooda.co.uk,
6. www.newfarm.org/training
7. <https://www.youtube.com/watch?v=JIWsx05nNgg>
8. <http://www.soilassociation.org>

22PBG 302 CROP IMPROVEMENT (2+1)

Course Objectives:

- Acquire knowledge on cereal breeding
- Gain knowledge on breeding of pulses
- Gain knowledge on breeding of oilseeds and fibres
- Learn about the breeding of vegetables and cash crops
- Gain the knowledge on breeding for biotic and abiotic stresses

Course Outcome:

- Describe the emasculation and artificial pollination in crops
- Explain the production of hybrids in different crops
- Clarify the difficulties on crop improvement and rectifications
- Explain the development of the varieties in crops
- Explain the genetics of qualitative and quantitative characters

THEORY

UNIT I: Breeding Cereals

Place of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.

Cereals and Millets: Rice, Wheat, Maize, Sorghum, Pearl millet and Finger millet.

UNIT II: Breeding Pulses and Oilseeds

Place of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.

Pulses: Red gram, Bengal gram, Green gram, Black gram, Cowpea and Soybean. Oilseeds: Groundnut, Sunflower, Gingelly, Castor, Rape and Mustard.

UNIT III: Breeding Cash crops and Fodder crops

Place of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.

Fibres: Cotton, Mesta and Jute; Sugars and starches: Sugarcane and Potato; Fumitories: Tobacco and Areca nut; Fodder: Guinea grass, Napier grass, Cumbu – Napier hybrids, Lucerne and *Stylosanthes*.

UNIT IV: Breeding for Biotic and Abiotic stresses and Quality

Breeding for insect resistance – mechanisms, basis, genetics of insect resistance - suitable breeding methods-merits and demerits of resistance breeding; Breeding for disease resistance – horizontal and vertical resistance. Gene for gene hypothesis – mechanisms, genetics of disease resistance; Suitable breeding methods for disease resistance-exploitation of vertical resistance in plant breeding-multilines, gene pyramiding, gene deployment. Breeding for Abiotic stress – drought – mechanisms, basis, genetics of drought resistance - suitable breeding methods-limitations of drought resistance breeding; Breeding for Abiotic stress –salinity and alkalinity; Breeding for quality traits- Important quality traits in different crops- nutritional quality of cereals and pulses-Genetics of nutritional traits-breeding methods- Breeding for low toxic substances- limitations of breeding for enhanced nutritional quality.

UNIT V: Maintenance breeding and IPR Issues

All India Coordinated Crop Improvement Projects. Procedure for release of new varieties; stages in seed multiplication; steps in nucleus and breeder seed production. Varietal rundown and renovation. Participatory plant breeding. Intellectual Property rights issues. Protection of plant varieties under UPOV and PPV & FR Act of India. Plant breeder's rights, Registration of plant varieties under PPV & FR Act 2001. Breeders right, researcher rights and farmers rights.

PRACTICAL

Observation on floral biology – anthesis and pollination – selfing – crossing techniques – observation on cultivated germplasm, wild species – Experimental design – handling segregating generations- Yield trials in following crops- Rice, Maize and Sorghum, Pearl millet and Finger millet, Redgram, Bengal gram, Green gram, Black gram, Cowpea and Soybean, Groundnut and Sunflower, Sesame and Castor, Cotton, Sugarcane, Guinea grass, Cumbu – Napier hybrids, Lucerne and *Stylosanthes*, Bhendi, Brinjal, Tomato, Papaya and Banana, Study of quality characters in rice, Study of donor parents for different characters, General seed production techniques in field crops, Visit to AICRP and seed production plots of different field crops

Lecture Schedule

Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops:

1. Cereals: Rice.
2. Cereals: Wheat

3. Cereals : Maize
4. Cereals: Sorghum
5. Cereals: Pearl millet and Finger millet
6. Pulses: Red gram and Bengal gram
7. Pulses: Green gram and Black gram
8. Pulses: Soybean and Cowpea
9. Oilseeds: Groundnut and Gingelly
10. Oilseeds: Rapeseed and Mustard
11. Oilseeds: Castor and Sunflower
12. Fibres: Cotton and Jute
13. Sugars and starches: Sugarcane and Potato
14. Forrage Grasses: Guinea grass, Napier grass, Cumbu-Napier hybrids
15. Forage legumes: Lucerne and *Stylosanthes*
16. Fumitories and Narcotics: Tobacco and Areca nut
17. **Mid Semester Examination**
18. Breeding for insect resistance – mechanisms, basis, genetics of insect resistance-
19. Suitable breeding methods- merits and demerits of resistance breeding
20. Breeding for disease resistance –horizontal and vertical resistance
21. Gene for gene hypothesis – mechanisms, genetics of disease resistance
22. Suitable breeding methods for disease resistance- exploitation of vertical resistance in plant breeding- multi lines, gene pyramiding, gene deployment.
23. Breeding for Abiotic stress – drought – mechanisms, basis.
24. Genetics of drought resistance - suitable breeding methods-limitations of drought resistance breeding.
25. Breeding for Abiotic stress – salinity and alkalinity
26. Breeding for quality traits- Important quality traits in different crops- nutritional quality of cereals and pulses.
27. Genetics of nutritional traits-breeding methods- Breeding for low toxic substances- limitations of breeding for enhanced nutritional quality.
28. All India Coordinated Crop Improvement Projects.
29. Procedure for release of new variety.
30. Stages of seed production. Nucleus and Breeder seed production of field crops. Varietal rundown and renovation.
31. Intellectual property and IPR Issues.
32. Protection of plant varieties under UPOV and PPV & FR Act of India, Plant breeder's rights.
33. Registration of plant varieties under PPV & FR Act, 2001.
34. Breeders, researcher and farmers rights.

Practical schedule

Observation on floral biology – anthesis and pollination – selfing – crossing techniques – observation on cultivated germplasm, wild species – Experimental design – handling segregating generations- Yield trials in following crops.

1. Rice.
2. Maize and Sorghum.
3. Pearl millet and Finger millet.
4. Red gram, Bengal gram and Soybean.
5. Green gram, Black gram and Cowpea.
6. Groundnut and Sunflower.

7. Sesame and Castor.
8. Cotton.
9. Sugarcane.
10. Guinea grass, Cumbu – Napier hybrids Lucerne and *Stylosanthes*.
11. Bhendi, Brinjal, Tomato.
12. Papaya and Banana.
13. Study of quality characters in rice.
14. Study of donor parents for different characters.
15. General seed production techniques in field crops.
16. Visit to AICRP and seed production plots of different field crops.

17. Final Practical Examination.

Text books

1. Sharma, J.R. 1994. Principles and practice of Plant Breeding. Tata McGraw – Hill Publishing Co. Ltd., New Delhi.
2. Singh, R.B., R.M. Singh and B.D. Singh, 1984. Advances in Cytogenetics and crop improvement. Kalyani Publishers, New Delhi.
3. Singh, B.D. 2007. Plant breeding - Principles and methods.
4. Phundan Singh. 2015. Essentials of Plant Breeding. Kalyani Publishers, New Delhi
5. D.N.Bharadwaj. 2012. Breeding Field Crops. Agrobios (India), Jodhpur - 342002

References

1. George Acquaah.2012. Principles of Plant Genetics and Breeding. Blackwell Publishing Ltd., USA.
2. Kumar, N. 2006. Breeding of Horticultural Crops - Principles and Practices. New India Publishing Agency, New Delhi.
3. Ram, H. H and Govind H. S. 1994. Crop breeding and Genetics. Kalyani Publishers, New Delhi.
4. Sleper, D. A. and J. M. Poehlman. 2007. Breeding Field Crops. Blackwell Publishing Professional (USA).

Web References:

1. https://agritech.tnau.ac.in/crop_improvement/crop_imprv_breed.html
2. <https://www.bayer.com/en/agriculture/plant-breeding>
3. <https://www.cwrdiversity.org/project/pre-breeding/>
4. <https://learn.genetics.utah.edu/content/cotton/crop>
5. <https://www.crops.org/about-crops/breeding/>

22AEC 302 AGRICULTURAL FINANCE AND CO-OPERATION (2+1)

Course objective:

- Explain the importance of agricultural finance
- Identify and understand the Agriculture Finance institutions
- Discuss the Farm finance analysis
- Describe the types of banking institutions in India and overseas financial institutions
- Identify Agriculture co-operations and cooperation institutions in India
- Explain RBI, monetary policies and non-banking financial institutions and Insurance for crops

Course outcome:

- Outline the financial activities in a farm
- Identify the institutional approach to avail projects and funding
- Describe on financial products in banks

- Recall the information on central bank and monetary policies
- Summarize the Activities of Agriculture cooperative banks and regional rural banks
- Identify Credit gaps and Agriculture insurances

THEORY

Unit I – Agricultural Finance – Nature and Scope

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Sources of credit - advantages and disadvantages - Rural indebtedness- History and Development of rural credit in India.

Unit II – Financial Institutions

Sources of agricultural finance: institutional and non-institutional sources and their roles, commercial banks - social control and nationalization of commercial banks. Micro financing including KCC, Micro finance – SHG Models, Lead Bank Scheme, RRBs, Scale of finance and unit cost. Cost of credit. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Recent development in agricultural credit: Rural credit policies of Government – Subsidized farm credit - Differential Interest Rate (DIR) Scheme – Loan relief measures

Unit III – Farm Financial Analysis

Credit analysis: 4 R's, 7 P's and 3C's of credit. Preparation of bankable projects / Farm credit proposals – Feasibility; Appraisal - Time value of money: Compounding and Discounting - Undiscounted and Discounted measures. Preparation and analysis of financial statements – Balance Sheet, Income Statement and Cash Flow Statement. Basic guidelines for preparation of project reports - Bank norms – SWOT analysis.

Unit IV – Co-operation

Agricultural Cooperation in India – Meaning, brief history of cooperative development in India - Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Co-operating credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. Strength and weakness of co-operative credit system, Policies for revitalizing co-operative credit.

Unit V – Banking and Insurance

Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI – functions - Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money - Financial Inclusion and Exclusion: credit widening and credit deepening monetary policies. Credit gap: Factors influencing credit gap. Non - Banking Financial Institutions (NBFI). NPA – Causes, consequences and mitigation. Crop Insurance: Schemes, Coverage, Advantages and Limitations in Implementation - Estimation of Crop Yields - Assessment of crop losses, Determination of compensation - Weather based crop insurance, features, determinants of compensation. Livestock Insurance Schemes Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

PRACTICAL

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank / cooperative society to acquire first - hand knowledge of their management, schemes and procedures. Visit to

District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan–Fixation of Scale of Finance. Estimation of credit requirement of farm business – A case study. Preparation and analysis of Balance Sheet, and Cash Flow Statement – A case study. Exercise on Financial Ratio Analysis. Appraisal of farm credit proposals–A case study. Preparation and analysis of income statement–A case study. Preparation of Bankable projects / Farm Credit Proposals and appraisal- Undiscounted methods and Discounted methods. Techno-economic parameters for preparation of projects for various agricultural products and its value added products. Seminar on selected topics. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.

Lecture Schedule:

1. Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture.
2. Agricultural credit: meaning, definition, need and classification.
3. Sources of credit - advantages and disadvantages.
4. Rural indebtedness - History and Development of rural credit in India.
5. Sources of agricultural finance: institutional and non-institutional sources - their roles.
6. Commercial banks - social control and nationalization of commercial banks.
7. Micro financing including KCC, Micro finance – SHG Models, Lead bank scheme.
8. RRBs, Scale of finance and unit cost. Cost of credit.
9. An introduction to higher financing institutions–RBI, NABARD, ADB, IMF and World Bank.
10. Role of Insurance and Credit Guarantee Corporation of India.
11. Recent developments in agricultural credit.
12. Rural credit policies of Government: Subsidized farm credit- Differential Interest Rate (DIR) Scheme. – Loan relief measures
13. Credit analysis: 4 R's, 7 P's and 3C's of credit.
14. Preparation of bankable projects / Farm credit proposals – Feasibility.
15. Appraisal: Time value of money: Compounding and Discounting - Undiscounted and Discounted measures.
16. Preparation and analysis of financial statements – Balance Sheet, Income Statement and Cash Flow Statement.
17. **Mid Semester Examination**
18. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.
19. Agricultural Cooperation in India – Meaning, brief history of cooperative development in India.
20. Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.
21. Co-operating credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing;
22. Role of ICA, NCUI, NCDC and NAFED.
23. Strength and weakness of co-operative credit system, Policies for revitalizing co-operative credit.
24. Negotiable Instruments: Meaning, Importance and Types.
25. Central bank: RBI – functions, Credit control – Objectives and Methods: CRR, SLR and Repo rate.
26. Credit rationing - Dear money and cheap money. Financial Inclusion and Exclusion: credit widening and credit deepening monetary policies.

27. Credit gap: Factors influencing credit gap.
28. Non - Banking Financial Institutions (NBFI).
29. NPA – Causes, consequences and mitigation.
30. Crop Insurance: Schemes, Coverage, Advantages and Limitations in Implementation.
31. Estimation of Crop Yields - Assessment of crop losses, Determination of compensation.
32. Weather based crop insurance, features, determinants of compensation.
33. Livestock Insurance Schemes
34. Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

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, cooperative bank / cooperative society to acquire first - hand knowledge of their management, schemes and procedures.
6. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan – Fixation of Scale of Finance.
7. Guest lecture on Role and functions of Commercial Bank and Lead Bank / NABARD and its Role and Functions.
8. Estimation of credit requirement of farm business – A case study.
9. Preparation and analysis of Balance Sheet and Cash Flow Statement – A case study.
10. Exercise on Financial Ratio Analysis. Appraisal of farm credit proposals – A case study.
11. Preparation and analysis of income statement – A case study.
12. Preparation of Bankable projects / Farm Credit Proposals and appraisal.
13. Undiscounted methods and Discounted methods.
14. Techno-economic parameters for preparation of projects for various agricultural products and its value added products.
15. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.
16. Seminar on selected topics.

17. Final Practical Examination.

Text Books

1. Bhagat, D. 2014. Textbook of Agricultural Marketing and Co-operation. India: Neha Publishers & Distributors. pp. 2-66
2. Reddy, S, S., 2017. Agricultural Finance and Management. New Delhi: Oxford & IBH Publishing. pp 1-268

Reference Books

1. Charles Moss, B. 2013. Agricultural Finance.UK: Routledge Company. pp.1-295
2. Geman. H 2015. Agricultural Finance: From Crops to Land, Water and Infrastructure (The Wiley Finance Series), USA: Wiley Publishers. pp.1-288
3. Lee, W.F., Boehlje, M.D., Nelson, A.G., & Murray, W.G. 1998. Agricultural Finance, New Delhi: Kalyani Publishers. pp.1- 468

Web-References

1. www.rbi.org.in
2. www.nsic.co.in
3. www.nabard.org

22PAT 302 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT -II (2+1)

Course objective:

- To study the symptoms and cause of disease
- To understand host pathogen interaction
- Understand the role of environmental factors in disease development
- Gain knowledge on integrated disease management.

Course outcome: At the end of the course the student should be able to

- Diagnosis and distinguish various diseases of field and horticultural crops
- Distinguish the diseases caused by biotic factors and abiotic factors
- Detailed understanding of host parasite relationship, survival and spread
- Plan and recommendation of appropriate management practices

THEORY

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of diseases and nematode disease complex. Mushroom cultivation.

Unit I- Diseases of Cereals, Pulses and Oil Seed Crops

Cereals: Wheat - Rust, loose smut, bunt, powdery mildew, foot rot, leaf blight, yellow ear rot. Pulses: Chickpea - Wilt, blight, rust, powdery mildew, root rot, lentil – Rust and wilt. Oil seeds: Sunflower and mustard - leaf spot, rust, root rot, stem rot, powdery mildew, downy mildew, white rust, mosaic

Unit II- Diseases of Cash Crops and Fruit Crops

Cash crops: Cotton - wilt, root rot, anthracnose, grey mildew, rust, leaf spot, bacterial leaf blight, Sugarcane - Red rot, smut, wilt, sett rot, red stripe, rust, leaf spot, mosaic, ratoon stunting, grassy shoot, pokkah boeng. **Fruit crops:** Mango - mango malformation, powdery mildew, anthracnose, black tip of mango, algal leaf spot, gray blight, sooty mold, die back, gummosis, root rot, Citrus - citrus canker, citrus tristeza disease, citrus greening, citrus stubborn, citrus die back, citrus wilt, exocortis, root rot, citrus nematode, Grapevine - anthracnose, rust, powdery mildew, downy mildew, pierce disease, grape fan leaf virus, Apple - fire blight of apple, apple canker, anthracnose, apple scab, root rot, Peach - leaf curl, powdery mildew, Strawberry - leaf spot, rust, fruit blight, powdery mildew, Plum and pear – Leaf spot, powdery mildew, brown rot, black knot, crown gall.

Unit III- Diseases of Vegetable And Spice Crops

Vegetable crops: Potato - late blight, early blight, ring rot, leaf roll, mosaic, leaf spot, black scurf, silvery scurf, powdery scab, black leg, bacterial soft rot, golden cyst nematode, Cucurbits - powdery mildew, leaf spot, downy mildew, root rot, wilt, bacteria leaf spot, mosaic disease, Peas – powdery mildew, fusarium wilt, rust, Cassava - leaf spot, mosaic disease, root rot, Colocasia and yam – Leaf spot, root rot, Chilli - damping off, leaf spot, anthracnose, powdery mildew, wilt, root rot, Turmeric - rhizome rot, leaf blotch, leaf spot, root rot, blast, bacterial wilt, Ginger – soft rot, bacterial wilt, leaf spot, storage rot, yellows, dry rot, Onion - blight, smut, smudge, rust, root rot, Garlic – basal rot, white rot, downy mildew, botrytis rot, penicillium rot, Coriander - stem gall, powdery mildew, Cardamom - Katte/marble mosaic disease, azhukal disease, rhizome rot, leaf spot.

Unit IV- Diseases of Plantation and Flower Crops

Plantation crops: Black pepper - quick wilt, slow wilt, pollu disease, charcoal rot, root rot, Betelvine – foot rot, wilt, powdery mildew, anthracnose, leaf spot. Flower crops: Rose - black spot, powdery mildew, flower blight, rust, gray blight, die back, crown gall, Jasmine - leaf spot, collar rot, phyllody, root rot, Marigold - leaf spot, wilt, root rot, Crossandra – wilt, root rot, leaf

blight, , Chrysanthemum - leaf spot, white rust, wilt, root rot, stunt viroid, Tube rose - stem rot, flower bud rot, botrytis spot and blight, sclerotial wilt, leaf spot, Carnation - wilt, root rot, wilt, rust, fairy ring spot, stem rot, Lillium - wilt, root rot, leaf spot, Orchids – Leaf spot.

Unit V- Post Harvest Diseases of Fruits and Vegetables, Mushroom Cultivation

Post-harvest diseases of fruits and vegetable. Mushroom cultivation: Importance of mushroom - Cultivation of oyster mushroom, milky mushroom, paddy straw mushroom and button mushroom – Constraints in mushroom cultivation - Post harvest technology

PRACTICAL

Identification of diseases based on symptoms, microscopic examination of causal organism and study of host parasite relationship and management of major diseases of wheat, chickpea, lentil, sunflower, mustard, cotton, sugarcane, mango, citrus, grapevine, apple, peach, plum, pear, strawberry, cucurbits, potato, peas, cassava, colocasia, yam, chilli, turmeric, ginger, onion, garlic, coriander, cardamom, black pepper, betelvine and flower crops. Cultivation of button and paddy straw mushroom

Cultivation of oyster, and milky mushroom

Lecture schedule:

1. Diseases of wheat I
2. Diseases of wheat II
3. Diseases of chickpea and lentil
4. Diseases of sunflower and mustard
5. Diseases of cotton
6. Diseases of sugarcane
7. Diseases of mango
8. Diseases of citrus
9. Diseases of grapevine
10. Diseases of apple and peach
11. Diseases of plum and pear
12. Diseases of strawberry
13. Diseases of cucurbits
14. Diseases of potato I
15. Diseases of potato II
16. Diseases of peas
17. **Mid-semester examination**
18. Diseases of cassava, colocasia and yam
19. Diseases of chilli
20. Diseases of turmeric and ginger
21. Diseases of onion
22. Diseases of garlic
23. Diseases of coriander and cardamom
24. Diseases of black pepper and betel vine
25. Diseases of rose and jasmine
26. Diseases of marigold and crossandra
27. Diseases of chrysanthemum
28. Diseases of tuberoses and carnation
29. Diseases of lillium and orchids
30. Post-harvest diseases of fruits and vegetables
31. Importance and scope of mushroom
32. Cultivation for button mushroom

33. Cultivation of paddy straw mushroom
34. Cultivation of oyster mushroom and milky mushroom

Practical schedule:

Symptomatology, host parasite relationship and management of (1 to 14)

1. Diseases of wheat
2. Diseases of chickpea, lentil, sunflower and mustard
3. Diseases of cotton and sugarcane
4. Diseases of mango
5. Diseases of citrus and grapevine
6. Diseases of apple, peach, plum, pear and strawberry
7. Diseases of cucurbits
8. Diseases of potato and peas
9. Diseases of cassava, colacasia and yam
10. Diseases of chilli, turmeric and ginger
11. Diseases of onion and garlic
12. Diseases of coriander, cardamom
13. Diseases of black pepper and betelvine
14. Diseases of flower crops
15. Cultivation of button and paddy straw mushroom
16. Cultivation of oyster, and milky mushroom
17. **Final Practical Examination.**

Text Books

1. Agrios, G.N. 2005. *Plant Pathology* (5th Ed.). New York: Academic Press. pp. 1-922.
2. Girish Chand and Santhosh Kumar. 2016. *Crop Diseases and Their Management*. Florida: CRC press. pp. 1-295.
3. Gupta, V. K. 2008. *Diseases of Fruit Crops*. Kalyani Publishers. pp. 1-344
4. Gupta, V.K. & Paul, Y S. 2005. *Diseases of Plantation Crops*. Kalyani Publishers. pp. 1-197.
5. Rangasawmi, G and Mahadevan, A. 2004. *Diseases of Crop Plants in India*. New Delhi: Prentice Hall of India Pvt. Ltd. pp. 1-548.
6. Roland N Perry & Maurice Moens. 2013. *Plant Nematology*. UK: CABI. pp. 1-568.
7. Sanjeev Kumar. 2015. *Diseases of Horticultural crops, Identification and Management*. India: New India Publishing Agency. Pai & Sons. pp. 1-296.

Reference Books

1. Alfred Steferud. 2005. *Diseases of Plantation Crops*. Delhi: Biotech Books. pp. 1-317.
2. Alfred Steferud. 2005. *Diseases of Vegetable Crops*. Delhi: Biotech Books. pp. 1-210.
3. Dasgupta, M.K. and Mandal, W.C. 1989. *Post-harvest pathology of perishables*. New Delhi: Oxford IBH publishing Co. pp. 1-638.
4. Madhu Meeta. 2005. *Diseases of Ornamental Plants in India: Reference Book Cum Bibliography*. South Asia Books. pp. 1-327.
5. Sonia Ahuja. 2005. *Plant Diseases*. New Delhi: Vishvabharti. pp. 1-268.
6. Trivedi, P.C. 2016. *Diseases of vegetables and their management*. Jaipur: Pointer publisher. pp. 1-270.

Web-References

1. <http://www.biologydiscussion.com>
2. <https://www.microscopemaster.com/fungi>
3. www.apsnet.org/edcenter
4. Tolweb.org
5. <http://www.hillagric.ac.in/edu/coa/ppath/lectures.htm>

6. <http://ecoursesonline.iasri.res.in/course/view.php?id=143>
7. www.ucmp.berkeley.edu/fungi
8. www.ictv.org
9. www.vivo.library.cornell.edu
10. <https://www.youtube.com/c/MTutorEdu/search?query=plant+pathology>
11. <https://www.youtube.com/channel/UCsqovy3LIp-dB8pMxU2VZ7A>
12. <https://www.youtube.com/user/uwipm/search?query=diseases>

22ABT 301 PLANT BIOTECHNOLOGY (2+1)

Course Objectives:

- Explain the basic techniques in tissue culture.
- Understand the techniques in molecular biology.
- Gain knowledge about the rDNA technology.
- Inculcate the molecular markers for the identification of transgenes .

Course Outcome:

- Describe the concepts and scope of plant tissue culture.
- Interpret mapping populations, linkage and QTL analysis.
- Apply plant regeneration methods for crop improvement.
- Analyse GMOs regulations and biosafety.
- Evaluate the genetic transformants by using rDNA technology.

THEORY

UNIT I: Basics of Plant Tissue culture

Plant tissue culture: Concepts, history and scope, Media and Culture Conditions, Sterilization techniques, Regeneration methods - morphogenesis, organogenesis and embryogenesis. Cell culture types: callus culture and cell suspension culture, shoot tip and meristem tip culture, anther and pollen culture, ovule and embryo culture.

UNIT II: Applied Plant Tissue Culture

Micropropagation - banana and ornamental plants; National certification and Quality management of TC plants. Applications of organ culture - Meristem tip culture (virus free plants) and anther culture (doubled haploids). Protoplast isolation and fusion, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation. Secondary metabolite production and *in-vitro* germplasm conservation.

UNIT III: Basic Molecular Biology

Genome organization- prokaryotes vs eukaryotes - Central dogma of life. Structure of nucleic acids. DNA replication, Transcription and translation. Genetic codes. Structure of a gene, regulation of gene expression, Operon concept. Polymerase chain reaction- DNA sequencing methods. Blotting techniques.

UNIT IV: Recombinant DNA Technology and Genetic Transformation

DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases - Different types of vectors: plasmids, phagemids, cosmids, BAC - Construction of recombinant DNA molecules. Bacterial transformation - Direct and indirect gene transfer methods in plants, physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods. Tissue specific promoters, selectable and scorable markers, reporter genes. Molecular analysis of transgenic plants. Transgenic in crop improvement - Biotic stress resistance (Pest, Viral, Bacterial & Fungal), Abiotic stress tolerance (Herbicide, Salt, Drought),

Crop improvement (Flavr Savr tomato, Golden rice, Amino acid enrichment). GMOs regulations and biosafety.

UNIT V: Molecular Marker Technology and Molecular Breeding

DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs. DNA fingerprinting of crop varieties – Development of mapping populations-linkage and QTL analysis- principles, methods and applications of Marker Assisted Selection in crop improvement. Applications of Plant Genomics and genome databases.

PRACTICAL

Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening/ Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques-direct methods; Demonstration of Gene transfer techniques-indirect methods; Demonstration of Confirmation of Genetic transformation; Demonstration of gel electrophoresis techniques. Restriction enzymes for digestion of DNA.

Lecture schedule:

1. Plant tissue culture: Concepts, history and scope.
2. Media and Culture Conditions and Sterilization techniques.
3. Regeneration methods - morphogenesis, organogenesis and embryogenesis.
4. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture.
5. Anther and pollen culture; ovule and embryo culture.
6. Micropropagation - banana and ornamental plants.
7. National certification and Quality management of TC plants.
8. Applications of organ culture - Meristem tip culture (virus free plants) and anther culture (doubled haploids).
9. Protoplast isolation and fusion.
10. Synthetic seeds and their significance; Embryo rescue and its significance.
11. Somatic hybridization and cybrids.
12. Somaclonal variation and its use in crop improvement and cryo-preservation.
13. Secondary metabolite production and *in-vitro* germplasm conservation.
14. Genome organization and Central dogma of life.
15. Structure of nucleic acids.
16. DNA replication, Transcription and translation. Genetic codes.
- 17. Mid Semester Examination**
18. Structure of a gene and regulation of gene expression and Operon concept.
19. Operon concept and Polymerase chain reaction.
20. DNA Sequencing.
21. Blotting techniques.
22. DNA manipulation enzymes and Different types of vectors.
23. Construction of recombinant DNA molecules and bacterial transformation.
24. Direct and indirect gene transfer methods in plants. Promoter, marker and reporter genes.
25. Molecular analysis of transgenic plants.
26. Transgenic in crop improvement – Biotic stress resistance, Abiotic stress tolerance and Crop improvement.
27. GMOs regulations and biosafety.

28. DNA markers - hybridization based markers (RFLP).
29. PCR based markers- RAPD, and SSR.
30. PCR based markers- AFLP, and SNPs.
31. DNA fingerprinting of crop varieties.
32. Development of mapping populations, linkage and QTL analysis.
33. Principles, methods and applications of Marker Assisted Selection in crop improvement.
34. Applications of Plant Genomics and genome databases.

Practical schedule

1. Plant tissue culture media preparation, Culture Conditions and Sterilization techniques.
2. Regeneration methods - morphogenesis, organogenesis and embryogenesis.
3. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture.
4. Anther and pollen culture; ovule and embryo culture.
5. Micro-propagation of Banana and ornamental plants.
6. Meristem tip culture (virus free plants) and anther culture (doubled haploids).
7. Isolation of Bacterial Plasmid DNA.
8. Restriction Digestion and Ligation.
9. Competent Cell Preparation and Bacterial Transformation.
10. Confirmation of Transformation through Colony Screening.
11. Agrobacterium mediated gene transfer in plants.
12. Genomic DNA Extraction from Plants.
13. Quantification of DNA and Quality Check through Agarose Gel Electrophoresis.
14. DNA Fingerprinting using PCR.
15. A demonstration on hardening and field transfer of TC plants.
16. Visit to Tissue Culture Units /Biotech Lab in Seed Industry/Bt Cotton Field – Lateral Flow Strip Assay.

17. Final Practical Examination.

Text books

6. Razdan M K, 2014. Introduction to plant Tissue Culture 2nd Edn. Science Publishers, inc. USA.
7. Thomar, R.S., Parakhia, M.V., Patel, S.V. and Golakia, B.A., 2010. Molecular markers and Plant biotechnology, New Publishers, New Delhi.
8. Purohit, S.S., 2004. A Laboratory Manual of Plant Biotechnology 2nd Edn. Agribios, India.
9. Singh, B.D. 2012. Plant biotechnology. Kalyani publishers, Ludhiana.
10. Chahal, G.S. and Gosal, S.S.2003. Principles and procedures of plant approaches breeding Biotechnological and conventional. Narosa Publishing House, New Delhi.

References

5. Singh, B D, 2004. Biotechnology Expanding Horizons 2nd Edn. Kalyani Publishers, New Delhi.
6. Gupta, P.K., 2015. Elements of Biotechnology 2nd Edn. Rastogi and Co., Meerut.
7. Gautam V K, 2005. Agricultural Biotechnology. Sublime Publications.
8. Bilgrami, K.S. and Pandey, A.K.1992. Introduction to biotechnology. CBS Pub. New Delhi.
9. Gupta, P.K. 1994. Elements of biotechnology. Rastogi Pub. Meerut.

Web References

1. <https://www.plantcelltechnology.com/blog/tissue-culture-vs-conventional-techniques-of-growing-plants/>

2. <https://www.sigmaaldrich.com/IN/en/applications/cell-culture-and-cell-culture-analysis/cell-culture-by-cell-type/plant-tissue-culture>
3. <https://www.intechopen.com/chapters/40180>
4. <https://www.isaaa.org/resources/publications/pocketk/14/default.asp>
5. <https://labassociates.com/6-plant-tissue-culture-media-for-beginners>

22RSG 301 GEO-INFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING (1+1)

Course objective:

- To impart knowledge on application of ICT in agriculture using computerized models
- To understand the role of RS, GIS, GPS, and drones in agriculture
- To learn about precision agriculture using geospatial technology
- To learn, design and develop Decision Support Systems (DSS) and soil information for agricultural applications.
- To learn about the scope and importance of precision farming
- To familiarize with crop simulation models and their role in precision farming

Course outcome:

- Understand and use the information, communication, and technology (ICT) in agriculture.
- Demonstrate use of GIS and GPS systems in precision agriculture
- Apply and develop computerized models to understand plant growth process.
- Relate the use of GIS and GPS systems in drip installation and fertigation techniques
- Demonstrate use of Unmanned Aerial Vehicle (UMAV) to gather information.
- Develop precision farming technology for important crops.

THEORY

Unit I – Concept of Geoinformatics

Geo-informatics – Meaning, objectives, scope, and importance; Science and Technologies involved; Cartography, Geodesy- Geology- Remote Sensing- Geographical Information System-Photogrammetry - Information & Communication Technologies- Global Positioning System- Digital Image Processing – Hyperspectral Image Processing - Map as decision tool; Georeferencing, Geofencing and map design.

Unit II – Application of Geoinformatics

Application of Geoinformatics: Rural Development, Geosciences, Agriculture, Forestry, Soil Studies, Meteorology, Military, Transport, Environmental studies, Banking and Health Civil Engineering etc..

Unit III – Nanotechnology

History, definition, terminologies in nanoscience - Importance of Moore's law - Scientific revolution - nano-scale effects, emergence and challenges of nanoscience and nanotechnology; Introduction to nanoparticles, 1D, 2D, 3D and Quantum Dots; bucky ball – CNT – Metals NPs, Metal oxide NPs, core-shell NPs, micelle; Use of nanotechnology in seed science, fertilizer, plant protection for scaling-up farm productivity

Unit IV – Precision Farming Technology

Precision farming – Definition, scope and importance, principles and concepts; Recent precision farming equipment's / sensors / devices; Variable rate technology – principles and application; spatial and temporal variability, variable rate machinery; Soil mapping and fertilizer recommendation – Site Specific Nutrient Management; variable Spraying; Geospatial technology for generating valuable Agri-information; IOT - applications of IOT in agriculture / agro-

hydrology, recent IoT systems; Smart sprayers for agro based application- Intelligent advance harvesting machines, Fruit picking machine; Grading and packing system

Unit V – Crop Simulation models

Crop simulation models and their uses for optimization of agricultural Inputs; DSSAT – Crop – info – CropSyst – Wofost; Agriculture Expert Systems; Decision Support Systems, concepts, components, and applications in Agriculture; Preparation of contingent crop-planning using IT tools.

PRACTICAL

Map appreciation – map interpretation – thematic layers – map objects – data dictionary. Methods of data analysis: Measurement – Buffer – overlay – network analysis – surface interpolation – reclassification – TIN – DEM – Distance tools. Interpretation of Aerial Photographs, Use of Google Earth, Bhuvan and MOSDAC portal. Application of spectroradiometer for development of vegetation index. Application of GPS in soil sampling. Use of precision farming equipment/sensors/devices. Reading and displaying satellite data from BIL, BSQ and BIP formats. Generating True, False and Pseudo Colour Composite (FCC). Geo referencing the base image, Image to Image, Map to Image – Geometric correction of satellite image. Land resource management: Change detection in various land use/ land cover types and cross tabulation - land capability assessment - soil erosion estimation - Village GIS- urban sprawl. Water resource management: Watershed delineation and identification of suitable site for constructing water harvesting structures – assessing the water holding capacity of a dam. Hydrological modelling - drought assessment – metrological, agricultural, hydrological and socio - economic drought - locating site for artificial recharge zone – water quality assessment. Use of spatial data in Arc-GIS / Open-source GIS / Web-GIS in Environmental analysis. Synthesis of Au, Ag and ZnO nanoparticles. UV-Visible spectroscopic measurement of Au, Ag and ZnO nanoparticles. Design variable rate fertilizer map for site specific nutrient management. DSSAT – Crop model for Banana and Paddy

Lecture Schedule

1. Geoinformatics – Meaning, Objectives, scope, and importance.
2. Science and Technologies involved - Cartography, Geodesy, Geology, Remote sensing.
3. Science and Technologies involved – Geographical Information Systems – Photogrammetry - Information & Communication Technologies
4. Global Positioning System- Digital Image Processing – Hyperspectral Image Processing - Map as decision tool; Georeferencing, Geofencing and map design
5. Application of Geoinformatics – Rural Development, Geosciences, Agriculture, Forestry
6. Application of Geoinformatics – Soil Studies, Meteorology, Military, Transport
7. Application of Geoinformatics – Environmental studies, Banking and Health Civil Engineering
8. History, definition, terminologies in nanoscience - Importance of Moore's law - Scientific revolution - nano-scale effects, emergence and challenges of nanoscience and nanotechnology
9. **Mid Semester Examination**
10. Introduction to nanoparticles, 1D, 2D, 3D and Quantum Dots; bucky ball – CNT – Metals NPs, Metal oxide NPs, core-shell NPs, micelle
11. Use of nanotechnology in seed science, fertilizer, plant protection for scaling-up farm productivity
12. Precision farming – Definition, scope and importance, principles and concepts; Recent precision farming equipment's / sensors / devices.

13. Variable rate technology – principles and application; spatial and temporal variability variable rate machinery; Soil mapping and fertilizer recommendation –
14. Site Specific Nutrient Management; variable Spraying; Geospatial technology for generating valuable Agri-information.
15. IOT - applications of IOT in agriculture / agro-hydrology, recent IoT systems; Smart sprayers for agro based application- Intelligent advance harvesting machines, Fruit picking machine; Grading and packing system
16. Crop simulation models and their uses for optimization of agricultural Inputs. DSSAT – Crop – info – CropSyst – Wofost
17. Agriculture Expert Systems; Decision Support Systems, concepts, components and applications in Agriculture. Preparation of contingent crop-planning using IT tools

Practical Schedule

1. Map appreciation – map interpretation – thematic layers – map objects – data dictionary
2. Methods of data analysis: Measurement – Buffer – overlay – network analysis – surface interpolation – reclassification – TIN – DEM – Distance tools.
3. Interpretation of Aerial Photographs, Use of Google Earth, Bhuvan and MOSDAC portal
4. Application of spectroradiometer for development of vegetation index
5. Application of GPS in soil sampling
6. Use of precision farming equipment/sensors/devices
7. Reading and displaying satellite data from BIL, BSQ and BIP formats
8. Generating True, False and Pseudo Colour Composite (FCC)
9. Geo referencing the base image, Image to Image, Map to Image – Geometric correction of satellite image
10. Land resource management: Change detection in various land use/ land cover types and cross tabulation - land capability assessment - soil erosion estimation - Village GIS- urban sprawl
11. Water resource management: Watershed delineation and identification of suitable site for constructing water harvesting structures – assessing the water holding capacity of a dam
12. Hydrological modelling - drought assessment – metrological, agricultural, hydrological and socio - economic drought - locating site for artificial recharge zone – water quality assessment
13. Use of spatial data in Arc-GIS / Open-source GIS / Web-GIS in Environmental analysis
14. Synthesis of Au, Ag and ZnO nanoparticles. UV-Visible spectroscopic measurement of Au, Ag and ZnO nanoparticles
15. Design variable rate fertilizer map for site specific nutrient management
16. DSSAT – Crop model for Banana and Paddy

17. Final Practical Examination

Textbooks

1. Anji Reddy, M. 2008. *Textbook of Remote Sensing and Geographic Information Systems*. Third Edition. BS Publication, Hyderabad
2. Reddy, S. R. 2017. *Geoinformatics and Nanotechnology for Precision Farming*. First edition. Kalyani Publishers, India
3. T. Pradeep 2009 *Nano: The essentials understanding nanoscience and Nanotechnology* - 2009 - Mc Graw Hill.
4. John R Jenson, 1986 *Introducing Digital Image Processing*, Prantice Hall. New Jersey 1986.

Reference Books

1. Kang-tsungchang 2006. *Introduction to Geographic Information Systems*. Tata McGraw – Hill Publishing Company Limited, New Delhi.

2. George Joseph 2003 *Fundamentals of Remote Sensing*. Universities Press (India) Pvt Ltd, 3-5-819 Hyderguda, Hyderabad 500 029. 2003. 433 pp
3. Thomas & Kiefer R.W. 2007. *Remote Sensing and Image Interpretation*. John Wiley & Sons, New York

Web-References

1. www.geospatialworld.net
2. <https://www.indiawaterportal.org/articles/remote-sensing-applications-book-nrsc-2010>
3. <https://www.nrcan.gc.ca/maps-tools-publications/satellite-imagery-air-photos/tutorial-fundamentals-remote-sensing/9309>
4. <https://www.ucdavis.edu/minors/precision-agriculture>

22AEC 303 INTELLECTUAL PROPERTY RIGHTS (1+0)

Course objective:

- Expose the students on intellectual properties
- Gain knowledge on various property rights
- Understand the process of patent filing
- Learn about IPR Institutions
- Acquire knowledge about PPV & FR
- Expose the students on intellectual properties

Course outcome:

- Explain about IPR and importance
- Appraise on IPR's
- Explain the Ideology on filing IPR's
- Persuade about the scope and importance for future generations
- Speculate about conservation of traditional food crops and Traditional Knowledge
- Elaborate on Bio-diversity conservation acts related to food crops

THEORY

Unit I–Origin and Genesis Intellectual Property Rights

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO

Unit II –Types of Intellectual Property and Legislations

Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.

Unit III – Procedures in Filing Patent

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–International Union for the Protection of New Varieties of Plants

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

Unit V – International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

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. Traditional knowledge-meaning and rights of TK holders. Farmer's Rights, Tribal rights, Consumer rights, Indigenous people rights Food Security.

Lecture Schedule

1. Historical perspectives and need for the introduction of Intellectual Property Right regime; GATT, WTO;
2. Brief introduction to GATT and WTO
3. TRIPs and WIPO TRIPS Agreement Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;
4. Copyrights, geographical indications, designs and layout, Trade secrets and traditional

5. Knowledge and trademarks, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.
6. Indian Legislations for the protection of various types of Intellectual Properties;
7. Fundamentals of patents, patent, filing of patent
8. Patent specification, patent claims, compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

9. Mid Semester Examination

10. Origin and history including a brief introduction to UPOV for protection of plant varieties Protection of plant varieties and farmers' rights.
11. Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001,
12. Protection of other biological materials, ownership and period of protection;
13. Biodiversity protection, Protectable subject matters, protection in biotechnology,
14. National Biodiversity protection initiatives; Convention on Biological Diversity;. International Treaty on Plant Genetic Resources for Food and Agriculture;
15. Licensing of technologies, Material transfer agreements,
16. Research collaboration Agreement, License Agreement. Patent system in India, Patent search and patent database.
17. Traditional knowledge-meaning and rights of TK holders. Farmer's Rights, Tribal rights, Consumer rights, Indigenous people rights Food Security.

Text Books

1. Neeraj, P., & Khusdeep, D., 2014. Intellectual Property Rights. India: PHI learning Private Limited. pp1-268
2. Nithyananda, K, V., 2019. Intellectual Property Rights: Protection and Management. India: Cengage Learning India Private Limited. Pp. 1-396

Reference Books

1. Ahuja, V, K., 2017. Law relating to Intellectual Property Rights. India: Lexis Nexis. Pp. 10-150

Web-References

1. www.wipo.int/portal/index.html.en
2. www.wto.org/
3. www.uspto.gov
4. www.patentoffice.nic.in/
5. www.ipindia.nic.in/Niipm/index.htm
6. www.nbaindia.org/

22ENS 301 Environmental Studies and Disaster Management (2+1)

Course Objective

- To study the nature of Environmental Science and Natural Resources
- To expose the students to Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems - Energy resources: Growing energy needs, renewable and non-renewable energy sources, and use of alternate energy sources - Urban problems related to energy
- To impart knowledge on Environmental Science and disaster management

Course Outcome

- Basics of Environmental Science, Ecosystems and Biodiversity, Environmental Pollution and Management, Social Issues, Human Health and the Environment, Disaster Management

THEORY

Unit I – Introduction to Multidisciplinary nature of Environmental Science and Natural Resources

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

Unit II – Ecosystems and Biodiversity

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids - Species interactions and Biogeochemical cycles - Introduction, types, characteristic features, structure and function of Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Biodiversity - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India - Value of biodiversity - Biodiversity at global, National and local levels, India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity - In-situ and Ex-situ conservation of biodiversity; Biosphere Reserve - National parks and Wildlife Sanctuaries; Botanical Garden; Biodiversity legislation.

Unit III – Environmental Pollution and Management

Environmental Pollution - Definition, cause, effects and control measures of Air pollution and Noise pollution - Definition, cause, effects and control measures of Soil pollution – Bioremediation - Definition, cause, effects and control measures of Water pollution - Definition, cause, effects and control measures of marine pollution, Thermal pollution and Nuclear hazards - Causes, effects and control measures of urban and industrial wastes and Solid Waste Management.

Unit IV – Social Issues, Human Health and the Environment

Social Issues and the Environment: From Unsustainable to Sustainable development, consumerism and waste products - Role of an individual in prevention of pollution - Environment Protection Act in India - Issues involved in enforcement of environmental legislation - Public awareness - Global treaties and Conventions for Environmental Protection - Water conservation, rain water harvesting, watershed management - Wasteland reclamation - Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme - Environment and human health: Human Rights, Value Education, HIV/AIDS - Women and Child Welfare - Role of information technology in environment and human health.

UNIT V – Disaster Management

Natural Disasters - Meaning and nature of natural disasters, their types and effects - floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves - Man Made Disasters- Nuclear disasters and holocaust, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, pollution, road accidents, rail accidents, air accidents, sea accidents - Issues and possible solutions for climate change, global warming, sea level rise, acid rain, ozone layer depletion, deforestation - Concept of disaster management, national disaster management framework; financial arrangements - Disaster Management- Effect to migrate disaster at national and global levels - International strategy for disaster reduction - Role of NGOs, community –based organizations and media - Central, state, district and local administration on disaster management - Armed forces, police and other organizations in disaster response and disaster management - Contingency Planning for Disaster Risk Reduction - Existing schemes and government policies to tackle agricultural disasters.

PRACTICAL

Waste water sample collection, processing and preservation. Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Study of simple ecosystems-pond, river, hill slopes - Crop adaptation to different ecosystems. Biodiversity assessment in polluted and un polluted system. Visit to river/forest/grassland/hill/mountain to document environmental assets. Air sampling and determination of suspended particulate matter and important air pollutants. Estimation of acidity and alkalinity in water samples. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Solid waste management: composting and vermicomposting of farm wastes. Case studies on successful implementation of sustainable development model. Case studies on environmental issues and human health: Climate change. Quantitative risk assessment for natural hazards and preparation of environmental zonation map for cyclone. Visit to areas affected by natural disaster

Lecture Schedule

1. Environmental Science: Definition, scope and importance - Multidisciplinary nature of environmental science, Concepts and Segments; Global environmental initiatives and perspectives; Ecological footprint.
2. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems - Energy resources: Growing energy needs, renewable and non-renewable energy sources, and use of alternate energy sources - Urban problems related to energy, Case studies
3. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people
4. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems
5. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies
6. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies; Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles
7. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids - Species interactions and Biogeochemical cycles

8. Introduction, types, characteristic features, structure and function of Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
9. Biodiversity - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India - Value of biodiversity
10. Biodiversity at global, National and local levels, India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India
11. Conservation of biodiversity - In-situ and Ex-situ conservation of biodiversity; Biosphere Reserve - National parks and Wildlife Sanctuaries; Botanical Garden; Biodiversity legislation
12. Environmental Pollution - Definition, cause, effects and control measures of Air pollution and Noise pollution
13. Definition, cause, effects and control measures of Soil pollution – Bioremediation
14. Definition, cause, effects and control measures of Water pollution
15. Definition, cause, effects and control measures of marine pollution, Thermal pollution and Nuclear hazards
16. Causes, effects and control measures of urban and industrial wastes and Solid Waste Management
17. **Mid semester examination**
18. Social Issues and the Environment: From Unsustainable to Sustainable development, consumerism and waste products
19. Environment Protection Act in India
20. Issues involved in enforcement of environmental legislation - Role of an individual in prevention of pollution
21. Global treaties and Conventions for Environmental Protection
22. Water conservation, rain water harvesting, watershed management - Wasteland reclamation
23. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme
24. Environment and human health: Human Rights, Value Education, HIV/AIDS - Women and Child Welfare - Role of information technology in environment and human health
25. Natural Disasters - Meaning and nature of natural disasters, their types and effects - floods, drought, cyclone
26. Earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves
27. Man Made Disasters- Nuclear disasters and holocaust, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, pollution, road accidents, rail accidents, air accidents, sea accidents
28. Issues and possible solutions for climate change, global warming, sea level rise, acid rain, ozone layer depletion
29. Concept of disaster management, national disaster management framework; financial arrangements
30. Disaster Management- Effect to migrate disaster at national and global levels - International strategy for disaster reduction
31. Role of NGOs, community –based organizations and media - Central, state, district and local administration on disaster management
32. Armed forces, police and other organizations in disaster response and disaster management

33. Contingency Planning for Disaster Risk Reduction: agronomic, engineering other non-engineering interventions - Weather forecasting and early warning systems, flood forecasting, agricultural drought monitoring and forecasting
34. 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 Schedule

1. Waste water sample collection, processing and preservation
2. Biogas production from organic wastes
3. Visit to wind mill / hydro power / solar power generation units
4. Study of simple ecosystems-pond, river, hill slopes - Crop adaptation to different ecosystems
5. Biodiversity assessment in polluted and unpolluted system
6. Visit to river/forest/grassland/hill/mountain to document environmental assets
7. Air sampling and determination of suspended particulate matter and important air pollutants
8. Estimation of acidity and alkalinity in water samples
9. Estimation of water hardness
10. Estimation of DO and BOD in water samples
11. Estimation of COD in water samples
12. Solid waste management: composting and vermicomposting of farm wastes
13. Case studies on successful implementation of sustainable development model
14. Case studies on environmental issues and human health: Climate change
15. Quantitative risk assessment for natural hazards and preparation of environmental zonation map for cyclone
16. Visit to areas affected by natural disaster
17. **Final Practical examination**

Text Books

1. Erach Bharucha. 2013. *Text book for Environmental studies*. New Delhi, India: University Grants Commission, pp.1-324.
2. Prasanthrajan, M & Mahendran, P.P. 2013. *A text book on Ecology and Environmental Science*. Udaipur, India: Agrotch Publishing Academy. pp.1- 285.

Reference Books

1. Bhattacharya, T. 2012. *Disaster Science and management*. New Delhi, India: Tata McGraw Hill Education private limited, pp.1-198.
2. De, A.K. 2010. *Environmental Chemistry*. New Delhi, India: New Age International Publishers. pp.1-384.
3. Khanna, B.K & Nina Khanna. 2011. *Disaster–Strengthening community Mitigation and Preparedness*. New Delhi, India: New India Publication Agency. pp.1-308.
4. Mani, N. 2017. *Environment, Climate change and Disaster management*. New Delhi, India: New Century publication. pp.1-276.
5. Sharma P.D. 2010. *Ecology and Environment*. Meerut, India: Rastogi Publications. pp. 1-600.
6. Tyler Miller & Scot Spoolman. 2009. *Living in the Environment (Concepts, Connections, and Solutions)*. Belmont, USA: Brooks/cole, Cengage learning publication. pp.1-816.

Web References:

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=486>

22ELC 304 COMMERCIAL PLANT BREEDING (2+1)

Course Objectives:

- Study the modes of reproduction and breeding lines.

- Learn about the genetic purity and seed production.
- Gain the knowledge on cultivars and IPR protection.
- Acquire knowledge on variety test and variety release.
- Study the principles in seed production techniques.

Course Outcome:

- Classify the types of seeds in crops
- Discuss the IPR issues in plant breeding
- Explain about seed quality and seed production
- Design the protocol for variety test
- Explain about variety release

THEORY

UNIT I

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids.

UNIT II

Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops. Advances in hybrid seed production techniques.

UNIT III

Hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops under open and protected environment.

UNIT IV

Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. Speed breeding, Rapid generation advancement, Molecular markers and Genomic selection.

UNIT V

IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release, replacement rate and notification systems in India.

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.

Lecture Schedule

1. Types of crops and modes of plant reproduction.
2. Line development and maintenance breeding in self pollinated crops (A/B/R and two line system).
3. Principles and techniques of seed production in self pollinated crops.
4. Development of hybrids and seed production in self pollinated crops.

5. Line development and maintenance breeding in cross pollinated crops.
6. Principles and techniques of seed production in cross pollinated crops.
7. Development of hybrids and seed production in cross pollinated crops.
8. Genetic purity test of commercial hybrids.
9. Types of seeds, quality testing in self and cross pollinated crops.
10. Advances in hybrid seed production techniques.
11. Hybrid seed production in rice.
12. Hybrid seed production in maize.
13. Hybrid seed production in sorghum.
14. Hybrid seed production in pearl millet.
15. Hybrid seed production in castor.
16. Hybrid seed production in sunflower.
17. **Mid Semester Examination**
18. Hybrid seed production in cotton.
19. Hybrid seed production in pigeon pea.
20. Hybrid seed production in brassica.
21. Quality seed production of vegetable crops under open and protected environment.
22. Hybrid seed production in tomato.
23. Hybrid seed production in brinjal and bhendi.
24. Hybrid seed production in capsicum and chilli.
25. Hybrid seed production in cucurbits, cabbage and cauliflower.
26. Alternative strategies for the development of the line and cultivars.
27. Haploid inducer and tissue culture techniques.
28. Alternative strategies for the development of the line.
29. Cultivars: genetic engineering tools.
30. Speed breeding and rapid generation advancement.
31. Molecular markers and Genomic selection.
32. IPR issues in commercial plant breeding.
33. DUS testing and registration of varieties under PPV & FR Act.
34. Variety testing, release, replacement rate and notification systems in India.

Practical schedule

1. Floral biology in self and cross pollinated species, selfing and crossing techniques.
2. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system.
3. Learning techniques in hybrid seed production using male-sterility in field crops.
4. Understanding the difficulties in hybrid seed production.
5. Tools and techniques for optimizing hybrid seed production.
6. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production.
7. Role of pollinators in hybrid seed production.
8. Hybrid seed production techniques in rice and sorghum.
9. Hybrid seed production techniques in maize and pearl millet.
10. Hybrid seed production techniques in pigeon pea and cotton.
11. Hybrid seed production techniques in rapeseed-mustard, sunflower and castor.
12. Hybrid seed production techniques in vegetable crops (brinjal, bhendi, and capsicum).
13. Sampling and analytical procedures for purity testing and detection of spurious seed.
14. Seed drying and storage structure in quality seed management.
15. Screening techniques during seed processing viz., grading and packaging.

16. Visit to public private seed production fields and seed processing plants.

17. Final Practical Examination.

Text books

1. L.O. Copeland, 1999. Principles of Seed Science and Technology. Springer Publications.
2. Agrawal R. L. 1999. Seed Technology. Oxford and IBH Publicity Company, New Delhi.
3. N.P. Nema, 1988. Principles of seed certification and Testing. Allied Publications.
4. G.N. Kulkarni, 2002. Principles of Seed Technology. Kalyani Publishers, Ludhiana.
5. Arya, Prem Singh. 2003. Vegetable seed Production Principles. Kalyani Publishers. Ludhiana.

References

1. P. Hazra and M.G. Som, 2009. Vegetable seed production and Hybrid Technology. Kalyani Publishers, Ludhiana.
2. Agarwal, P. K. 2010. Techniques in Seed Science and Technology. South Asian Publishers. New Delhi.
3. Fageria, M. S. 2011. Vegetable Crops- Breeding and seed production. Kalyani publishers Ludhiana.
4. D. N. Bharadwaj. 2012. Breeding Field Crops. Agrobios (India), Jodhpur.

Web References

1. <https://www.crops.org/about-crops/breeding/>
2. <https://plantbreeding2010.blogspot.com/p/commercial-plant-breeding.html>
3. <https://iipr.icar.gov.in/pdf/molecularbulletins2may13.pdf>
4. <https://lawexplores.com/intellectual-property-in-plant-breeding/>
5. https://agritech.tnau.ac.in/crop_improvement/crop_imprv_breeding_methods.html

22ELC 305 AGROCHEMICALS (2+1)

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

- Have an acquaintance with the methods involved in manufacture and properties of various inorganic fertilizers
- Have knowledge about different agro-chemicals, their properties and uses
- Understand the importance of fertilizers and pesticides, their uses and residual effects in soil

Course Outcome

- At the end of this course, the students will be able to Remember the properties of fertilizers and agro-chemicals, their properties and uses
- Understand the concept of **Fertilizers and their importance.**

THEORY

Unit I - Introduction to agrochemicals

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

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.

Unit III - Fungicides

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 IV - Insecticides

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.

Unit V - Fertilizers and their importance

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

PRACTICAL

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

Lecture Schedule

1. Introduction to agrochemicals – classification, type and role of agrochemicals in agriculture - Introduction to insecticides and classification of insecticides based on chemical nature with examples
2. Botanical insecticides – examples, advantages – disadvantages. Neem – chemicals in neem and insecticidal action of neem
3. Natural pyrethrum – sources, extraction, chemistry and insecticidal action
4. Nicotene and Rotenone – sources, chemistry and mode of action
5. Organochlorine insecticides – structure, properties and insecticidal activity of BHC, DDT, endosulfan
6. Organophosphorous insecticides – mode of action – classification with structures of Acids
7. Examples of organophosphorous insecticides derivatives –
8. Structure-activity relationships of thiophosphoric acid derivative insecticides - structure and properties of DDVP, phosphamidon, chlorpyrifos,
9. Malathion, phorate, profenofos, methyl parathion, acephate, monocrotophos
10. Carbamate insecticides – chemistry – mode of action – structure and properties of carbaryl, carbofuran
11. Synthetic pyrethroids – examples, uses, advantages and disadvantages

12. Neonicotinoids – chemistry and insecticidal action – properties and uses of neonicotinoid insecticides imidacloprid, acetamaprid.
13. Herbicides – classification with examples – selectivity of herbicides – Mode of action of herbicides with examples
14. Structure and properties of important herbicides – Atrazine, butachlor, 2, 4-D, glyphosate - Fate of herbicides
15. Fungicides – classification with examples. Inorganic fungicides – characteristics, preparation, mode of action and use of sulphur fungicides
16. Characteristics, preparation, mode of action and use of copper fungicides – Bordeaux mixture and copper oxy chloride
17. Mid semester Examination
18. Organic fungicides – Dithiocarbamates - mode of action – structure, preparation, properties and use of zineb, maneb.
19. Organic fungicides – Dithiocarbamates - mode of action – structure, preparation, properties and use of thiram and ziram
20. Systemic fungicides – structure, characteristics and use of benomyl, carboxin, oxycarboxin, metalaxyl, carbendazim
21. Insecticide Act and rules - Pesticides banned, withdrawn and restricted use
22. Plant growth regulators – examples and uses - Biorationals, biopesticides, reduced risk insecticides.
23. Bio-insect repellents - Animal origin insecticides
24. Fertilizers – classification with examples – their importance in agriculture Nitrogenous fertilizers – Haber-Bosch process – feed stocks for ammonia synthesis
25. Feed stocks and manufacturing process of ammonium sulphate, ammonium nitrate.
26. Feed stocks and manufacturing process of calcium ammonium nitrate, ammonium chloride.
27. Feed stocks and manufacturing process of urea, slow release N-fertilizers
28. Phosphatic fertilizers – Feed stocks and manufacturing process of SSP – Preparation of bone meal and basic slag
29. Potassic fertilizers – natural sources – manufacturing of potassium chloride, potassium sulphate
30. Complex fertilizers – manufacturing of ammonium phosphates, nitrophosphates, potassium nitrate and NPK complexes
31. Mixed fertilizers – sources and compatibility – preparation of major, secondary and micronutrient mixtures
32. Fertilizer control order- fertilizer logistics - fertilizer subsidy - fertilizer marketing
33. Persistence of agrochemicals – fate and effect of their use on the environment, soil, human health and animal health
34. Merits and demerits of use of chemicals in agriculture – management of agrochemicals for sustainable agriculture

Practical Schedule

1. Sampling of fertilizers and pesticides for analysis
2. Pesticide application technology – pesticide application appliances
3. Pesticide formulations - formulations of pesticides available in market
4. Quick tests for identification of fertilizers – identification of cations
5. Quick tests for identification of fertilizers – identification of anions
6. Estimation of nitrogen content of urea
7. Estimation of phosphorous content in SSP by colourimetry

8. Estimation of potassium content of potassic fertilizers using flame photometer
9. Determination of calcium content of fertilizers
10. Standardization of sodium thiosulphate by iodimetry
11. Determination of iodine content of test solution by iodometry
12. Determination of purity of copper oxy chloride
13. Determination of purity of sulphur fungicide
14. Determination of purity of malathion
15. Calculations of fertilizer application and preparation of fertilizer mixtures
16. Calculation of doses of pesticides to be used

17. Final Practical Examination

Reference Books

1. Manures and Fertilizers Yawalkar K S Agarwal J P and Bokde, S. 1992. Agri. Horticultural Publishing House, Nagpur
2. Fertilizers Guide Tandon, HLS 1994. Fertilisers Development Consultation Organization, New Delhi
3. Hand Book on Fertilizers Usage Seetharaman S Biswas B C, Yadav D S and Maheswaru S 1996. Oxford and IBH Publishing Company, New Delhi
4. Chemistry of insecticides and Fungicides Sreeramulu US 1991. Oxford and IBH Publishing Company, New Delhi
5. Fungicides in Plant Disease Control Nene Y L and Thapliyal P N 1991. Oxford and IBH Publishing Company, New Delhi
6. Principles of Weed Science Rao V S 1992. Oxford and IBH Publishing Company, New Delhi
7. The Pesticide Manual – A World Compendium 1995 British Crop Production Council, U.K.

22ELC 306 LANDSCAPING (2+1)

Course Objective

- Demonstrating the scope of landscaping.
- Imparting knowledge on propagation and maintenance of plants involved in landscaping
- Demonstrating designing and maintenance of landscapes

Course Outcome

- Understand the basic principles and importance of landscaping
- Select and propagate plants suitable for landscaping
- Propagate and manage pot plants
- Contribute to improve bio-aesthetic landscaping architecture in urban and rural areas
- Manage bonsai and lawns
- Develop and design sustainable landscapes

THEORY

UNIT I Scope and Importance

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 Propagation

Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting,

UNIT III Garden Plants for Landscaping

Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management.

UNIT IV Landscape Designing and planning

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 and Landscape software

Bonsai: principles and management, lawn: establishment and maintenance. CAD applications.

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 lath house. Use of computer software, visit to important gardens/parks/ institutes.

Lecture Schedule

1. Importance and scope of landscaping- Goals of landscaping – Categories of landscaping (Residential, public, commercial, specialty landscaping).
2. Principles of landscaping-Initial approach – Axis – Focal Point – Mass effect – Unity – Space – Divisional Lines – Proportion and Scale – Texture – Time and Light – Tone and Colour – Mobility- Rhythm – Balance – Contrast – Harmony – Vista – Style.
3. Garden types- Formal - Informal – Wild Garden - Styles of garden in the world- Mughal Garden- Site and design – Walls and gates – Terrace- Running water- Baradari- Trees and flowers.
4. Features of English – Italian – French – Persian Gardens – Japanese Garden – Types of Japanese Garden – Hill – Flat – Tea – Passage – Sand Gardens.
5. Features of Japanese Garden – Ponds – Streams – Waterfalls – Fountains – Islands – Bridges –

- Water Basins – Stone Lanterns – Stones – Pagodas – Fences and Gates – Vegetation (Ever green, Deciduous and Flowering plants).
6. Famous Gardens of India –Lal bagh (Bangalore) – Brindavan Garden (Mysore) – Government Botanic Gardens (Ootacamud) Mughal garden (Pinjore) – Chandigarh Rose garden.
 7. Terrace gardening – Features –Plants suitable – Planning – Maintenance.
 8. Vertical gardening – Components.
 9. Garden components or features-Garden walls – Retaining wall – Fences and Gates – Hedges and Edges – Flower bed – Borders – Carpet Bedding - Steps – Garden Drives (Gravel and Asphalt) and Paths (Gravel, Brick, Grass, Stone, Crazy pavings).
 10. Arches and Pergolas – Screens – Bridges – Outdoor garden rooms (Gazebos, garden pavilions, band stand, bower and thatched huts) walk-Paths, bridges, other constructed features etc.
 11. Garden adornments– Garden Seats – Ornamental tubs, urns and vases – Bird baths – Sun dials – Floral Clocks – Japanese Lanterns – Ornamental Stones – Fountains – Statues – Towers – Wells – Plants Containers – Plant Strands.
 12. Lawn making– Selection of Grass – Bermuda grass – Korean grass – Poa grass – Fescue grass – Kentucky blue grass - Grasses for shady areas – Site Selection – Soil – Preparation of soil – Drainage – Digging – Manuring and grading – Methods of planting – Sowing of Seeds – Dibbling.
 13. Turfing – Turf plastering – Bricking – Planting on Polythene – Maintenance of lawn –Mowing – Rolling – Sweeping – Scraping – Raking – Weeding – Irrigation – Top dressing with compost and fertilizers - Diseases and other problems – Fairy ring – Pale Yellow Lawns.
 14. Rockery- Rock Garden – Types of rock garden – Selection of site – Construction of the Rockery – Planting – Management of the Rockery – Plants for rock garden – Examples of cacti and succulents, ferns, shrubs, herbaceous plants, bulbs, flowering annuals.
 15. Water garden – Informal pool – Formal Pool – Construction – Planting methods – Filling the pool (water course and falls) – Care of the water garden – Plants for water garden – Surface flowering aquatics – Oxygenators – Floaters – Marginals.
 16. Gardens for special purposes- Specialized gardens – Herb garden – Bog Garden – Sunken garden - Topiary Garden – Kitchen garden – Paved garden – Moon Garden – Gardening in hanging baskets – Window garden – Miniature garden – Mini Zoo – Importance of Green house. Conservatory – Lath house – Fernery in ornamental horticulture.
- 17. Mid semester examination**
18. Trees: Selection, propagation, planting schemes, canopy management- Ornamental and shady Trees – Definition – Classification based on purpose with suitable examples – Specimen trees – Shady trees – Flowering trees
 19. Avenue or road side trees – Screening trees – Fragrant flowering trees – Pollution controlling trees.
 20. Shrubs - Definition – Utility (aesthetic values) – Classification with suitable examples – Based on purpose of growing – Flowering – Foliage – Flowering and foliage – Fragrant shrubs – Based on sunlight requirement - Growing of shrubs – Soil – Climate – Cultivation practices.
 21. Herbaceous perennials – Definition – Introduction – Classification with suitable examples – Herbaceous perennials for plains and for hills – Planting – Manuring Propagation.
 22. Climber and creepers: Utility (aesthetic values) – Classification with suitable examples – Sunny situation – Partial shade – Shade loving climbers – Showy flowering climbers – Climbers with scented flowers – Climbers with attractive foliage – Climbers for pots – Annual climbers – Climbers for hedge making – Classification based on vegetative growth – Heavy climbers – Light climbers – Soil – Digging of pits – Planting of climbers – After care – Manuring - Maintenance. Annuals: classification- Summer annuals- Winter annuals- Flowering annuals- Foliage annuals- Propagation - Colour scheme- Grouping – After care – Maintenance
 23. Palms- – Definition – Introduction – Utility (aesthetic values) – Classification with examples- Feather leaved Palm – Fan leaved Palm – Propagation – Pot culture – Potting – Re-potting - Potting media – Manuring – After care.
 24. Ferns- – Introduction – Utility (aesthetic values) – Propagation – Spore – Division of Clumps – Suckers – Bulbils – Site of growing – Soil media – Pot culture – Repotting– Irrigation - Indoor

- culture – Important Examples. Selaginellas – Introduction – Propagation – Cultural hints – Important Examples.
25. Ornamental grasses- Bamboos and reeds – Introduction – Propagation – Soil and climatic requirements – Site of growing – Planting – Important Examples.
 26. Cacti and Succulents – Introduction – Characteristics of Cactaceae – Site of growing – Natural habitat – Domestication (Housing of cacti) – Propagation – Seeds – Offsets – Grafting – Soil – Climate – Containers – Time and method of planting – Potting – Re-potting – Irrigation – Staking.
 27. Pot plants: introduction – Pots – Potting – Potting- Compost – Re-potting - Arrangement, management.
 28. Bio-aesthetic Planning – Definition – Aim and Concept – Need for Bio-aesthetic planning – Air pollution – Human welfare.
 29. Landscaping of urban and rural areas, Peri-urban landscaping- Road side – Planting trees in colonies – Landscaping City parks – Large – Medium – Small parks – Pleasure grounds – Examples of ornamental shade and flowering trees for town roads.
 30. Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Importance – Need – Planting materials for different areas of institutions.
 31. Bonsai: Definition – Criteria for selecting plants – Examples – Classification of Bonsai – Upright (formal and informal) – Production management - Production, plant layout and material handling - Winding – Oblique – Gnarled – Semi-cascade cascade – Clasped to stone.
 32. Containers (pots) and Media – Potting and Re-potting – Training – Pruning and Pinching (Shoot, leaf and root) – Watering – manuring – Defoliation – Mame Bonsai.
 33. Computer Aided Designs (CAD) – Applications in landscaping.
 34. Computer Aided Designs (CAD) – Applications in landscaping

Practical Schedule

1. Identification of avenue trees.
2. Identification of shrubs.
3. Identification of annuals.
4. Identification of pot plants.
5. Propagation of ornamental trees.
6. Propagation of shrubs.
7. Propagation of annuals, care and maintenance of plants.
8. Potting and repotting of ornamentals.
9. Identification of tools and implements used in landscape design.
10. Training and pruning of plants for special effects.
11. Lawn establishment and maintenance.
12. Study of planning, designing and layout of formal gardens and informal gardens.
13. Layout of special type of gardens (sunken garden, terrace garden, rock garden).
14. Designing of conservatory and lath house.
15. Use of computer software.
16. Visit to important gardens/ parks/ institutes.

17. Final practical examination

Reference books:

1. Bhattacharjee, S. K. 2004. *Landscape Gardening and Design with plants*. Aavishkar Publishers and Distributors, Jaipur.
2. Bose, T.K. 1999. *Floriculture and Landscaping*. Naya Prakash, Kolkatta.
3. Chadha K.L and Choudhary, B. *Ornamental Horticulture in India*. ICAR, New Delhi.
4. Randhawa, G.S. and Mukhopadhyaya, A. 1998. *Floriculture in India*. Allied Publishers Pvt. Ltd., New Delhi

5. Chattopadhyay, S.K. 2007. *Commercial Floriculture*. Gene-Tech Books, New Delhi
6. Bose T.K., B. Chowdhury and S.P. Sharma 2001. *Tropical garden plants in colour*. Horticulture and Allied Publishers, Kolkata.
7. Veena Amarnath, 2012. *Nursery and Landscaping*. AGROBIOS, Jhodpur.

Web References

1. www.bestgarden.net
2. www.indiaagronet.com
3. www.intuxford.tripod.com
4. www.webct.uark.edu
5. www.personal.psu.edu

SCHOOL OF AGRICULTURAL SCIENCES

UNDERGRADUATE PROGRAMME

SEMESTER SYSTEM RULES AND REGULATIONS

2023



DHANALAKSHMI SRINIVASAN UNIVERSITY TIRUCHIRAPPALLI – 621 112, India

<http://www.dsuniversity.ac.in/>

DHANALAKSHMI SRINIVASAN UNIVERSITY
TIRUCHIRAPPALLI - 621 112

SCHOOL OF AGRICULTURAL SCIENCES

UNDERGRADUATE PROGRAMME- B.Sc. (Hons.) Horticulture

SEMESTER SYSTEM RULES AND REGULATIONS – 2023

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**DHANALAKSHMI SRINIVASAN UNIVERSITY
TIRUCHIRAPPALLI - 621 112**

**SCHOOL OF AGRICULTURAL SCIENCES
UNDERGRADUATE PROGRAMME- B.Sc. (Hons.) Horticulture**

SEMESTER SYSTEM RULES AND REGULATIONS – 2023

01. REGULATIONS

Rules and Regulations for the B.Sc. (Hons.) Horticulture Degree Programmes (Semester system).

The Regulations provided here in shall apply to the B.Sc. (Hons.) Horticulture Degree Programmes offered by the School of Agricultural Sciences, Dhanalakshmi Srinivasan University.

The system of instructions and education in the University will be **SEMESTER COURSE CREDIT SYSTEM**.

02. SHORT TITLE

These regulations shall be called “B.Sc. (Hons.) Horticulture Degree Programme Rules and Regulations – 2023”.

03. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

“Programme” means Degree Programme, that is B.Sc. (Hons.) Agriculture, Degree Programme.

“Head of the Institution” means The Dean of School of Agricultural Sciences

“Head of the Department” (HOD) means the Head of the Department concerned.

“Controller of Examinations (COE)” means the authority of the University who is responsible for all activities of the University Examinations.

“University “ means Dhanalakshmi Srinivasan University, Tiruchirappalli

3.1 Academic Year means a period consisting of two consecutive semesters including the inter-semester break as announced by the University/ Deans of respective colleges. The first year of study

shall be the first and second semesters following a student's admission. The second year of study shall be the third and fourth semesters; the third year, the fifth and sixth semesters and the fourth year, the seventh and eighth semesters.

3.2 Academic Coordinator/ Faculty advisor means a teacher of the faculty who has been nominated by the Dean concerned to look after academic matters of a particular year of the degree programme. He/she will attend to registration, preparation of time tables, and distribution of courses, regulation of credit load and maintenance of individual student's records of the concerned batch.

3.3 Academic counselor/ Mentor means the Dean of the college will allot a group of not less than five students to the nominated Academic Counselor. The Academic Counselor will counsel the group of students in curricular and extra-curricular activities for the entire period of degree programme by conducting periodical meetings.

3.4 Curriculum is a group of courses and other specified requirements for the fulfillment of the degree programme.

3.5 Curricula and Syllabi are a list of approved courses for Degree Programme wherein each course is identified with a three-letter code, a course number, outline of syllabus and credit assigned.

3.6 Course is a teaching unit of a discipline to be covered within a semester as detailed in the Curricula and Syllabi issued by the University.

3.7 Credit Load of a student during a semester is the total number of credits of all the courses a student registers during that particular semester.

3.8 A credit in theory means one hour of class room lecture and a credit in practical means two and a half hours of laboratory or workshop or field work per week. For example, a 1+1 course (2 credits) means 1 hour theory and 2½ hours practical per week.

3.9 Grade Point means the total marks in percentage obtained in a course divided by 10 and rounded to two decimal places.

3.10 Credit Point means the grade point multiplied by the credit load of the course.

3.11 Cumulative Grade Point Average (CGPA) means the total credit points of the courses completed by the student divided by total credits of the courses. The CGPA is to be worked out and then rounded to two decimals.

3.12 Duration of Semester means the duration of each semester of 105 working days inclusive of the mid-semester examination (90 working days) and practical examinations (15 days) but excluding the study holidays and final theory examinations.

3.13 Transcript Card is the consolidated report of academic performance of a student issued by the University on completion of the curriculum.

3.14 Class Grade Chart means a grade chart prepared by the Controller of Examinations indicating marks obtained by the students belonging to a particular class for each course.

3.15 Statement of Marks means a report of grades, obtained by a student in a particular semester.

3.16 Reappearance is an examination written for the failed courses by a student without undergoing regular class / course.

3.17 ERP Coordinator means a Faculty Member who has been designated by the Dean to look after the E-variety of UG Degree programme.

4. CLASS COMMITTEE

4.1 Every class (comprising of sections) of the Undergraduate programme will have a Class Committee consisting of faculty and students. The class committees for the B.Sc. (Hons.) degree programme of each semester will be constituted by the Head/Dean of the concerned Faculty.

4.2 The constitution of the Class Committee for the School of Agricultural Sciences of each semester will include the following members:

- a. All teachers of the Courses
- b. Four students from the class to be chosen by the students of the class.
- c. Faculty Adviser (s) of the respective class.
- d. One senior faculty of the concerned Department and not associated with teaching of the class, to be nominated by the concerned Head of the Department/Dean, to act as the Chairperson of the Class Committee.

4.3 The basic responsibilities of the Chairperson of the Class Committee:

- a. To review periodically the progress of the classes.
- b. To discuss problems concerning curriculum and syllabus, the conduct of the classes as well as non-academic issues concerning students.

- c. To define the method of assessment in the courses in consultation with class committees and announcing to the students at the beginning of the semester.
- d. To organize the class committee meeting at least twice a semester, one just before in-semester examination and one just before practical examinations.
- e. To prepare the minutes of the meeting with the assistance of faculty advisers and duly signed by the HOD/Senior faculty, sent the same to the Dean (FAS) within 7 days from conduct of the meeting. The minutes shall also be circulated to the class committee members and displayed in the notice board.

5. ADMISSION

5.1 ELIGIBILITY FOR ADMISSION TO ALL UNDERGRADUATE PROGRAMS

5.1.1 Educational Qualifications - H.Sc./Equivalent - Academic stream

Candidates seeking admission into B.Sc (Hons.) degree programme must have passed the Higher Secondary Examination (10 + 2) conducted by any recognized Board/ University, with any one of the following subject group

Group I : Physics, Chemistry, Biology and Mathematics

Group II : Physics, Chemistry and Biology

Group III: Physics, Chemistry and Mathematics

Group IV : Physics, Chemistry, Botany and Zoology

Group V : Physics, Chemistry and Forestry

Group VI : Physics, Chemistry and Agriculture

Group VII Physics, Chemistry, Biology and Mathematics

H.Sc. - Vocational stream : Biology and Agricultural Practices as vocational subject including theory and practicals.

5.2 Admission process : As per the norms approved by Board of management of DSU

6. PROGRAMMES OFFERED: B.Sc. (Hons.) Horticulture

The medium of instruction is English for all courses, examinations and project works

7. Structure of Programmes

The entire B.Sc. Hons. Horticulture Programme consists of 4 academic years and distributed 2 semesters in each year . The following streams are distributed over entire 8 semesters as listed below

- 1) Compulsory course: Courses corresponding to the major stream of the concerned UG degree programme
- 2) Supportive course : Courses comprising to other related divisions of the concerned stream including social sciences and skill education
- 3) Allied : Courses offered from the department of mathematics
- 4) Extension activity : Courses offered by department of physical and Health education (Yoga/ Physical education / NSS / NCC
- 5) Supplementary courses: Courses from the related fields / streams of the concerned UG

degree programme.

- 6) Student Ready : Courses in compliance with Rural Agricultural Work Experience, In plant training / Industrial attachment, All India Study tour and Experiential learning programme
- 7) Elective course: Courses under the category of experiential learning
- 8) 'Non-Gradial course' means a course which is compulsorily registered by the student for the completion of B.Sc. (Hons.) Agriculture / Horticulture degree programme. The non-gradial course will be evaluated as Satisfactory or Not-satisfactory. The marks obtained by the student in a non-gradial course will not be taken into account for calculating CGPA.
- 9) Value Added Courses (VAC) : The students may optionally undergo Value Added Courses (VAC) over and above the topics covered in the curriculum to obtain practical and industry specific knowledge. The credits earned through the Value Added Courses shall be over and above the total credit requirements prescribed in the curriculum for the award of the degree. One / Two credit courses shall be offered by a Department of an institution with the prior approval from the Head of the Institution without any additional fee charged from the students. The details of the syllabus, time table and course coordinator may be sent to the School at least one month before the course is offered for approval. Students can take a maximum of two one credit courses / one two credit course during the entire duration of the Programme.
- 10) Online Courses: Students may be permitted to credit a maximum of two online courses, subject to a maximum of six credits, with the approval of the Dean, in lieu of open elective / professional elective courses. The Head of the Institution shall form a three member committee with members as HOD and a faculty member from the Department of the student, HOD of any other branch of the Institution to ensure that the student has not studied such courses and would not repeat it again as Professional Core/Professional Elective/Open Elective courses. Suitable online courses shall be chosen from the SWAYAM platform

8. Personality and Character Development

All students shall enroll, on admission, in any one of the personality and character development programmes NCC/NSS/NSO/YRC and undergo training / conduct activities for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. Alternately, activities of science, literature and arts also help for personality and character development. So, students shall conduct and participate actively in Science club/Literary Forum/Fine Arts activities for 80 hours and participate in at least ONE event.

National Cadet Corps (NCC) will have about 20 parades.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

National Sports Organization (NSO) will have Sports, Games, Drills and Physical exercises.

Youth Red Cross (YRC) will have activities related to social services in and around College/Institution.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

Science club shall organise activities of popularisation of science and scientific temper through activities related to astronomy, works of great scientists from India and abroad, observing National Science Day, etc.

Literary Club like 'Tamil Ilakkiya Mandram' shall be formed, which shall organise colourful literary events to propagate good humanist values, morals and ethics reflected in the literature.

Fine Arts Club like music, painting and documentary films with social themes shall be encouraged.

Students who enroll and take active participation in anyone of the above activities for 80 hours and participate at least one event/programme will be given a certificate by the Head of the Institution and the copy of the same shall be forwarded to the Controller of Examinations for the purpose of record and scrutiny.

09 SYSTEM OF EDUCATION

- 9.1 Maximum Duration Permissible:** The system of education followed for all the undergraduate programmes is Semester System with duration of four academic years (8 Semesters). The maximum duration permissible for a student shall be 'n' plus four academic years (16 semesters), where 'n' denotes the normal duration of the degree programme (8 semesters). The hostel facilities will be provided only for the actual duration of academic programme.
- 9.2 Credit Requirements:** The minimum credit requirement for the B.Sc. (Hons.) Horticulture programme is 184
- 9.3 Maximum Credit Load:** A student can register for a maximum of 26 credits during a semester. An additional 1 or 2 credits shall be permitted at the discretion of The Dean.
- 9.4 Course Teacher:** The Dean concerned, in consultation with the respective Head of the Department, will nominate the course teacher for each course at the beginning of the semester. The course teacher shall be responsible to the Head of the Department in all matters connected with the conduct of the course. The Head of the Department will monitor the progress of the course(s) of the respective Department.
- 9.5 Class Time Table:** At the beginning of each semester, the Dean of the college will prepare the class time table with the help of Coordinator of the respective year and announce the same.
- 9.6 Working Days and Time Schedule:** Except Sundays and other listed holidays, all other days of a week including Saturdays are working days for the students. **Normal Working Hours: 7.30 a.m. to 5.00 p.m.**

- 9.7 Depending upon the need, the respective Dean will decide about the timings. Time schedule may vary in each teaching campus to suit the local needs.
- 9.8 **Commencement and Closure of Semesters:** The date of commencement and closure of semesters as well as inter-semester break shall be announced by the Deans of the college after the approval of academic calendar. The schedule of the final theory examinations shall be announced by the Controller of Examinations in consultation with Deans of Colleges. The University should approve any deviation after dates are announced.
- 9.9 **Inter-semester Break:** A break of about 15 (fifteen) days shall normally be allowed between any two consecutive semesters. A longer inter-semester break during summer may be allowed every year, subject to a maximum of 30 days during May - June.
- 9.10 **Academic Calendar:** A common academic calendar shall be prepared by the Faculty Dean (Agriculture) every year by including the date of registration, date of mid semester examinations, final theory examinations, inter-semester break and summer holidays for all the undergraduate programmes. The Deans of all Colleges shall schedule the academic activities within the specified period without deviation.
- 9.11 **Condensation of Semesters:** The Dean concerned has the responsibility to adhere to the common Academic Calendar. However, under extraordinary situation upon the recommendation of Dean and with the permission of the University, condensation of semester may be made up to a maximum of 10 days to cope up for examination schedule. The loss of classes in such cases should be compensated by special time table.

10.0 REGISTRATION OF COURSES

- 10.1 A course shall be offered only once in an academic year during the semester as listed in the course curricula and syllabi.
- 10.2 All eligible candidates shall register the requisite courses at the beginning of each semester IN PERSON or ONLINE under the guidance of the Co-ordinator. IN ABSENTIA registration will not be permitted under any special / needy circumstance.
- 10.3 **Registration without fine:** The courses prescribed for a semester can be registered on the date scheduled in the academic calendar. The registration is also permitted on the second day (which is the first working day of the semester) without fine.
- 10.4 **Registration with fine:** Late registration shall be permitted by the Deans concerned up to seven working days inclusive of the date of registration on payment of a late registration fee.
- 10.5 **Procedure to get permission for late registration:** The student concerned shall apply with proper reason to the Dean concerned through the Academic Counselor and Coordinator to get the permission of the Dean for the late registration of the courses. Beyond the prescribed time limit, no student shall be permitted to register the courses for a particular semester.

11. ATTENDANCE REQUIREMENTS

- 11.1 A minimum of 80 per cent attendance separately in theory and practical of the concerned course is a must, failing which the student shall not be permitted to appear for both final theory and practical examination in the course concerned and grade 'E' (incomplete) will be awarded. The student must re-register the course when offered again, with the permission of the Dean.
- 11.1.1 For the first year first semester students, for calculating 80 per cent attendance the number of working days will be calculated only from the date of joining of the student.
- 11.2 Students failing to attend the classes/ examinations on unofficial ground will be treated as 'absent'.
- 11.3 As for student ready course, 100 per cent attendance is compulsory. However, the university may condone up to 10 per cent attendance, under extra-ordinary situations, based on the genuineness of the case and upon the recommendation of the course teacher and Dean.
- 11.4 The PED, NCC/NSS courses shall be registered during first semester and evaluated at the end of the fourth semester.
- 11.5 Students deputed for sports, cultural meets, etc., with prior permission of the Deans of the colleges shall be given attendance for the period of absence. However, students under this category must have attended a minimum of 70% classes in the total theory and practical classes conducted.
- 11.6 Calculation of Attendance

THEORY CLASS: Number of classes conducted for a course from the first working day as per the time table to the last theory class of that semester is to be construed as the total number of theory classes conducted by the course teacher. The mid-semester examinations are normally conducted during class hours. The attendance for mid semester examination will be counted as a theory class. Final theory examinations will be conducted after 105 working days.

PRACTICAL CLASS: The final practical examination will be conducted in the last practical class as per the time table which will not be considered as attendance for practical class of a particular course.

The student belonging to a batch will attend classes and earn attendance in the particular batch only as per the time table. No student shall be permitted to attend along with another batch to gain attendance either in theory or in practical.

12. SYSTEM OF EXAMINATIONS

Performance in each course of study shall be evaluated based on i) Continuous internal

assessment through out the semester (MSE) and ii) University examination at the end of the semester

- 12.1 **Mid Semester Examination:** Writing the mid-semester examination is a pre- requisite for writing the final theory and practical examinations. Students failing to write mid-semester examination, will not be permitted to attend the classes further in the course concerned and the student will be awarded 'E' grade. The mid-semester examination mark list should reach the office of the Controller of Examinations within fifteen days from the date of conduct of mid-semester examination.
- 12.2 **Missing Examination:** A student who fails to attend a mid-semester examination due to unavoidable circumstances shall be permitted with prior approval of the Dean to take up missing examination of the particular course, subject to payment of Rs.1000/- for each missing mid-semester examination. Students deputed for official programmes of the University are exempted from paying the fee for missing test. Such missing examinations should be completed outside the regular class hours within 15 working days of the respective examinations. Attendance will not be given for taking up missing examinations. The missing examinations are allowed only for mid-semester examinations and not for final theory and practical examinations.
- 12.3 **Theory Examination:** An examination schedule approved by the Dean and the Controller of Examinations for the mid-semester and final examinations, respectively, shall be final. Laptop is mandatory for e-classroom and online examinations.

Duration for mid-semester and final theory examinations

Mid semester: 1 hour (Handwritten Mode / Digital mode)

Final theory (Handwritten Mode / Digital mode)

1+1, 2+1, 1+2 and 2+2 Credits	: 3 hours (100 marks)
1+0, 2+0 and 3+0 Credits	: 3 hours (100 marks)
0+1 and 0+2 credits	: 3 hours (100 marks)

- 12.4 **Practical Examination:** The Dean of School will announce the schedule of final practical examinations. The Controller of Examinations, based on the proposal sent by the Deans concerned, will nominate the external examiner and the course teacher shall be the internal examiner. In the event of external/ internal examiner nominated for practical examination could not conduct the examination, then the Dean concerned shall nominate an alternative examiner to conduct practical examination in anticipation of approval by the Controller of Examinations. Submission of *bona fide* practical records certified by the Course Teacher is a pre-requisite for appearing in the practical examinations failing which 'F' grade will be awarded. The duration of practical examination shall be two and a half hours. The practical marks should be communicated to Controller of Examinations within 10 days of the last working day. If a student fails to write practical examination, 'F' grade will be awarded if he/she has 80% attendance. The student has to appear for the reappearance examination (vide rule 7.6)
- 12.5 **ASSESSMENT FOR VALUE ADDED COURSES** The one / two credit course shall carry 100 marks and shall be evaluated through continuous assessments only. One Assessment (MSE) as per the

clause 12.1 and 12.2 shall be conducted by the Department concerned. A committee consisting of the Head of the Department, faculty handling the course and a senior faculty member nominated by the Head of the Institution shall do the evaluation process. The list of students along with the marks and the grades earned shall be forwarded to the Controller of Examinations for appropriate action at least one month before the commencement of End Semester Examinations. The grades earned by the students for Value Added Courses will be recorded in the Grade Sheet, however the same shall not be considered for the computation of CGPA.

- 12.6 **ASSESSMENT FOR ONLINE COURSES** Students may be permitted to undergo two online courses (which are provided with certificate), subject to a maximum of six credits. The online course of 3 credits can be considered instead of one elective course. These online courses shall be chosen from the SWAYAM platform, provided the offering organisation conducts regular examination and provides marks. The credits earned shall be transferred and the marks earned shall be converted into grades and transferred, provided the student has passed in the examination as per the norms of the offering organisation.
- 12.7 **Postponement of Final Examination:** Whenever the Government declares holidays on the dates of final examinations, the examination that falls on the particular date will be postponed to the date after the last examination as per the original examination schedule.
- 12.8 **Reappearance examination:** Reappearance is permitted only for the final theory and practical examinations. The students are permitted to write the Reappearance examinations along with the regular semester examinations for the failed courses with the permission of Dean after paying the necessary fees as applicable. A student is permitted to write either theory or practical examination alone or both in the reappearance examination for the failed subjects. The marks secured in theory reappearance will be computed into 70 marks for courses with theory and practical and 100 marks for course with theory alone. A student is permitted to write reappearance examination for the failed courses during n+4 years. Reappearance will not be applicable to industry and institutional educational tours, RAWE, agro-industrial tie-up programmes, crop production, NSS, NCC and physical education courses. The camp requirement in NSS and NCC may be allowed along with juniors if the student has secured more than 80% attendance in the regular courses.
- 12.9 The minimum grade point to be secured for a pass in a course is 6.00.
- 12.10 A student has to maintain a minimum OGPA of 6.00 out of 10.00 at the end of final year (VIII semester) to become eligible for the award of degree.
- 12.11 Reappearance examination for the undergraduate failed subjects shall be conducted once in six months, during the semester breaks for 100 marks.

13. INDUSTRY AND INSTITUTIONAL EDUCATIONAL TOUR

- 13.1 All educational tours are compulsory; those who miss the study tours for any valid reason must re-register and undertake the tour along with juniors to complete the degree programme.
- 13.2 The study tour shall be conducted within the 105 working days. The course teachers will do the evaluation of the educational tour.

- 13.3 Field trips are compulsory. If any student is absent for field trips, the student will be marked absent for all compensating classes on the day of the field trip in addition to the field courses.
- 13.4 The Dean of University is empowered to organize all educational tours and field trips by following the University norms.
- 13.5 The students should wear blazer during Industry and Institutional Educational tours and during University official functions.

14. DISCONTINUANCE AND READMISSION

- 14.1 A student who discontinues the first semester (I year) without getting permission from the Dean concerned will not be re-admitted. However, the student who discontinues the first semester (I year) for genuine reasons with the prior permission of the Dean (within 30 days) will be re-admitted in the first semester of the next year along with the junior batch (I year) of students with the approval of the Academic Council.
- 14.2 Students admitted to any of the courses discontinuing their studies with permission of concerned Dean before completing the course may be re-admitted to the course, if they have completed at least one semester before such discontinuance.
- 14.3 A student discontinuing studies temporarily on valid and genuine grounds with prior permission of the Dean of the School will be awarded Grade 'E' for all the registered courses. The student has to rejoin with the permission of the Dean at the beginning of same semester along with junior batch of students on payment of a re-registration fee and semester fee.
- 14.4 When a student discontinues his/her studies in a semester (other than the first semester) on his/her own accord after getting the written permission of the Dean concerned or by the order of the University, he/she shall be re-admitted in the same semester where he/she discontinued, along with the junior batch of students.

In case of revision of curricula and syllabi the student has to complete all the course works in the original syllabus in which he/she has joined, by registering equivalent / special semester courses (or) the student has to forgo all the courses registered so far in the original curricula and syllabi and register all the courses from first semester in the new syllabus along with juniors.

- 14.5 A student shall not be allowed to discontinue consecutively, beyond a period of two semesters. If the discontinuance period exceeds two semesters the name of the student will be removed from the roll.

15. QUESTION PAPER SETTING AND EVALUATION

- 15.1 The mid semester question papers will be set and answer papers evaluated by the course teacher concerned and the mid semester examination is on digital / handwritten mode.
- 15.2 The semester final theory question paper for all the courses will be set by the Controller of

Examinations after obtaining question papers from External/ Internal examiners outside the University.

15.3 The practical examination will be conducted and evaluated by the external examiner with the help of internal examiner.

15.4 The Controller of Examinations will arrange for evaluation of semester final theory papers with External/ Internal examiners.

16. EVALUATION OF COURSE WORK

16.1 The results of the course shall be indicated by grade points ranging from 0.00 to 10.00. . The minimum grade point to be secured for the successful completion of a course will be 6.00. Securing a grade point less than 6.00 in a course will be treated as 'F' and the grade point will be 0 for calculating the GPA/OGPA. In case of course with theory and practical, minimum of 50% mark separately in theory and practical with an aggregate of 60 per cent is essential. A minimum of 50 % mark shall be secured in the end semester theory examination. An OGPA of 6.0 shall be the minimum requirement for the award of Degree.

16.2 The following symbols shall be used

O	– 91- 100 (marks obtained)
A+	– 81 - 90 (marks obtained)
A	– 76 - 80 (marks obtained)
B+	– 71 - 75 (marks obtained)
C	– 60-70 (marks obtained)
F	– 0-59 (FAIL)
E	– Incomplete (Lack of 80% Attendance)
RR	– Re-Registration
RE	– Re- Examination
EE	– Incomplete for reasons other than attendance
*R	- Remedial course;
**NC	- Non-gradual compulsory courses

16.3 Examination pattern: Each course has a weightage of 100 marks and examinations are conducted with three phases viz., Mid-semester examination, practical examination, and final end semester examination. Mid-semester examination is conducted on 56th working day of semester for 20 marks. Final practical exam is conducted at last practical class of the respective courses in the semester for 30 marks. Final end semester examination will be conducted for 100 marks and converted to 50 marks.

Particulars	Prescribed marks	Pass Marks
Course with Theory and Practical		

Theory [Mid- semester (20)+ End Semester theory (50)]	70	35 (50%)	60
Practical [<i>Practical written part / field and lab work</i> (15) + Record (05) + Assignment (05) + Viva voce (05)]	30	15 (50%)	
Course with Theory only			
Theory [Mid-semester (40) + End Semester theory (50) + Assignment (10)]	100	60	
Course with Practical only (External)			
Mid-semester (40) + Assignment (10) + Record (5) + Viva voce (05) + Practical External (40)	100	60	
Course with practical only (Purely internal –Project work)			
Mid Semester Evaluation (50) + Final evaluation (50)	100	60	
Non Gradiual Courses (Purely internal –NSS/NCC, Yoga, Physical Education, Study Tour, Elementary Mathematics)			
Internal assessment	100	60	

Assessment of marks in Mid semester examination

(a) Course with practical and theory (1+1), (2+1), (1+2)

S. No.	Components	Course with theory and practical		
		Mid semester		
		Mark for each question	No. of questions to be answered	Marks
1	Part – A (All questions have to be answered)			
	Multiple choice questions	0.5	5	2.5
	Fill in the blanks	0.5	5	2.5
	True or false statement	0.5	5	2.5
	Match the following	0.5	5	2.5

2	Part – B (Five questions out of seven have to be answered)			
	Short note in one or two sentences.	1.0	5	5
3	Part – C (Either or pattern)			
	Brief description in half a page.	2.5	2	5
Total				20

(b) Course with only theory (1+0), (2+0) & only Practical (0+1)

S. No.	Components	Course with only theory		
		Mark for each question	Number of questions to be answered	Marks
1	Part – A (All questions have to be answered)			
	Multiple choice questions	0.5	10	5
	Fill in the blanks	1.0	5	5
	True or false statement	1.0	5	5
	Match the following	1.0	5	5
2	Part – B (Five questions out of seven have to be answered)			
	Short note in one or two sentences.	2.0	5	10
3	Part – C – Either or Pattern			
	Brief description in half a page.	5.0	2.0	10
Total				40

(c). End Semester Assessment for Course with practical and theory (1+1), (2+1), (1+2) and courses with theory alone (1+0), (2+0) – Pattern of question Paper

Time: 3 hours and Max Marks: 100 Marks.

S. No.	Components	Course with theory and practical
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		End-semester		
		Mark for each question	Number of questions to be answered	Marks
1	Part – A (All questions have to be answered. Minimum of Five questions from each unit covers all the following nature)			
	Multiple choice questions	1.0	5	5
	True or false statement	1.0	5	5
	Match the following	1.0	5	5
	Fill in the blanks	1.0	5	5
2	Part – B (Ten questions out of Twelve have to be answered in half page. Minimum two question from each unit)			
	Brief description in half a page.	3	10	30
	Part – C (Five questions have to be answered in 2-3 pages. Two questions from each unit in the either or pattern.)			
	Explain in 2-3 pages	10	5	50
Total Marks				100

Marks secured by the candidate will be converted to 50, while adding with Mid-semester marks

d.) Industry and Institutional Educational Tours

Particulars	Max marks
Written test	50
Attendance and behavior	20
Record and Pocket Note Book	20
Viva-voce	10

e). Rural Work Experience for all disciplines

Components	VSP (60 days)	ADA (10 days)	NGO (10 days)	Industry (10 days)	Total (90 days)
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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
Overall exhibition	-	-	-	-	15 marks
Total	40 marks	15 marks	15 marks	15 marks	100 marks

f. Evaluation pattern for project work

S. No.	Particulars	Evaluation	Marks
1	Research area identification and collection of literature	7th semester	20
2	Work done	8th semester	30
3	Report	8th semester	20
4	Presentation	8th semester	20
5	Viva voce	8th semester	10
Total			100

G) . PED & NCC

Particulars	Max marks
Attendance & routine activities	60
Behavior	10
Participation in tournaments / Camps	20
Viva-voce	10

16.4 Return of evaluated answer papers: The evaluated answer papers of mid- semester shall be shown to the students after the examination. Discrepancies if any, in awarding marks, the student can approach the teacher concerned immediately, for rectification. Evaluated final theory answer papers may be retained up to six months by the Controller of Examinations after the conduct of examination and then disposed off. The same is applicable to re-examination also.

16.5 In the event of a candidate who has failed to secure minimum required marks to pass in the

subject shall be permitted to write the re-appearance either final theory or practical or both examinations.

- 16.6 A student who desires to forego the chance of re-examination is also permitted to reregister the failed courses as and when the course(s) are offered with the permission of the Dean concerned on payment of re-registration fee as specified by the University.
- 16.7 **Revaluation:** A student can submit request for revaluation in the prescribed format to the Controller of Examinations through the Dean concerned not later than ten working days after the issue of class grade charts to the student. Appeals received thereafter will be summarily rejected. The fee for revaluation or re-totaling is Rs.1000/- per subject. Revaluation is not permissible normally for practical examinations. However, the Dean, if satisfied, may constitute a committee consisting of at least three faculty members to moderate the marks of practical examinations. The report of the committee in such cases should be submitted within two days. The decision of the Dean shall be final.
- 16.8 **Late for Examinations:** The students who are late by 30 minutes shall not be allowed to enter the examination hall. Similarly no student will be allowed to leave the examination hall within 30 minutes of the commencement of the examination.

17 Conduct of Academic Audit

Every educational institution shall strive for a better performance of the students by conducting the internal assessments as mentioned in Clause 16. In order to ensure the above, Academic Audit is to be done for every course taught during the semester. For the internal assessments conducted for each course as per details provided in Clause 16, the academic records shall be maintained in the form of documentation for the individual assignments / case study report / report of mini project submitted by each student and assessment test question paper and answer script. Report of industrial training / internship shall also be maintained, if applicable. For laboratory courses students' record shall be maintained. Further, the attendance of all students shall be maintained as a record. The Head of the Institution shall arrange to conduct the Academic Audit for every course in a semester by forming the respective committees with an external course expert as one of the members drawn from a Technical institution of repute near the institute. The University or any inspection team appointed by the University may verify the records of Academic Audit report of the courses of both current and previous semesters, as and when required.

18 MALPRACTICES IN EXAMINATIONS AND MISCONDUCT OF STUDENTS

- 18.1 The Chief superintendent / CoE shall be responsible for dealing all cases of unfair means by students in writing records, assignments and examinations as applicable
- 18.2 The invigilator or the course teacher concerned shall report each case of unfair means with full details of the evidence of malpractice and written explanation of the student concerned to the Dean immediately.

18.3 The Chief superintendent / CoE shall take appropriate action on receipt of the report and the penalty may be given as per the University norms defined.

18.4 Ragging Rules: Students found involved in ragging or in any other misconduct, or if a complaint is received from the affected student(s) to that effect, will be immediately expelled from the current semester and the Registrar shall further constitute a committee to probe and conduct enquiry into the matter and based on the report of the committee, the Dean shall pass the final orders on merit of case within three working days.

18.5 Unlawful Activities: In case of students found involved in any unlawful activities either within or outside the Hostel/College Campus, besides expulsion both from the Hostel and College, at the discretion of the Dean, the matter will be reported to the Police of the jurisdiction to be dealt with, in accordance with the appropriate law in force.

Ragging – An offence

Extract of Tamil Nadu Government Gazette - Extra ordinary dt.29.01.97 (Bill No.8 of 1997 Tamil Nadu Prohibition of Ragging ACT)

In this Act, unless the context otherwise requires, “Ragging” means display of noisy, disorderly conduct, doing any act which causes or is likely to cause physical or psychological harm or raises apprehension or fear or shame or embarrassment to a student in any educational Institution and includes:

Teasing, abusing or playing practical jokes on or causing hurt to such student or

Asking the student to do any act or perform something which such student will not, in the ordinary course willingly act or perform. Ragging within or outside any educational institution is prohibited.

Whoever directly or indirectly commits, participates in, abets or propagates “Ragging” within or outside any educational institution, shall be punished with imprisonment for a term which may extend to two years and shall also be liable to fine which may extend to ten thousand rupees.

Any student convicted of an offence under section 4 shall also be dismissed from the educational institution and such students shall not be admitted in any other educational institution.

Without prejudice to the foregoing provision, whenever any student complains of ragging to the head of an educational institution, or to any other person responsible for the management of the educational institution, they shall inquire into the same immediately and if found true shall suspend the student who has committed the offence from the educational institution.

The Deans of concerned School will have full powers to punish any student who violates the rules by imposing a fine, suspension or expulsion. Dean's decision is final and he need not assign any reason or explanation for the punishment awarded. These rules will be altered or amended, and further rules may be added if necessary. All the rules for the time being in force should be observed by the students.

19 PREPARATION OF STATEMENT OF MARKS

19.1 Preparation of Class Grade Charts: The Controller of Examinations shall prepare the class grade charts for the subjects registered in a semester and a copy shall be sent to the departments concerned for record. Defects, if any, should be reported to the Controller of Examinations within 5 working days after the receipt of class grade charts.

19.2 Preparation of Statement of Marks: The semester statement of marks shall be prepared by the Controller of Examinations. The Deans of Colleges should send the mid-semester marks in typed hard and soft copy (or email) within 15 days after the conduct of the examination. The final practical marks should be in hard and soft copy (or mail) within 10 days after the completion of 105 working days. This should also accompany the attendance particulars of regular students to incorporate the attendance in the class grade chart by the Controller of Examinations.

19.3 Calculation of OGPA: To arrive at the Overall Grade Point Average (OGPA) at the end of the semester, the Grade Point of each course is multiplied by the credit hours of the course to obtain the credit points. Then the sum of the credit points secured by the student in all the courses taken till the end of semester is divided by the total number of credit hours of the courses, provided that the credit hour and credit points of courses which have been repeated are not counted more than once for this purpose.

While calculating OGPA the credit hours of courses in which the student secured 'E' grade (for lack of 80% attendance) will be deducted since it will be repeated by re-registration. The OGPA shall be rounded to nearest two decimals.

20 APPROVAL OF FINAL RESULTS, AWARD OF DEGREE AND ISSUE OF PROVISIONAL CERTIFICATES AND TRANSCRIPTS

20.1 Award of Degree: The degrees for the different undergraduate programmes shall be awarded during Annual Convocation conducted in the University under the seal of the University to candidates who have successfully completed the graduation requirements (credits requirement).

20.2 Eligibility for the Award of the Degree: The successful completion of all the prescribed courses included in the Curricula and Syllabi and an Overall Grade Point Average (OGPA) of 6.00 shall be minimum requirement for the award of the Degree. For calculating the class equivalents for OGPA in UG programme an OGPA of 8.1 and above will be graded as first class with distinction if he takes every course in first attempt, if he re-appears will be awarded only first class and that of above 7.1 to 8.0 will be graded as second class and 6.0 to 7.0 will be graded as third class.

20.3 Approval of Final Results for Certificates and Transcripts: The Vice- Chancellor shall approve

the final results. The Registrar shall issue Provisional Certificates, Transcripts, Migration Certificates to the Candidates. The Transcript Card shall contain details of all the courses and the Grades and OGPA obtained by the candidates indicating the number of times appeared. This will be prepared for all the students by the Controller of Examinations and countersigned by the Registrar. For preparation of Transcript Card, the Deans should send recent passport photograph (size 5.0 x 3.75 cm) of the student along with filled in proforma and the required fee as specified by the Controller of Examinations.

20.4 The Transfer Certificate and Conduct Certificate shall be issued by the Registrar.

20.5 Amending or Canceling the Result: The Vice Chancellor is empowered to withhold or cancel the degree awarded when a mistake willfully committed by a student is detected at a later date regarding the registration, OGPA and other requirements for successful completion of the respective degree programme. If it is established that the result of a candidate has been vitiated by malpractice, fraud or other improper conduct and that he/she has been a party to malpractice connivance or improper conduct of another student, the Vice Chancellor shall have the powers at any time to amend the results of such a candidate and to make such declaration as the Vice Chancellor may deem necessary on that behalf including return of prize, scholarship money and debarring the candidate from the University for such periods as may be specified and to cancel the results of the candidate in such manner as the Vice Chancellor may decide.

21 TUITION FEES AND OTHER FEES

21.1 In case of new admissions, the students should pay the first semester fees on the date specified failing which admission will be cancelled.

21.2 In other cases, the fees are payable within seven working days including the date of registration. If the seventh day happens to be a holiday, the next working day shall be the last date for payment of fees without fine.

21.3 In case of default of full payment within seven working days, a fine of Rs.100/day along with semester fees will be collected. The students who fail to pay tuition fees "**within 30 days**" of commencement of the semester will not be allowed to attend classes and their name will be struck off the rolls.

21.4 Students who are away on study tour or other extra-curricular activities organized by the University or Colleges concerned with proper permission from the Dean may, however, pay their tuition fees and other fees within **three working days** after they return from such assignments.

21.5 A student who has been granted scholarship by the Adi-Dravidar Welfare Department or by the Government of India or State Government through the Director, Adi-Dravidar Welfare, Chennai will however be exempted from the levy of fines, provided the scholarship is actually sanctioned to him/her. In case of default of payment on the day next to the day of the disbursement of the scholarship amount, the student shall be permitted to pay the fees within seven working days by paying a fine of Rs.15/- failing which the name will be struck off the rolls. The concession mentioned above will apply to those who have actually been granted

scholarship and not those who have applied for and are expecting sanctions.

- 21.6 In case of a student who re-registers with junior batch, he/she has to pay the tuition fee applicable to the junior batch semester in which he/she registers besides re-registration fee.
- 21.7 In the case of two overlapping of semesters the student need not pay the semester fee for the registration of courses in the overlapping semester, but overlapping period should be within 40 days from the date of registration of the regular semester.
- 21.8 Collection of Penalty for Special Semester Courses: A penalty equivalent to tuition fee in addition to special semester fee is to be collected from the students who register for special semester.
- 21.9 In case of a student who registers courses along with juniors after completion of four-year study period the student need to pay all the fee including self- supporting fee as applicable to junior batch students.
- 21.10 **Fee for Newly Admitted Candidates**
 - a) Newly admitted candidates will pay the fee to the DSU. The students shall register the course only after payment of all the fees.
 - b) Candidates who discontinue after first semester are not eligible for refund of any other fee except caution money deposit.
 - c) At the time of payment of fee from the second semester onwards, the student shall produce the identify card and no-due certificate from the hostel.

22 RULES FOR STUDENTS STUDYING AFTER N+4 YEARS

- 22.1 The Deans concerned can permit the students who are having arrear subjects beyond n+4 years to write the supplementary examinations. The supplementary examination is applicable only for the Semester students who have joined the degree programme at DSU.
- 22.2 The students having arrear subjects beyond n+4 years shall be permitted to write the supplementary examinations by registering the course in the concerned college where the student had undergone the degree programme. The Controller of Examinations will intimate the examination schedule after the receipt of Registration Card from the Dean concerned. The examination will be conducted 15 days after the receipt of the Registration Card from the Deans of University.
- 22.3 Students who have exhausted the supplementary examination provision, have to re-register the equivalent course along with juniors, under existing rules whenever offered. Based on the request from the students, the Head of the Department shall recommend to the Deans concerned the equivalent course for approval. In case of short fall of credits to meet the minimum credit requirements in the award of degree in the event of registering equivalent courses at the end of the programme, the Deans concerned can nominate a committee of two

senior Professors to suggest the course to be studied for satisfying the total credit requirement.

22.4 All the students who are re-registering courses beyond the prescribed duration of n+4 years should pay two times of current semester fee, besides fee prescribed for re-registration of courses.

22.5 For reappearance examinations twice the current prescribed fee has to be paid.

23 REMOVAL OF DIFFICULTIES

23.1 If any difficulty arises in giving effect to the provisions of these regulations, the Vice-Chancellor may issue necessary orders which appear to him to be necessary or expedient for removing the difficulty.

23.2 Every order issued by the Vice Chancellor under this provision shall be laid before the Academic Council of the University immediately after the issuance.

23.3 Notwithstanding anything contained in the rules and regulations, the Academic Council shall make changes whenever necessary.

Dhanalakshmi Srinivasan University
School of Agricultural Sciences
B.Sc. (Hons.) Horticulture Programme-2023
Syllabus
Semester I

S. No	Course Code	Course Title	Credit Hours	Total Credits
32	23HOR101	Fundamentals of Horticulture	2+1	3
	23HOR102	Plant propagation and nursery management	1+1	2
	23HOR103	Botany of Horticultural crops	1+1	2
	23VSC101	Tropical and subtropical vegetable crops	2+1	3
	23AGR101	Introduction to major field crops	1+1	2
	23SAC101	Fundamentals of Soil Science	2+1	3
	23FOR111	Introduction to Forestry	1+1	2
33	23BIC101	Fundamentals of Plant Biochemistry	1+1	2
34	23LAN101	Comprehension and Communication Skills in English	1+1	2
		Total	12+9	21
35	23 NSS/ NCC 101	NSS or NCC *	0+1*	1*

36	23 PED 101	Physical Education and Yoga Practices*	0+1*	1*
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*Non- gradial courses

23HOR101 Fundamentals of Horticulture (2+1)

Objective:

- Outline the scope and importance of horticulture
- Summarize different propagation methods in horticulture
- Explain different climatic zone in horticulture crops
- Paraphrase different planting system
- Recognize the benefits of irrigation and fertigation methods in horticulture
- Outline the plan and layout of orchard

Outcomes:

- Describe skills on tools and implements used in horticulture
- Recognize skill for solving field problems
- Give original examples of cultivable horticulture crops in different zones of climacteric condition
- Narrate to handle postharvest losses in fruits and vegetable
- Paraphrase training and pruning methods in horticulture crops
- Outline skills to identify major physiological disorder in horticulture crops

Theory

Unit I Basic concepts of horticulture

Scope and importance – state, national and global scenario of horticultural crops & divisions of horticulture – area and production – export and import – classifications of horticultural crops – nutritive value of horticultural crops – horticultural therapy – horticultural zones of India and Tamil Nadu – horticultural developmental agencies – commodity boards and programmes

Unit II Role of soil and climatic factors on horticultural crop production

Role of season, soil and climate – physical and chemical properties of soil – climatic factors – light, temperature, photoperiod, relative humidity, rainfall, altitude, micro climate, pollution – effect of biotic and abiotic stresses on crop production.

Unit III Crop management

Nursery techniques – clonal orchards – vegetable garden – nutrition garden, kitchen garden and other types of gardens. Planting systems – planning – layout and management of an orchard – wind breaks and shelter beds. Water management – nutrient management – drip and fertigation – soil fertility management – weed management – after cultural practices – mulching – cover cropping – green manuring – application of growth regulators – cropping systems – intercropping and multi-tier cropping. Principles of organic horticulture – GAP and GMP.

Unit IV Growth and development

Important phases of growth and development – bearing habits. Principles and methods of training and pruning of horticultural crops – rejuvenation of old and senile orchards – factors influencing

fruitfulness and unfruitfulness – special horticultural practices – pinching – thinning, dis budding, blanching, smudging, notching, ringing.

Unit V Protected cultivation and postharvest handling

Protected cultivation – principles – structures – types and uses – hydroponics –nutrient film technique – aeroponics – maturity indices – harvesting, grading and post harvest handling – processing, value addition packing and storage of horticultural produce.

Practical

Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

Lecture Schedule

1. Scope, importance and divisions of Horticulture
2. National, state and global scenario – area, production, export and import of horticultural crops.
3. Classification and nutritive value of horticultural crops
4. Horticultural therapy
5. Horticulture zones of Tamil Nadu and India
6. National and state level agencies commodity board and programmes in horticultural development
7. Role of soil physical and chemical properties in horticultural crop production
8. Role of climatic factors in horticultural crop production
9. Biotic stress and management in horticultural crops
10. Abiotic stress and management in horticultural crops
11. Nursery techniques, clonal orchard and production of healthy planting materials
12. Vegetable gardens – nutrition garden, kitchen garden and other types of gardens
13. Planning, layout and management of an orchard
14. Planting systems and planting
15. Water management including drip irrigation and fertigation system in horticultural crops
16. Nutrient management in horticultural crops
17. **Mid semester examination**
18. Soil fertility management and fertigation in horticultural crops
19. Weed management in horticultural crops
20. After cultural practices – mulching, cover cropping, green manuring
21. Growth regulators and their applications in horticultural crops
22. Cropping systems – intercropping and multi-tier cropping
23. Principles of organic horticulture
24. Growth and development including bearing habits of horticultural crops
25. Principles and methods of training in horticultural crops
26. Principles and methods of pruning in horticultural crops

27. Factors influencing fruitfulness and unfruitfulness in major horticultural crops
28. Rejuvenation of old and unproductive senile orchards
29. Special horticultural practices - pinching - thinning, dis-budding, blanching, smudging, notching, ringing
30. Protected cultivation in horticultural crops
31. Hydroponics, aeroponics, nutrient film technique in horticultural crops
32. Maturity indices, harvesting and post harvest handling of horticultural crops
33. Packing and storage of horticultural crops
34. Processing and value addition of horticultural crops

Practical

1. Study of different features of an orchard
2. Tools and implements used for horticultural crop production
3. Planning and layout of an orchard
4. Preparation of pits and planting of fruit plants
5. Layout and study of nutrition garden
6. Preparation of nursery bed and sowing of seeds
7. Containers and protrait nursery
8. Layout of different irrigation systems and methods
9. Identification of manures, fertilizers and methods of fertilizer application and fertigation
10. Preparation and application of growth regulators
11. Identification and correction of nutritional and physiological disorders
12. Study of bearing habits in horticultural crops
13. Methods of training and pruning in horticultural crops
14. Observation of structures used in protected cultivation
15. Study of maturity standards, harvesting, grading, packing and storage of horticultural crops
16. Visit to private orchards and cold storage units
17. Practical Examination

Text Books

1. Jitendra Singh, (2017) Fundamental of Horticulture, Kalyani Publishers, New Delhi. pp.1-524
2. Chadha, K.L. (2019). Handbook of Horticulture. Vol. I (2nd revised edition). New Delhi: ICAR. pp1 - 299.
3. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). New Delhi: Oxford & I.B.H. Publishing. pp. 1 - 452.
4. Christopher, E.P. (2015). Introductory Horticulture, Biotech Books, New Delhi. pp1-490
5. Adams, C.R., M. P. Early, J. Brook and K. Bamford. (2014) Principles of Horticulture. Routledge, 2nd edition pp.1-416
6. Jacob John.P.(2008). A hand book of post harvest management of fruits and vegetables. Dayapublishers. 2nd edition pp 147
7. Singh, D.K. (2008). Hi-tech horticulture. Agrotech publishers, Udaipur
8. Rajan, S. and B.L. Markose. (2007). Propagation of horticultural crops. New India 2nd edition pp 320

23HOR102 Plant propagation and nursery management (1+1)

Objective:

To impart skill oriented knowledge on media preparation, propagation method and maintenance and after care of propagated plants.

Outcomes:

Students will be benefited with hands on training in media preparation, mother plant selection, propagation techniques and maintenance and after care of propagated plants.

Theory

Unit-I: Basics of propagation

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages.

Unit-II: Seed germination and seed dormancy

Seed dormancy types of dormancy, internal and external factors, methods of breaking dormancy, nursery techniques nursery management, apomixes – mono embryony and polyembryony in seed, types and stages of seed germination with examples.

Unit-III: Propagation structures, tools / implements and growth regulators

Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons, cost of establishment of propagation structures nursery tools and implements, use of growth regulators in propagation.

Unit-IV: Methods and physiology of vegetative propagation

Vegetative propagation, methods and techniques of division - stolons, pseudo bulbs, offsets, runners, cutting, layering, grafting, formation of graft union, factor affecting healing of graft age and budding, physiological and bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers, chimera and bud sport

Unit-V: Micro propagation

Micro grafting, meristem culture, callus culture, anther culture, organogenesis, somaclonal variation hardening of plants in nurseries. Nursery registration act. Insect pest / disease control in nursery.

Practical

Media for propagation of plants in nursery beds, potting and repotting. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, grafting and budding including top grafting and bridge grafting etc. Use of mist chamber in propagation and hardening of plants. Preparation of

plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Uprooting, labeling and packing of nursery fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, poly house and their maintenance. Nutrient and plant protection applications during nursery.

Lecture Schedule

1. Plant propagation – definition, need and potential for commercial nursery activities
2. Sexual Vs Asexual methods of propagation, its prospects and constraints
3. Pollination, fertilization and seed development, seed – definition, germination requirements, types of germination, viability and longevity
4. Dormancy in seeds, dormancy mechanism, types of dormancy mechanism of breaking dormancy in seeds
5. Plant propagation structures – principles and uses
6. Application of growth regulators in propagation
7. Vegetative propagation through cutting and physiological basis of rooting
8. Methods of layering in horticultural crops

9. Mid Semester Examination

10. Mother plant selection, maintenance, bud wood certification and nursery registration act
11. Propagation through grafting
12. Propagation through budding
13. Grafting incompatibility and stock-scion relationship
14. Propagation through specialized plant organs
15. Tissue culture techniques in horticultural crops and micro grafting
16. Application of micropropagation in horticulture crops
17. Plant protection in horticultural nursery

Practical Schedule

1. Study of nursery records, tools and implements
2. Studies on media and containers for propagation
3. Practice in potting and repotting of plants
4. Preparation of different types of nursery beds and seed sowing
5. Studies on seed treatment methods in horticultural crops
6. Establishment of mother plant nursery and bud wood certification
7. Raising of root stocks and preparation of scion for fruit plants
8. Preparation and use of growth regulators
9. Practice on propagation through different types of cuttings
10. Practice on propagation through ground and air layering
11. Studies on techniques of grafting in horticultural crops
12. Studies on techniques of budding in horticultural crops
13. Studies on propagation through specialised plant organs
14. Studies on the role of shade nets, mist chamber and poly house in propagation
15. Nutrient management and plant protection in horticultural nursery
16. Visit to tissue culture laboratory

17. Practical Examination

Textbooks

1. R. R. Sharma (2018). Propagation of Horticultural Crops: Principles & Practices, Kalyani Publishers; 3rd edition, India.
2. Rajan, S. and Markose, B.L. (2007). Propagation of Horticultural Crops Volume 6 of Horticulture science series New Delhi: New India Publishing (pp. 1-251)
3. Sharma, R.R. (2005). Propagation of Horticultural crops (Principles and practices). New Delhi: Kalyani Publishers. (pp.1 -272).
4. Sharma, R. R., Mani Srivastava. (2004). Plant Propagation and Nursery management. International book Distributing Company. (pp.1-488).
5. Chadha, K. L. (2002). Hand book of Horticulture. New Delhi: ICAR.(2nd ed.pp. 1-299)
6. Hartmann and Kesar's (2015). Plant propagation: Principles and practices, Pearson Education India. (1-928).
7. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). New Delhi: Oxford & I.B.H. Publishing. pp. 1 - 452.

23HOR 103 Botany of horticultural crops (1+1)

Objective:

- Outline the Systemic Botany
- Describe floral biology of fruit crops
- Describe the floral biology of vegetable crops
- Paraphrase the dissection of flowers
- Discuss the different families
- Identify the botany of different flowers

Outcomes:

At the end of this course, learners will be able to:

- Summarize flowers based on crop
- Describe botany of Horticultural crops
- Describe the classification of Families
- Outline dissection procedures
- Outline pollination mechanism
- Describe economical part of a crop

Theory

Unit I- Systematic botany

Terminology, morphological description and classification – root, stem, leaf, inflorescence, flower and fruit – flowering mechanism – modes of pollination – asexual/vegetative reproduction – floral biology – fertilization and fruit set. Principles involved in nomenclature, ICBN rules and recommendations with special reference to names of hybrids and names of cultivated plants.

Unit II - Botany, floral biology, pollination, fruit set and economic part in the families

Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin), Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove), Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

Unit III - Botany, floral biology, pollination, fruit set and economic part in the families

Solanaceae (tomato, brinjal, chilli, potato), Malvaceae, Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber), Moringaceae, Fabaceae (peas, French beans), Alliaceae (onion, garlic), Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae, Amaranthaceae, Convolvulaceae (sweetpotato), Araceae (elephant foot yam, colocasia), Dioscoreaceae (yam, medicinal dioscorea).

Unit IV - Botany, floral biology, pollination, fruit set and economic part in the families

Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (Vanilla, Dendrobium orchid), Apiaceae (Umbelliferae) (coriander), Myristicaceae, Lauraceae, Leguminosae, Caesalpiniaceae, Camelliaceae, Rubiaceae, Arecaceae(Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaceae(Cocoa).

Unit V - Botany, floral biology, pollination, fruit set and economic part in the families

Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae, Acanthaceae, Caryophyllaceae, Iridaceae, Apocynaceae, Poaceae (Graminae), (lemongrass, citronella, palmarosa, vetiver), Geraniaceae, Lamiaceae (Labiatae) (coleus, patchouli, mint, maruvu), Scrophulariaceae.

Practical

Observation and recording the morphology of root, stem, leaf, flower and fruit. Study of taxonomy and morphology of crops in the above families – herbarium (minimum 50 – covering not less than 25 families) collection of the crops mentioned in theory.

Lecture schedule

1. Systematic botany-principles involved in nomenclature.
2. Terminology, morphological description and classification based on root, stem, leaf, inflorescence, flower and fruit.
3. Flowering mechanism – modes of pollination – asexual/vegetative reproduction –floral biology – fertilization and fruit set. Botany, floral biology, pollination, fruit set and economic part in the families- ICBN rules and recommendations – special reference to names of hybrids and cultivated plants
4. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.
5. Moraceae, Vitaceae, Caricacea, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.
6. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear,plum, rose).
7. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.
8. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber).

9. Mid-semester examination.

10. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).
11. Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae and Amaranthaceae.
12. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal dioscorea).
13. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).
14. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
15. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm), Sterculiaceae.
16. Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae and Acanthaceae.
17. Caryophyllaceae, Iradiaceae, Apocynaceae, Graminae, (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae.

Practical schedule

Observation and description of the taxonomy and morphological characters of the crops in the families

1. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.
2. Moraceae, Vitaceae and Caricaceae.
3. Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.
4. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).
5. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.
6. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber).
7. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).
8. Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae and Amaranthaceae.
9. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal dioscorea).
10. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).
11. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
12. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm) and Sterculiaceae.
13. Oleaceae (malligai, mullai, jathimalli), Amaryllidaceae and Acanthaceae.
14. Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum)
15. Caryophyllaceae, Iradiaceae, Apocynaceae and Geraniaceae
16. Graminae (lemongrass, citrononella, palmarosa, vetiver), Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae

17. Final Practical examination.

Textbooks

1. Ratikanta Maiti, Allam Ramaswamy, Desari Rajkumar. (2018). Botany of Vegetable crops. USA: American Academic Press. (pp. 1 - 251)

2. Spichiger, R., Savolainen, V., Figeat, M., Jeanmond, D. (2004). Systematic Botany of flowering plants. USA: Science Publishers Inc.,
3. Mauseth, J.D. 2009. Botany: an introduction to plant biology. Jones and Bartlett Publishers, MA.
4. Kumar, R.A., Lakshmanan, V.Thondaiman. (2014). Botany of Vegetable crops. New Delhi: Narendra Publishing House.(pp. 1- 184).
5. Ponnuswami, V. Padmadevi, K. Muthukumar, S. (2012). Botany of Horticultural crops. New Delhi: Narendra Publishing House.
6. Rameshkumar, A., V. Lakshmanan and T. N. Balamohan. (2011). Botany of Vegetable Crops. New Delhi: New Delhi Publishers.
7. Jata S. Nanda & Pawan K. Agarwal (2011). Botany of Vegetable Crops, Kalyani Publishers, New Delhi.

23VSC101 Tropical and subtropical Vegetable Crops (2 + 1)

Objectives

To teach the students about the scenario of vegetable cultivation advanced production techniques and production constraints. Explain the different vegetable gardens and nutritional importance of vegetables

Outcome

1. Hands on experience of vegetable cultivation
2. Knowledge about quality requirement and production and techniques for export
3. Managing skill for solving field problems
4. Recognize the plan a suitable vegetable cultivation technology for a particular region

Theory

Unit-I: Scope and importance of tropical and sub tropical vegetables

Scope and importance- area and production, global and national scenario, industrial importance - export potential - institutions involved in vegetable crops research - Classification of vegetable crops - vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden - Types of vegetable farming - rice fallow vegetable production, river bed cultivation, rainfed cultivation, contract farming- Organic vegetable production - GAP for vegetable production, export standards of vegetables

Unit-II: Solanaceous and Malvaceous vegetable crops

Area and production - composition and uses - climate and soil requirements - season varieties and hybrids - seed rate- nursery practices - preparation of field --planting system - spacing - sowing or transplanting - manuring and nutrient management - water and weed management - mulching- Fertigation - special horticultural practices - nutrient deficiencies physiological disorders - growth regulators - maturity indices- harvest -yield - postharvest handling and storage - marketing. Crops: Tomato, brinjal, chilli, capsicum and bhendi

Unit-III: Cucurbitaceous vegetable crops

Area and production - composition and uses - climate and soil requirements - season varieties and hybrids - seed rate- preparation of field --planting system - spacing - direct sowing and raising in

protray/polybag - sex expression - growth regulators - manuring and nutrient management - water and weed management - mulching- fertigation-special horticultural practices - nutrient deficiencies- physiological disorders - maturity indices- harvest -yield - postharvest handling and storage - processing gherkin - marketing. Crops: Bitter gourd, snake gourd, ribbed gourd, bottle gourd, Ivy gourd, chow - chow, ash gourd, pumpkin, watermelon, musk melon, cucumber and gherkin

Unit-IV: Legumes and greens

Area and production - composition and uses - climate and soil requirements - season varieties- seed rate- preparation of field - planting system - spacing - sowing / planting - manuring and nutrient management - staking for climbing types - water and weed management - mulching- fertigation- nutrient deficiencies- physiological disorders - growth regulators - maturity indices- harvest -yield - postharvest handling and storage - marketing. Crops: Cluster beans, vegetable cowpea including yard long bean, lab-lab, broad bean, moringa bean, yam bean, amaranthus, basella, portulaca, chekkurmanis, roselle (*Hibiscus sabdariffa*), sorrel, moringa

Unit-V: Bulbous and Tuber crops

Area and production - composition and uses - climate and soil requirements - season varieties and hybrids - seed rate- nursery practices - preparation of field - planting system - spacing - sowing or transplanting - manuring and nutrient management - water and weed management - mulching- fertigation-special horticultural practices - nutrient deficiencies physiological disorders - growth regulators - maturity indices- harvest -yield - postharvest handling and storage - marketing. Crops: Onion, cassava, sweet potato, colocasia, Chinese potato (*vegetable coleus*), elephant foot yam, edible dioscorea, Colocasia and arrow root.

Practical

Identification and description of tropical and sub-tropical vegetable crops, nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and interculture, use of growth regulators, identification of nutrient deficiencies, physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed production and seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops).

Lecture Schedule

1. Scope and importance of vegetable crops. Area, production, global and national scenario, industrial importance, export potential of tropical and subtropical vegetable crops and institutions involved in vegetable crops research. Classification of vegetable crops.
2. Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden and floating garden. Types of vegetable farming - rice fallow cultivation, river bed cultivation, rainfed cultivation and contract farming. Organic vegetable production, GAP in vegetable production and export standards of vegetables
3. Tomato: Area and production- economic importance- composition and uses- export potentials- climate and soil requirements - season - varieties and hybrids. Tomato Nursery practices - protray nursery direct / transplanting - preparation of field - spacing - planting systems - spacing - water and weed management - inter cultural operation.

4. Tomato - nutrient requirement. – fertigation- nutrient deficiencies- physiological disorders - use of chemical and growth regulators – cropping system – harvest - yield – post harvest management- storage.

Area and production - economic importance- composition and uses- export potentials- climate and soil requirements – season - varieties and hybrids, Nursery practices – protrait nursery direct / transplanting - preparation of field - spacing - planting systems – spacing - water and weed management – inter cultural operation - nutrient requirement. – fertigation – nutrient deficiencies- physiological disorders - use of chemical and growth regulators – cropping system – harvest - yield – post harvest management- storage and marketing for the following crops:

5. Brinjal

6. Chilli

7. Capsicum

8. Bhendi

9. Bitter gourd

10. Snake gourd

11. Ribbed gourd and bottle gourd

12. Ivy gourd and chow-chow

13. Ash gourd and pumpkin

14. Watermelon

15. Musk melon

16. Cucumber, long melon, snap melon and gherkin

17. Mid Semester Examination

18. Cluster beans

19. Vegetable cowpea

20. Lab lab

21. Broad bean, moringa bean and yam bean

22. Amaranthus and chekkurmanis

23. Basella, portulaca and roselle

24. Moringa

25. Small Onion

26. Big Onion

27. Cassava - Area and production, composition and uses, significance of HCN in tubers, climate and soil requirements, season, varieties, propagation, single bud cuttings, production of CMD free planting materials – true cassava seed production , nursery practices, preparation of field, spacing, planting systems

28. Cassava -Manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, harvest, yield, post harvest handling, storage, marketing and starch estimation in tubers by relative density method and price fixation

29. Sweet potato

30. Chinese potato (vegetable coleus)

31. Elephant foot yam

32. Edible Dioscorea, xanthosoma and arrow root

33. Colacasia

34. Sorrel

Practical Schedule

1. Planning and lay out of kitchen/ nutrition garden.
2. Preparation of nursery, containerized transplant production and sowing of seeds for solanaceous vegetable crops.
3. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable crops and tuber crops.
4. Identification and description of species and varieties of tomato, brinjal and chilli. Working out cost- benefit ratio.
5. Identification and description of species and varieties of bhendi and leguminous vegetables. Working out cost- benefit ratio.
6. Identification and description of species and varieties of cucurbits and onion, moringa and chekkurmanis. Determination of sex ratio in cucurbits. Working out cost- benefit ratio.
7. Identification and description of species and varieties of amaranth moringa chekkurmanis and other leafy vegetables.
8. Identification and description of cultivars and wild relatives of tuber crops. Working out cost - benefit ratio.
9. Study of drip and fertigation, basal dressing, top dressing and foliar spray of fertilizers for vegetable crops.
10. Identification of weeds, preparation of herbicide spray fluids and their usage in the field. Working with the economics of weed management
11. Preparation of growth regulator spray solution- their usage in tropical vegetable crops
12. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
13. Maturity indices, harvesting and post harvest management of tropical and subtropical vegetable crops
14. Seed production in tropical and subtropical vegetable crops
15. Seed extraction in vegetable crops
16. Visit to commercial vegetable growing area / markets

17. Final Practical Examination

Textbooks

1. Dipika Sahoo and Bhimasen Naik (2020). Tropical and Subtropical Vegetable Crops, New India Publishing Agency.
2. S. P. Kanaujia, C.S. Maiti and Raj Narayan (2020). Textbook of Vegetable Production,
3. Gopalakrishnan, T.R., (2007). "Vegetable Crops" New India publishing agency, New Delhi. pp 1-360
4. Mukesh Topwal & Shruti Agarawal (2022). Production technology of minor vegetable crops, Scientific Publishers. pp 1-137.
5. Nem Pal Singh; A K Bhardwaj; Abnish Kumar and K M Singh (2004), Modern Technology of Vegetable Production, International Book, Lucknow.
6. Jahir Hussian (2012), Tropical Vegetable Production, SBS Publishers, India.
7. Thapa and Tripathy (2013), Production Technology of Tropical and Subtropical vegetable crops.

Agro Tech Publication, India.

23AGR101 Introduction to major field crops (1+1)

Objectives

- Acquire basic knowledge on agriculture
- Discuss the effect of environment factors on crop growth and productivity
- Compare, contrast, and appraise the different cropping systems, tillage system and make recommendations for sustainable management
- Outline the concepts in agronomy in the establishment and sustainable management of agricultural crops

Outcome

- Summarize the competency in sustainable crop management
- Outline the technical and scientific principles of the cultivation of major crops and the ability to modify the factors influencing the quantity and quality of crop yield.
- Know the cropped species, their requirements and the practices to obtain the main agricultural products.
- Summarize the key aspects of husbandry operations required to grow the major crops successfully
- Identify the critical management factors involved in profitable crop production

THEORY

Unit I - Principles of Crop Production

Agronomy-Definition, scope and importance - Factors affecting crop production-Classification of field crops -Tillage and tilth: objectives and different kinds of tillage - Seeds and sowing: different methods - Crop geometry.

Unit II - Integrated Crop Management

Manures and Fertilizers: methods of application - Irrigation methods - Weeds: principles and methods of weed management - Cropping pattern and cropping systems - Integrated Farming System (IFS).

Unit III - Major Cereals and Nutri-Cereals

Major cereals (Rice, Wheat, Maize) and nutri-cereals (Sorghum, Pearl millet, Finger millet) their origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultivation practices and yield.

Unit IV - Major Pulses and Oil Seeds

Major pulse crops (Bengal gram, Redgram, Blackgram, Greengram and Cowpea) their origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultivation practices and yield; Production technology of major oil seed crops (Groundnut, Sunflower, Sesame) their origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultivation practices and yield.

Unit V - Fibre, Sugar, Forage and Green Manure Crops

Cotton, sugarcane and forage crops (Cumbunapier hybrid, Fodder maize, Fodder cowpea and Hedge Lucerne) and Green manure crops (Sunnhemp, Glyricidia and Daincha) their origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultivation practices and yield

Practical

Study of Wet land, garden land and dry land farming systems. Identification of seeds, manures, tools and implements. Methods of land configuration for raising nursery for different ecosystems. Methods of seed treatments and working out seed rate, manure, and fertilizer requirement for different crops. Intercultural operations, weeding practices and irrigation methods. Growth and yield parameters, harvesting and maturity symptoms and working out economics for important field crops. Visit to nearby Agricultural Research Station / Farmer's field

Theory - Lecture Schedule

1. Agronomy - definition - scope and importance - major classifications of crops.
2. Factors affecting crop production - climatic - edaphic - biotic- physiographic and socio-economic factors.
3. Tillage - Definition - objectives - types of tillage - modern concepts of tillage - main field preparation.
4. Seeds - Seed rate - sowing methods - Germination - Crop stand establishment - Planting geometry.
5. Manures and fertilizers - role, types and methods of applications
6. Weeds - Definition - harmful and beneficial effects of weeds - methods of weeds management - IWM.
7. Irrigation - time and methods of irrigation - Cropping pattern and cropping system - IFS.
8. Rice - Origin - geographic distribution - economic importance - varieties - soil and climatic requirement - cultural practices - yield - economic benefits

9. Mid-Semester examination

10. Special type of Rice cultivation - SRI, Aerobic rice cultivation.
11. Wheat and Maize - Origin, geographic distribution, classification - economic importance, soil and climatic requirement, varieties, cultural practices and yield.
12. Sorghum, Pearl millet and Ragi - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
13. Redgram, Blackgram, Greengram, Cowpea and Bengal gram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
14. Groundnut, Sesame, Sunflower - Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices yield.
15. Cotton and sugarcane- Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices yield.
16. Fodder sorghum, Cumbunapier, Guinea grass, Fodder cowpea and Hedge Lucerne - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
17. Sunnhemp, Daincha and Glyricidia- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.

Practical Schedule

1. Study of Wet land, garden land and dry land farming systems

2. Identification of seeds, manures and fertilizers.
3. Identification of tools and implements.
4. Acquiring skills on handling primary and secondary tillage implements
5. Practicing different methods of land configuration for raising nursery for wet land crops
6. Practicing different methods of land configuration for raising nursery garden land crops.
7. Practicing different methods of seed treatments for major field crops
8. Working out seed rate, manure, and fertilizer requirement for different crops.
9. Practicing intercultural operations in different field crops
10. Identification of weeds, weeding practices and handling of weeding tools and implements.
11. Practicing different irrigation methods
12. Observations on growth parameters for important field crops
13. Observing harvesting and maturity symptoms for major field crops
14. Study of yield parameters and estimation of yield in major field crops
15. Working out cost and returns of important field crops
16. Visit to nearby Agricultural Research Station / Farmer's field

17. Final Practical Examination

Text Books

1. Ahlawat, I.P.S., Om Prakash and Saini, G.S. (2010). Scientific Crop Production in India. Rama publishing House, Meerut. pp. 1-680.
2. Cassius Foster. (2017). Introduction to Agronomy. Larsen and Keller Education Publishers, New York, USA. pp. 1-270
3. Chidda Singh, Prem Singh and Rajbir Singh. (2020). Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co Pvt.Ltd, New Delhi. pp. 1-596.
4. Mukund Joshi. (2015). Text Book of Field Crops. PHI Learning Private limited. New Delhi.
5. Rajendra Prasad. (2017). Textbook of Field Crops Production (Volume 1 & 2). Indian Council of Agricultural Research (ICAR), New Delhi. 1-1008.
6. Reddy. S.R. (2014). Principles of Crop Production. Kalyani Publishers, Ludhiana. 794p.
7. Yellamanda Reddy, T. and Sankara Reddy, G.H. (2017). Principles of Agronomy. Kalyani publishers, Ludhiana. pp. 1-685

23 SAC101 Fundamentals of Soil Science (2 + 1)

Objectives:

- To impart knowledge about the soil forming process.
- To learn about physical properties of soil.
- To have a general understanding on soil chemical properties reactions.
- To study the impacts of soil pollution and the remediation measures.

Outcomes:

- Knowledge gained about the soil forming process.
- Physical properties of soil studied.
- Various soil chemical properties and reactions understood.
- Impact of soil pollution and remediation measures learnt.

Theory

Unit I : Soil Genesis

Soil as a natural body, Pedological and edaphological concepts of soil. Components of soil. Soil genesis: Composition of Earth's crust- soil forming rocks and minerals – Primary and secondary minerals. Weathering of rocks and minerals. Factors of soil formation. Soil forming processes. Soil Profile.

Unit II : Soil physical properties

Soil texture, structure, density and porosity, soil colour, consistence and plasticity. Soil water retention, movement and availability. Soil air, composition, gaseous exchange-problem and its effect on crop growth. Source, amount and flow of heat in soil, Soil temperature and crop growth.

Unit III : Soil chemical properties

Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability. Electrical conductivity. Soil colloids - inorganic and organic. Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation.

Unit IV : Soil organic matter

Composition, properties and its influence on soil properties. Humic substances - nature and properties. Soil Biology: Soil organisms : macro and micro organisms, their beneficial and harmful effects. Soil enzymes.

Unit V : Soil resource inventory

Soil survey, types, uses and objectives of soil science research institute in India: Land use planning; classification and uses: Soil pollution – Types and behaviour of pesticides. and Inorganic contaminants. Prevention and mitigation of soil pollution.

Practical

Identification of rocks and minerals. Soil profile, collection and processing of soil samples, soil moisture, soil bulk density, particle density, pore space, particle size analysis- feel, international pipette method, Bouyoucos Hydrometer, soil colour. Studies of capillary rise phenomenon of water in soil column and water movement in soil., soil temperature and heat transfer. Determination of Soil pH, soil EC, cation exchange capacity of soil, organic carbon content. Study of soil map (India and Tamil Nadu)

Lecture Schedule:

1. Soil definition - Soil as a three-dimensional natural body, Pedological and edaphological concepts of soil
2. Components of soil – soil a three phase system- Composition of Earth's crust.
3. Soil genesis: soil forming rocks-definition, formation, Classification of rocks- igneous, sedimentary and metamorphic rocks
4. Brief description of important rocks - mineralogical composition
5. Minerals- definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals
6. Formation of secondary minerals - clay minerals and amorphous minerals

7. Weathering - Rocks and minerals - Physical, chemical and biological weathering
8. Factors of soil formation- Passive and active soil forming factors
9. Soil forming process- Fundamental - Simenson's four fold soil forming process -eluviation, illuviation, translocation and humification
10. Specific Soil forming processes - podzolization, laterization, salinization, alkalization, calcification, decalcification and pedoturbation
11. Soil Profile - Horizons, Master horizons and subordinate horizons, subdivisions, Lithological discontinuity.
12. Soil physical properties: Soil texture - particle size distribution - textural classes - textural triangular diagram - significance of soil texture
13. Soil structure - classification - genesis - factors influencing structural stability -significance of soil structure
14. Soil bulk density, particle density and porosity - factors influencing – significance.
15. Soil colour - causes and measurement - Munsell colour chart - factors influencing soil colour – Significance of soil colour.
16. Soil consistence - cohesion, adhesion, plasticity, Atterberg's constants - upper and lower plastic limits, plasticity number- significance of soil consistence

17. Mid semester Examination

18. Soil water- forms of water, units of expression and pF scale
19. Soil water potentials - gravitational, matric, osmotic- Soil moisture constants and Soil moisture measurements.
20. Movement of soil water - Saturated and unsaturated flow - infiltration, hydraulic conductivity, percolation, permeability and drainage
21. Soil air, composition, gaseous exchange – Problem and its effect on crop growth.
22. Source, amount and flow of heat in soil, soil temperature and crop growth. and crop growth.
23. Soil reaction (pH) - definition, pH scale, soil acidity and alkalinity, buffering, effect of pH on nutrient availability and factors affecting soil pH
24. Soil Electrical Conductivity - Factors affecting EC – its significance
25. Soil colloids - inorganic and organic
26. Silicate clays: constitution and classification - 1:1, 2:1, 2:2 expanding and non expanding - clay minerals, amorphous minerals and their properties
27. Sources of charge, ion exchange – positive and negative charge – isomorphous substitution, pH dependant charge.
28. Ion exchange - Cation and anion exchange capacity and base saturation
29. Soil organic matter: composition, properties, and its influence on soil properties
30. Humic substances – fractionation, nature and properties, Theories of humus formation.
31. Soil Biology- Soil organisms: macro and microorganisms, their beneficial and harmful effects, Soil enzymes
32. Soil carbon sequestration and carbon trading
33. Soil pollution - behaviour of pesticides and inorganic contaminants
34. Prevention and mitigation of soil pollution

Practical schedule:

1. Study of soil sampling tools, collection of representative soil sample, its processing and storage.

2. Study of soil profile in field.
3. Study of soil forming rocks and minerals.
4. Determination of soil density and porosity.
5. Determination of soil colour and moisture content and porosity.
6. Determination of soil texture by feel and Bouyoucos Methods
7. Determination of soil texture by International pipette method.
8. Studies of capillary rise phenomenon of water in soil column and water movement in soil (Infiltration Rate)
9. Studies of capillary rise phenomenon of water in soil column and water movement in soil (Hydraulic conductivity)
10. Determination of soil temperature and demonstration of heat transfer.
11. Preparation and standardization of laboratory reagents, indicators and buffers
12. Determination of soil pH and electrical conductivity.
13. Determination of cation exchange capacity of soil - I.
14. Determination of cation exchange capacity of soil - II
15. Estimation of soil organic carbon.
16. Study of soil map (India and Tamil Nadu)

17. Final Practical Examination

Text books

1. Brady, N.C. and Raymond, C.Weil. 2013. The Nature and Properties of Soils (14th Edition). Pearson Education, Inc. Publishing as Prentice Hall.
2. Dilip Kumar Das. 2015. Introductory Soil Science. Kalyani Publishers, Ludhiana.
3. Sahai, V.N. 2001. Fundamentals of Soil, Kalyani Publishers, Ludhiana
4. Rathinasamy, A and B.BakiyathuSaliha.2014 Fundamentals of Soil Science. Scientific Publishers. Jodhpur
5. R.K.Mehra. 2006. Text Book of Soil Science. ICAR. New Delhi
6. Kolay A.K. 2008. Basic concepts of Soil Science. New Age International Publishers. New Delhi
7. Rajput, S.G.2012. Concepts of Soil Science. Kalyani Publishers, Ludhiana
8. Dipak Sarkar and Abhijit Halder. 2010. Physical and chemical methods in soil analysis New Age International Publishers. New Delhi

23FOR 111 Introduction to Forestry (1 + 1)

Objectives

- To study the importance of forest and agroforestry systems in sustaining the land productivity
- To understand the crop tree interactions in different types of agroforestry systems
- To get an idea of the productive and protective functions of agroforestry

Outcome

- Students learnt about the concepts of agroforestry practiced in various agro ecosystems
- Basic understanding of the multipurpose trees in agroforestry systems
- Beneficial effects of agro forestry such as nitrogen fixing, soil conservation, litter dynamics and nutrient cycles will be studied

Theory

UNIT I: Forest and Forestry

Introduction - Definition of Forest and Forestry - Role of Forest (Production, Protection and Amelioration) - Classification of Forest (Regeneration, Age, Composition, ownership, object of management, growing stock) - National Forest Policy 1988.

UNIT II: Silviculture and Forest plantation

Forest regeneration - Natural regeneration- Seeds and vegetative parts (Coppice, Root suckers) - Artificial regeneration, Objectives - Nurseries - Types of nurseries, Quality seedling production techniques - Silvicultural practices for *Eucalyptus spp*, *Casuarina equisetifolia*, *Tectona grandis*, *Ailanthus excelsa*, *Melia dubia*, *Leucaena leucocephala*. Tending operations - Weeding, Cleaning, Thinning and pruning.

UNIT III: Forest Mensuration

Forest Mensuration - Objectives- Diameter measurements, instruments used in diameter measurement-Height measurement, instrumental methods of height measurement - Tree form, form factor, Volume estimation of standing and felled trees.

UNIT IV: Social forestry and Agroforestry

Social Forestry and its branches - Extension Forestry, Urban forestry - Agroforestry, definition-Importance- Agroforestry systems - Shifting Cultivation, Taungya, Alley cropping, Wind break, Shelter belt, Home garden - Tree and crop combination in Agroforestry - Tree crop interaction in Agroforestry - National Agroforestry Policy 2014.

UNIT V: Forest Utilization

Forest Utilization - Definition - Wood products - solid wood and composite wood.- Non Wood Forest Products - fibres, floss, bamboo, tan, dye, resin, oleoresin.

Practical

Identification of important farm grown trees, tree seeds and seedlings, Site selection for tree nursery and layout of nursery, nursery techniques for *Casuarina equisetifolia*, *Tectona grandis*, clonal propagation in trees *Eucalyptus* / *Casuarina*, land preparation, stacking, pitting and plantation, intercultural operation, measurement of growth - height, diameter, volume. Study of wood and non wood forest products, Visit to Agroforestry plantations and forest based industry.

Lecture schedule:

1. Introduction about forests, Definition of Forest and Forestry, branches in forestry
2. Role of Forest - Production function, Protection function and ameliorative functions of forests
3. Classification of Forest based on mode of regeneration, age, composition, ownership, object of management and growing stock
4. National Forest Policy 1988- Objectives and salient features

5. Forest regeneration - Types of regeneration - Natural regeneration through seeds and vegetative parts including coppice and root suckers
6. Artificial regeneration , Objectives - Nurseries - Types of nurseries, Quality seedling production techniques
7. Silvicultural practices for *Eucalyptus* spp, *Casuarina equisetifolia*, *Tectona grandis*, *Ailanthus excelsa*,
8. Silvicultural practices for *Melia dubia*, *Leucaena leucocephala*. Tending operations - Weeding, Cleaning, Thinning and pruning.

9. Mid Semester Examination

10. Forest Mensuration - Objectives- Diameter measurements, instruments used in diameter measurement
11. Height measurement, instrumental methods of height measurement - Tree form, form factor, Volume estimation of standing and felled trees.
12. Social Forestry and its branches - Extension Forestry and Urban forestry.
13. Agroforestry, definition- Importance- Agroforestry systems - Shifting Cultivation, Taungya, Alley cropping, Wind break, Shelter belt, Home garden
14. Tree and crop combination in Agroforestry- Tree crop interaction in Agroforestry -
15. National Agroforestry Policy 2014 , objectives and salient features
16. Forest Utilization - Definition - Wood products - solid wood and composite wood.
17. Forest Utilization - Non Wood Forest Products - fibres , floss, bamboo, tan, dye, resin, oleoresin

Practical schedule:

1. Identification of important farm grown trees
2. Identification of tree seeds and seedlings
3. Site selection for tree nursery and layout of nursery
4. Study of nursery techniques for *Casuarina equisetifolia*
5. Study of nursery techniques for *Tectona grandis*
6. Practicing clonal propagation in trees *Eucalyptus* / *Casuarina*
7. Practicing land preparation, stacking, pitting,
8. Planting techniques in plantation
9. After care operations in plantations
10. Height measurement in trees

11. Diameter measurement in trees
12. Volume estimation in standing and felled trees
13. Identification and study of wood products
14. Identification and study non- wood forest products
15. Visit to Agroforestry plantations
16. Visit to forest based industry
- 17. Final Practical Examination**

Text books

4. Puri, S and Panwar, P. (ed.). 2007. Agroforestry Systems and Practices. New India Publishing Agency, New Delhi, 643p
5. Gupta, R.K. 1993. Multipurpose Trees for Agroforestry and Wasteland Utilization. Oxford and IBH, 562p
6. Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwere Academic Publications, Dordrecht, The Netherlands, 499p

23 BIC101 Fundamentals of Biochemistry (1+1)

Objective:

- Outline the scope and importance of Biochemistry.
- Discuss biomolecules.
- Discuss the role of enzymes and hormones in plant growth.
- Explain the metabolic pathways occurring in plants.
- Describe the structure of nucleic acids.

Outcome:

- Explain the role of biochemistry in agricultural sciences.
- Recall the knowledge on the various biomolecules that make up a plant.
- Outline the importance of enzymes and hormones in plant growth.
- Illustrate the various metabolic pathways of plants.
- Describe the nucleic acids that compose the life.
- Demonstrate the qualitative analysis and separation techniques of biomolecules.

Theory

Unit I: Carbohydrates

Carbohydrates - occurrence and classification. Structure of monosaccharides, oligosaccharides and polysaccharides. Physical and chemical properties of carbohydrates

- optical isomerism, optical activity, mutarotation, reducing property, reaction with acids and alkalis.

Unit II: Lipids

Lipids - occurrence and classification. Storage lipids - Fatty acids and triacyl glycerol. Essential fatty acids and phospholipids - types and importance; Sterols - basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

Unit III: Proteins

Amino acids - Classification and properties, essential amino acids. Importance and classification of proteins based on functions and solubility. Structure of proteins. Properties and reactions of proteins.

Unit IV: Enzymes

Enzymes - Properties, classification and nomenclature. Coenzymes, cofactors and isoenzyme Mechanism of enzyme action. Factors affecting enzyme activity. Allosteric enzymes.

Unit V: Nucleic acids

Nucleic acids: Function, classification, structure, replication, transcription and translation.

Practical:

Qualitative tests of carbohydrates and amino acids. Quantitative estimation of carbohydrates, lipids, proteins, pigments and vitamins. Titration methods for estimation of amino acids/lipids. Assay of enzyme. Paper chromatography/ TLC demonstration for separation of amino acids/ Mono saccharides.

Theory Lecture schedule:

1. Introduction to Biochemistry, Carbohydrates - occurrence and classification
2. Structure of mono saccharides, oligosaccharides and polysaccharides
3. Physical properties of carbohydrates - Mutarotation, optical activity, isomerism. Chemical reactions of carbohydrates.
4. Lipids - occurrence and classification.
5. Storage lipids - Fatty acids and triacyl glycerol. Essential fatty acids.
6. Phospholipids - types and importance. Physical and chemical constants of oils. Rancidity of oils.
7. Sterols - basic structure and their importance.
8. Amino acids - Classification, structure and properties (amphoteric nature, isomerism, Zwitter ion, colour reactions), essential amino acids.
9. Mid-semester Examination.
10. Proteins- Importance and classification based on function and solubility.
11. Structure of protein - Primary, secondary, tertiary and quaternary structure
12. Physical and chemical properties of proteins.

13. Enzymes - Properties, classification and nomenclature. Coenzymes, cofactors and isoenzyme
14. Mechanism of enzyme action; Michaelis & Menten and Lineweaver Burk equation & plots.
15. Factors affecting enzyme activity. Enzyme inhibition - competitive, non-competitive, uncompetitive and allosteric enzymes.
16. Nucleic acids: Function, classification and structure.
17. Replication, transcription and translation.

Practical Schedule:

1. Qualitative analysis of carbohydrates
2. Estimation of starch
3. Estimation of amylose
4. Determination of reducing sugars
5. Qualitative analysis of amino acids
6. Sorenson's formal titration of amino acids
7. Estimation of amino acids by Ninhydrin method
8. Estimation of protein by Biuret method
9. Extraction of oil from oil seeds
10. Determination of free fatty acid of an oil
11. Determination of iodine number of an oil
12. Estimation of ascorbic acid by dye method
13. Assay of amylase
14. Extraction and estimation of lycopene and carotenoids
15. Separation of amino acids by paper chromatography
16. Thin layer chromatography
17. Final Practical Examination

References:

6. Berg JM, Tymoczko JL and Stryer L, (2007), Biochemistry, 7th Ed. Wiley Eastern Ltd. ISBN:0-7167-8724-5.
7. Thayumanavan, B, Krishnaveni, S and Parvathi, K, (2004), Biochemistry for Agricultural Sciences, Galgotia Publications Pvt Ltd., New Delhi. ISBN :81-7515-459-4.
8. Lehninger, Nelson, D. L. and Michael, M. C. 2004. Principles of Biochemistry. Freeman Publishers.
9. Rameshwar, A. 2006. (3rd edit). Practical Biochemistry. Kalyani Publishers, New Delhi.
10. Sadasivam, S and Manickam, A. 1996. Biochemical methods for Agricultural sciences. Newage International publishers, New Delhi.

23 LAN101 Comprehension & Communication Skills in English (1 +1)

Objectives:

- Describe appropriate communication skills across settings, purposes, and audiences
- Demonstrate knowledge of communication theory and application
- Identify the technologies to communicate effectively in various settings and contexts
- Demonstrate appropriate and professional ethical behaviour

Outcomes:

- Demonstrate critical and innovative thinking
- Illustrate competency in oral, written, and visual communication
- Outline ethical Communication
- Identify the opportunities in the field of communication

Theory

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. 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. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Lecture Schedule

1. War Minus Shooting - The Sporting Spirit (George Orwell)
2. A Dilemma- A Layman looks at Science- Raymond B. Fosdick
3. You and Your English - Spoken English and Broken English - G.B. Shaw
4. Reading Comprehension
5. Vocabulary - Synonyms, Antonyms, Homophones, Homonyms, often confused words
6. Exercises on Vocabulary Enrichment
7. Articles, Prepositions
8. Verb, Subject Verb Agreement
9. **Mid-Semester Examination**
10. Transformation, Synthesis, Direct and Indirect Narration
11. Writing Skills: Paragraph writing, Precise writing
12. Report writing & Proposal writing
13. The Style: Importance of professional writing
14. Preparations of curriculum vitae and job applications
15. Synopsis writing
16. Interviews: Kinds
17. Importance and process

Practical Schedule

1. Short talk

2. Lectures
3. Speeches
4. Phonetics
5. Stress and Intonation
6. Conversation Practice
7. Conversation Practice
8. Conversation Practice
9. Conversation Practice
10. Rapid reading
11. Dialogues
12. Intensive Reading
13. Intensive Reading 3
14. Testing initiative, team spirit
15. Leadership,
16. Intellectual ability
- 17. Final Practical Examination**

Text books

3. Sundararajan, N, Attentive Listening: How it Matters, University News, March 19-25, 2005.
4. Greenbaum Sidney, Oxford English Grammar, New Delhi, Oxford University Press. Peregoy, 2009.
5. Goodale, Malcolm, Professional Presentations, Cambridge University, 2005.
6. Jones Daniel, English Pronouncing Dictionary, Cambridge University Press, 2006.
7. Lynch, Tony and Kenneth Anderson, Study Speaking, Cambridge University, 1992.

23 NSS/NCC 101 (0 + 1) ** (non gradial)

National Service Scheme NSS

I Year

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – Women and child welfare – Education for all – National days – Commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

II Year

Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Care of Senior citizens – Personality

development - meditation, Yoga Art of living - Activities on the preservation of National monuments, cultural heritage and folklore - special camp activities - National days - commemorative days - NSS thematic programmes - literacy & computer awareness campaigns.

Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers day, Sports meet and other University / College functions.

NSS Volunteers will attend one special camp in the selected village for a duration of 10 days and undertake various activities based on the need of that village.

For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance). Special camp activity will be conducted in a village situated within a radius of 15 - 20 KM.

Evaluation

C. Regular activities

60 marks	I Semester	15 marks
	II Semester	15 marks
	III Semester	15 marks
	IV Semester	15 marks

(Written test 10 marks - participation in programmes and behavior 5 marks) 80% attendance is mandatory for attending special camp

D. Special camp activities

- d. Attendance in daily activities during special camp : 30 marks
- e. Special camp activity report : 5 marks
- f. Viva-voce on the 10th day of special camp : 5 marks

Total : 40 marks

National Cadet Corps NCC

I Year

General - Military History - Introduction to NCC - Aims of NCC - Principles of NCC, NCC organization, Duties of good citizen - system of NCC training - Foot drill - Arms drill - Guard of Honour - Ceremonial Drill - Weapon training - First aid - Rifle and Light machine gun - Map reading - Civil defence - Leadership.

II Year

Drill - Weapon drill - Weapon training and firing - Introduction to National Integration - Historical - geographical - Religions back ground of India - Health and Sanitation - Aid to Civil Authorities -

Civil defence - Ecology / Nature awareness - Map reading - Social service - Adventure Activities - Leadership qualities.

Besides the above schedule, NCC cadets will be involved during important occasions during convocation, Independence day, Republic day, etc.

Evaluation:

		Sem I	Sem II	Sem III	Sem IV	Total
A.	Regular activities and Behaviour	10	10	10	10	40
B.	Participation in camps and special assignments	5	5	5	5	20
C.	Written test and viva	10	10	10	10	40
	Total	25	25	25	25	100

23 PED101 Physical Education and Yoga Practices (0 + 1)(non gradial)

Practical

(17 Practical classes - 2½ hours each class - 17 classes will be converted into 40 practical hours and 2½ hours for evaluation)

I Semester (20 Hours)

Exercises for strength, agility, co-ordination, flexibility, co-operation, vitalcapacity endurance, speed and for various systems of our body and team spirit.

Exercise for Good Posture - Conditioning and calisthenics for various Athletic activities *i.e* (a) Before start - Arm stretch, hand stretch and cat stretch (b) Loosening up jogging, bending and twisting (c) Standing - Lateral Arc, triangle and hands to feet pose (d) Sitting - camel kneel, spinal twist and supine knee bend (e) Relaxation - The corpse pose, quick and deep relaxation. Basic gymnastic exercises - participation of athletic events - running, throwing and jumping events.

Skill development in anyone of the following games

Warming up, suitable exercise, lead up games, advance skill for all the games.

Basket Ball : Dribbling, pass, two or three men pass, pivot, lay up shot, shooting, pass break, hook pass, screening, positional play, defence and offence tactics.

Volley Ball : Fingering, under arm pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementary dive, flaying dive, roll, blocking and various types of services.

Ball Badminton : Grip, service, foot work, fore hand stroke, back hand stroke, lob, smash, volley, wall practice, spin service and defence tactics.

Foot ball : Dribbling, passing, dodging, kicking, heading, screening, chest pass, throwing, dragging, goal kick, defence and offence tactics.

Hockey : Grip, bully, dribbling, hitting, drive, push strokes, scoop, flick, stopping, various types of passes, dodging, defence and offence tactics.

Kho-Kho : Quadra ped, bi-ped, how to given kho, taking a direction, recede, parallel toe method, bullet tow method, distal method, foot out, dive, ring game, chains and persue and defence skills.

Chess : Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation.

Kabaddi : Raid, touch, cant, catch, struggle, various types of defence and offence tactics.

Cricket : Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.

Tennis : Grip, forehand drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics.

Table Tennis : Grip, tossing and serving, spin serve, rally, smash, flick, defence and offence tactics.

Shuttle Badminton : Grip, foot work, service, setting, smash, volley, forehand and back hand stroke, back hand serve and defence.

Gymnastics : Balanced walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

ATHLETICS

- Sprint : Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.
- Jumps : Western roll, belly roll, eastern cut off, fass ferry flop, approach, take off, straddle, hitch-kick, handging, clearance, landing, strides etc.
- Throws : Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method pary obraine, discoput, rotation, carry and glide.
- Hurdles : Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

Lead up games, advance skills and game for any one of the above games.

II Semester (20+ 2 ½ hours)

Rules and regulations of anyone of the games and athletic events.

Aims and objectiaves of yoga - asanas : ie. padmasana, pujankasana, sarvangasana, chakrasana,dhanurasana, halasana, mayurasana and savasana, asanas for ailments, back pain,

arthritis, abdominal problems, stress, fatigue, Insomnia, obesity, circulation, hypertension, varicose veins, respiration, heart, digestion, headaches, depression, addiction and eye problems.

Mental balance and importance – development of concentration suriyanamaskar – advance skills of any one of the games which were taught in the I semester.

METHOD OF EVALUATION:

a.	Attendance	60 Marks
b.	Behavior	10 Marks
c.	Participation in Sports and Games	20 Marks
d.	Final <i>Viva Voce</i>	10 Marks

Marks will be awarded at the end of the IV Semester based on the above method of evaluation procedure. Final class grade chart of each student will be sent to the Dean of Agricultural Sciences, DSU.

Semester II

S. No	Course Code	Course Title	Credit Hours	Total Credits
34.	23FSC101	Tropical and subtropical fruits	2+1	3
35.	23PSM101	Spices and condiments	2+1	3
36.	23AGR102	Introductory Agro-Meteorology and Climate Change	1+1	2
37.	23AGR103	Weed and water management of Horticulture crops	1+1	2
38.	23AGM101	Fundamentals of Microbiology	2+1	3
39.	23CRP111	Fundamentals of Crop Physiology	2+1	3
40.	23FSN111	Principles of Food Science and Nutrition	1+1	2
41.	23AEX101	Fundamentals of Agricultural Extension Education	2+1	3
42.	23MAT111	Elementary Mathematics	2+0	2
Total			15+8	23
43.	23 NSS/ NCC 101	NSS or NCC	0+1#	1#
44.	23 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

23FSC 101 Tropical and subtropical Fruit Crops (2 + 1)

Objective

- Summarize the knowledge on varieties and cultivation technologies of tropical and subtropical fruit crops
- Describe the knowledge on high density planting of tropical and subtropical fruit crops
- Identify the physiological disorders in tropical and subtropical fruit crops
- Outline the harvest and post-harvest handling of tropical and subtropical fruit crops

Outcomes:

- Outline the scope, importance and classification of fruit crops

- Describe the training and pruning practices in tropical fruit crops
- Explain different high planting density followed in tropical and subtropical fruit crops
- Paraphrase the cultivation aspects of tropical and subtropical fruit crops.
- Summarize post-harvest handling of tropical and subtropical fruit crops

THEORY

Unit I Scope and importance of tropical and sub tropical fruits

Scope and importance – Classification of tropical and sub tropical fruits. Tropical and subtropical zones of India and Tamil Nadu – Area, production, productivity and export standards

Unit II Tropical fruits (mango, banana and guava)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – HDP – after care – nutrients, water and weed management – training and pruning – canopy management – bearing behavior – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage – production constraints.

Unit III Tropical fruits (papaya, sapota, grapes, acid lime and sweet orange)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – after care – nutrients, water and weed management – training and pruning – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage – production constraints.

Unit IV Subtropical fruits (mandarin orange, jack fruit, avocado, pineapple, mangosteen, litchi and loquat)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – after care – nutrients, water and weed management – training and pruning – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage – production constraints.

Unit V Subtropical fruits (rambutan, carambola, durian, bilimbi, passion fruit, breadfruit and rose apple)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – after care – nutrients, water and weed management – training and pruning – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage.

Practical

Description and identification of varieties of Mango, banana and grapes, citrus, papaya, sapota, guava, pine apple, pomegranate, avocado, litchi, jack fruit, passion fruit, carambola, durian and mangosteen and minor fruits; arid zone and semi-arid zone fruits. Training and Pruning of Grapes, Mango, Guava and Citrus. Pre-treatment of Banana suckers and de-suckering in Banana - sex forms in Papaya. Use of plastics in fruit production - Visit to commercial orchards and cold storage units - Manure and fertilizer application in different fruit crops Use of growth regulators and its application in fruit crops. Seed production in Papaya, latex extraction and preparation of crude papain Post harvest handling and production economics for tropical and sub- tropical fruits.

Lecture Schedule

1. Scope and importance of tropical and subtropical fruit cultivation
2. Classification of tropical and sub tropical fruits
3. Tropical and sub-tropical zones of India and Tamil Nadu
4. Area, production, productivity and export standards of tropical and subtropical fruit crops
5. Mango – Composition and uses – origin and distribution – species and cultivars. soil and climatic requirements - propagation techniques - main field preparation – spacing, planting density and cropping systems – HDP – Planting and after care - nutrients, water and weed management – training and pruning
6. Mango – Flowering and bearing behavior – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints – off season mango production.
7. Banana – Composition and uses – origin and distribution – genomic classification – Hill banana – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care
8. Banana – Nutrients, water and weed management – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints.
9. Guava – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management
10. Guava – Training and pruning – crop regulation – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints
11. Papaya – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management
12. Papaya – Flowering, pollination and fruit set – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints

13. Sapota – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems.

14. Sapota – Planting and after care – nutrients, water and weed management. Training and pruning – use of plant growth regulators – maturity indices, harvesting and yield – production constraints

15. Grapes – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management

16. Grapes – Training and pruning – Bud forecasting - flowering, pollination and fruit set – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints.

17. Mid- semester examination

18. Acid lime – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management

19. Acid lime – Training and pruning – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints.

Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management – training and pruning – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints for the following crops

20. Sweet orange

21. Mandarin

22. Jackfruit

23. Avocado

24. Pineapple

25. Mangosteen

26. Litchi

27. Loquat

28. Rambutan

29. Carambola

30. Durian

31. Bilimbi and Rose apple

32. Passion fruit and Bread fruit

33. Bread fruit

34. Rose apple

Practical Schedule

1. Description and identification of mango varieties

2. Practices in propagation, planting and training and pruning in mango

3. Description and identification of banana varieties, their genome classification and scoring techniques

4. Selection, pre-treatment, planting and special intercultural operations in banana

5. Description and identification of guava varieties, propagation techniques, training and pruning, special intercultural operations

6. Description and identification of papaya varieties, sex forms, propagation, thinning and papain extraction

7. Description and identification of sapota varieties, propagation, training and pruning

8. Description and identification of grape varieties, propagation techniques, training and pruning

9. Description and identification of varieties, propagation techniques, training and pruning of acid lime, sweet orange and mandarin

10. Manures, fertilizers, biofertilizers and PGR application in major tropical fruit crops

11. Physiological disorders and remedies in major tropical and subtropical fruit crops

12. Description and identification of varieties of jack fruit, avocado, pineapple and litchi

13. Study of propagation techniques, planting systems, training and pruning in major sub tropical fruit crops

14. Study of maturity indices in major tropical and sub tropical fruit crops

15. Production economics for major tropical fruit crops

16. Visit to tropical fruit orchards/sub-tropical fruit zones

17. Practical Examination

Textbooks

1. Chadha, K.L. (2019). Handbook of Horticulture. Vol. I (2nd revised edition) New Delhi: ICAR. pp. 1 - 299.

2. Chattopadhyay, T.K. (2014). A text book on Pomology. Vol. II (Tropical fruits). Ludhiana: Kalyani Publishers. pp. 1 - 334.
3. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). New Delhi: Oxford & I.B.H. Publishing. pp. 1 - 452
4. Prasad, S & Bhardwaj, R. L. (2015). Production technology of fruit crops. India: Agrobios. pp. 1 - 438.
5. Dhillon, W.S. (2013). Fruit production in India. Delhi: Narendra Publishing House. pp. 1-704.
6. Mazumdar and Bibhas Chandra (2017) Minor fruits crops of India (Tropical and Subtropical fruits), Daya Publishing House.
7. Singh, Jagendra Pratap and Tomar (2020), Fundamental of Fruits Crops, Associated Publishing Company, India.

23PSM101 Spices and Condiments (2+1)

Objective:

- Understand the scope and importance of spices and condiments
- Explain the nursery management and propagation techniques of spices and condiments
- Determine the field management of spices and condiments
- Summarize the post-harvest technology and processing of spices and condiments
- Paraphrase the knowledge on value addition of spices and condiments

Outcome:

- Explain nursery management of various spices and condiments
- Discuss propagation techniques of various spices and condiments
- Summarize the package and practices of spices and condiments
- Determine the pre and post-harvest technique of various spices and condiments

THEORY

Unit I: Importance and classification of spices and condiments

Introduction, history of spices, definition of spices and condiments, important spice crops of India, importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle. Role of spices board, Pepper Export Promotion Council, Institutes working on spices and condiments, role of organizations for improvement of spices and condiments.

Unit II: Production technology of major spice crops

Origin and distribution, area and production, uses, botany, varieties, soil and climate, propagation, intercrop and mixed crop, shade and shade regulation, training and pruning, role of growth regulators, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology and value added products.

Crops: Black pepper, Betel vine, Cardamom, Turmeric and Ginger.

Unit III: Production technology of tree spices

Importance, origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing, storage and value added products.

Crops: Clove, Nutmeg, Cinnamon, All spice, Curry leaf and Tamarind

Unit IV: Production technology seed spices

Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products.

Crops: Coriander, Fenugreek, Fennel, Cumin, Dill, Celery, Bishop weed

Unit V: Production technology herbal and other spices

Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products.

Crops: Rosemary, Thyme, Vanilla, Saffron and Asafoetida

Practical

Identification of varieties, propagation, seed treatment, sowing, layout, planting, hoeing and earthing up, manuring and use of weedicides, training and pruning, fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

Theory – Lecture Schedule

1. Introduction, history of spices, definition of spices and condiments, important spice crops of India (List of the crops with Common name, Botanical name and family), importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy.
2. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle.
3. Institutes working on spices and condiments, role of organizations for improvement of spices and condiments like IISR, ICAR, DCASD and Spices Board.
4. Black Pepper – Origin, distribution, area, production, uses, botany, varieties, intercropping and mixed cropping techniques

5. Black Pepper – Production technology, processing techniques, packing, storage and value added products
6. Betel vine – Origin, distribution, area, production, uses, botany, varieties, production technology, harvesting, post harvest technology.
7. Cardamom – Origin, distribution, area, production, uses, botany, varieties
8. Cardamom – Production technology, processing techniques and value added products
9. Ginger – Origin, distribution, area, production, uses, botany, varieties
10. Ginger – Production technology, processing techniques and value added products
11. Turmeric – Origin, distribution, area, production, uses, botany, varieties
12. Turmeric- Production technology, processing techniques, storage, packing and value added products
13. Clove – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products like clove bud oil, clove stem oil, clove leaf oil, clove root oil, oil of mother clove.
14. Nutmeg – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
15. Cinnamon – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
16. All Spice – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products like berry oil, leaf oil, oleoresin

17. Mid-semester examination

18. Curry Leaf- Origin, distribution, area, production, uses, botany, varieties, production technology and post harvest technology
19. Tamarind – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
20. Coriander - Origin, distribution, area, production, uses, botany, varieties
21. Coriander – Production technology, processing techniques and value added products
22. Fenugreek – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
23. Fennel – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
24. Cumin – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
25. Dill – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products

26. Celery – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
27. Bishops weed (Ajwain) – Origin, distribution, area, production, uses, botany, varieties, technology, production, processing techniques and value added products
28. Rosemary – Origin, distribution, area, production, uses, botany, varieties, production technology.
29. Thyme – Origin, distribution, area, production, uses, botany, varieties, propagation, production technology
30. Vanilla – Origin, distribution, area, production, uses, botany, varieties, propagation techniques
31. Vanilla – Production technology, constraints of production, processing techniques, storage, packing and value added products
32. Saffron – Origin, distribution, area, production, uses, botany, varieties, propagation
33. Saffron – Production technology, processing techniques and value added products
34. Asafoetida – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products

Practical Schedule

1. Identification of species and varieties and rapid multiplication technique of black pepper
2. Identification of varieties and propagation of Cardamom
3. Curing and processing of Turmeric
4. Description of varieties and rapid multiplication technique of Ginger
5. Seed treatment, field preparation and sowing of Coriander and Fenugreek under shade net
6. Seed treatment, field preparation and sowing of Fennel and Cumin
7. Varieties description, harvesting and processing of Cinnamon and Clove
8. Practices in propagation and top working of Nutmeg and Allspice
9. Varieties description, practices in propagation, nursery preparation of Curry leaf and Tamarind
10. Propagation, harvesting and processing of Thyme and Rosemary
11. Propagation, training and pruning of Vanilla
12. Grading of spice crops
13. Techniques in extraction of essential oil and oleoresin from important spices
14. Economics of spice crops
15. Visit to Spice Board and IISR, Calicut
16. Visit to processing unit/ essential oil and oleoresin extraction units
17. Practical Examination

Textbooks

1. Kumar, N. (2018). Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. CBS Publishers; 2nd edition. pp 1-351
2. Jitendra Singh (2008). Spices and Plantation Crops. Aavishkar Publishers and Distributors, Jaipur. pp 1-465
3. Nybe, E.V., N. Miniraj and Peter, K.V. (2007). Spices – Horticulture Science Series Vol. 5. New India Publishing Agency, New Delhi. pp 1-320
4. Sharangi, A. (2018). Indian Spices: The Legacy, Production and Processing of India's Treasured Export. Springer International Publishing. pp1-461
5. Padma Lakshmi (2016), The Encyclopedia of Spices and Herbs, Ecco Publisher, India.
6. S. P. Kanaujia, Raj Narayan, Akali Sema and Moakala (2021), Spice Production, Today and Tomorrow publisher, India.
7. Christopher, E.P. (2015). Introductory Horticulture, Biotech Books, New Delhi. pp1-490

23 AGR 102 Introductory Agro-Meteorology & Climate Change (1+1)

Course objectives:

- Explain the importance of agro-meteorology and its uses in agricultural field
- Discuss about climate change and its impact on agriculture.
- Illustrate the relationship between crop and weather to predict various crop yields

Course outcome:

- Appreciate the importance of weather variables in agriculture
- Comprehend the role solar radiation in crop growth
- Analyze various forms of precipitation
- Interpret the role of weather hazards and climate change in crop growth
- Understand the correlation between weather and agriculture
- Measure weather parameters essential for crop growth

Theory

Unit I- Climate and weather

Meteorology - Agricultural Meteorology - Importance and scope in crop production - Co-ordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere

(stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu and climatic characteristics of India.

Unit II- Solar radiation, RH and Wind

Solar radiation - Light intensity, quality, direction and duration - Air and Soil temperature - Diurnal variation - importance in crop production. Heat unit and its importance in agriculture. Relative Humidity and its importance - vapor pressure deficit and its importance - Wind and its effect on crops.

Unit III- Atmospheric pressure and precipitation

Atmospheric pressure - cyclones, anticyclones, tornado, hurricane and storms - Wind systems of the world -. Clouds - types and their classification. Precipitation - forms - monsoon - Seasons of India- rainfall variability drought, flood and their effect - Cloud seeding - Evaporation - transpiration - Evapotranspiration - PET.

Unit IV- Agroclimatic zones and remote sensing

Agro climatic Zones of India and Tamil Nadu - Agro climatic normals - Weather forecasting - synoptic chart - crop weather calendar - Remote sensing - Impact of climate and weather on crop production and pest and diseases.

Unit V- Climate change

Climate change- climate variability - definition and causes of climate change - Impact of climate change on Agriculture.

Practical:

Site selection and layout for Agromet Observatory and calculation of local time. Measurements of solar radiation, sunshine hours, air and soil temperature, grass minimum thermometer, humidity wind direction and wind speed, atmospheric pressure, rainfall, evaporation . Heat Unit concept. Probability analysis of rainfall for crop planning. Synoptic charts and weather calendars. Length of growing periods using weekly rainfall data. Water balance studies. Identification of efficient cropping zone- RYI, RSI. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.

Lecture schedule

18. Meteorology - Agricultural Meteorology - Definition, their importance and scope in crop production.
19. Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
20. Climate and weather - Factors affecting climate and weather. Macroclimate - Meso climate - Microclimate - Definition and their importance - Different climates of India and Tamil Nadu and their characterization.
21. Solar radiation - Radiation balance - Wave length characteristics and their effect on crop production - Light - effect of intensity, quality, direction and duration on crop production.

22. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature - Isotherm, Heat unit and its use - Heat and cold injuries.
23. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
24. Humidity - Types - Dew point temperature - Vapour pressure deficit - Diurnal variation in Relative humidity and its effect on crop production - Wind and its role on crop production.
25. Atmospheric pressure, diurnal and seasonal variation - Isobar – cyclone, hurricane, tornado and storms.
26. **Mid Semester Examination.**
27. Wind systems of the world - wind speed in different seasons -. Clouds and their classification - Concepts of cloud seeding - present status.
28. Precipitation - Forms of precipitation - Isohyte - Monsoon - Different monsoons of India - Rainfall variability - Drought and flood - Impact on crop production.
29. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration - Definition and their importance in agricultural production. Agroclimatic zones of Tamil Nadu - Agroclimatic normals for field crops.
30. Weather forecasting - Types, importance, Agro Advisory Services - Synoptic chart - Crop weather calendar.
31. Remote sensing and its application in agriculture.
32. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.
33. Climate change, climate variability - definition and causes of climate change.
34. Impact of climate change on Agriculture.

Practical schedule

18. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements.
19. Measurements of solar radiation (pyranometers), sunshine hours (sunshine recorder) - working out weekly and monthly mean for graphical representation.
20. Measurement of air and soil temperature and grass minimum thermometers and thermographs - drawing isolines.
21. Humidity measurements - use of wet and dry bulb thermometers - Psychrometers - Hygrograph - Measurement of wind direction and wind speed and conversion (KMPH, KNOT, and M/Sec.) -Beaufort's scale.
22. Measurement of atmospheric pressure - barograph - Fortein-s barometer - Isobars based on past data for different seasons.

23. Measurement of rainfall - Ordinary and self-recording rain gauges - Measurement of Dew - dew gauge- study of Automatic weather station.
24. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data-Measurement of Evapotranspiration- Lysimeter.
25. Heat Unit concept- GDD, HTU, PTU for fixing time of sowing.
26. Probability analysis of rainfall for crop planning.
27. Drawing Synoptic charts for understanding weather.
28. Preparation of crop weather calendars and forecast based agro advisories.
29. Preparation pest weather calendar and pest forewarning.
30. Estimation of length of growing periods using weekly rainfall data.
31. Water balance studies.
32. Identification of efficient cropping zone- RYI, RSI.
33. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
34. **Final Practical Examination.**

Text books

7. Mahi, G.S. and Kingra, P.K. 2015. Fundamentals of Agrometeorology. Kalyani Publishers, New Delhi.
8. Reddy, S.R. and Reddy, D.S. 2014. Agrometeorology, Kalyani Publishers New Delhi.
9. John Warren Smith. 2007. Agricultural Meteorology: The Effect of Weather on Crops. Macmillan publishers, UK.
10. Sahu, DD. 2007. Agrometeorology and Remote Sensing: Principles and Practices, Agrobios, Jodhpur.
11. Mavi, HS and Tupper GJ. 2004. Agrometeorology: Principles and Application of Climate Studies in Agriculture, Haworth Press.
12. Varshneya, MC. and Balakrishana Pillai P. 2003. Textbook of Agricultural Meteorology, ICAR.

23AGR103 Weed and Water Management of Horticultural Crops 2 + 1

Course Objective:

To impart knowledge on different weed management practices and irrigation methods, water requirement of crops and irrigation scheduling considering various approaches

Course Outcome:

1. Understand the ecology of weed species, crop-weed interactions and different weed control methods

2. Realize the herbicide mode of action and compatibility
3. Understand and Identify factors that influence soil water plant relationship and various irrigation techniques, requirements of the crops
4. Plan irrigation measures for plant growth, development and effective drainage management

Theory:

Unit I - Introduction to weeds

Weeds – Definition, classification and characteristics of weeds – Weed ecology - Principles and methods of weed management: preventive, cultural, mechanical, chemical, biological and alternate methods – IWM for horticultural crops (Brinjal, Tomato, Chilli, Bhendi, Cucurbits Mango, Sapota, Guava and Banana) - management of problematic, parasitic and aquatic weeds.

Unit II - Herbicides

Herbicides: Classification, characteristics, formulations, methods of application, advantages and equipment's – Adjuvants – Herbicide mixture - Advantages and limitation of herbicide usage in India.

Unit III - Herbicide Selectivity

Mode and mechanism of action of herbicides - Herbicide selectivity - Principles of herbicide selectivity .Herbicide resistant weeds and crops – Principles and concepts - Herbicide residue management - Development of transgenic herbicide resistant crops – Success of herbicide resistant crops (HRC) in World and Indian agriculture.

Unit IV - Water Resources

Water resources of India and Tamil Nadu, Importance of irrigation water – soilwater- plant relationship – soil moisture constant – soil water movement – soil moisture extraction pattern – evapotranspiration – water requirement of horticultural crops (Brinjal, Tomato, Chilli, Bhendi, Cucurbits Mango, Sapota, Guava and Banana) – critical stages for irrigation and scheduling of irrigation.

Unit V - Irrigation methods

Irrigation methods – surface, sub-surface and advance methods – drip, sprinkler and green house and landscape irrigations – Fertigation - Water use efficiency –Deficit irrigation - Quality of irrigation water - Management of problem waters – Drainage

Practical:

Identification of weeds in wet, garden, dry land and hilly ecosystems - Weed control tools and implements - Characteristics of important herbicides - Herbicide spray equipments- Herbicide application techniques – Spray fluid calibration - Effect of herbicide on soil microflora - Economic evaluation of weed control methods in horticultural crops and cropping systems - Soil moisture content by gravimetric method and instrumentation technique - field capacity and permanent wilting point - Methods of irrigation - landscaping for different surface irrigation methods -

Measurement of irrigation water, evapotranspiration, crop water requirement - irrigation efficiency - Design and layout of micro irrigation systems - Economics of drip and sprinkler irrigation systems - Fertigation schedule for horticultural crops - water quality and drainage

Theory Lecture schedule:

1. Weeds – Definitions and characteristics of weeds- weed ecology and biology
2. Weed seed dormancy -- dissemination of weeds
3. Classification and characteristics of different agro ecosystem weeds
4. Classification and characteristics of problematic, parasitic and aquatic weeds
5. Crop weed interactions - Critical crop weed competition, competitive and allelopathic effects of weeds and horticultural crops.
6. Principles and methods of weed management- Preventive, cultural and mechanical
7. Principles and methods of weed management- Chemical, biological and alternate methods
8. IWM in horticultural crops and cropping systems - Brinjal, Tomato, Chilli, Bhendi and Cucurbits
9. IWM in horticultural crops and cropping systems - Mango, Sapota, Guava and Banana
10. Management of problematic, parasitic and aquatic weeds.
11. Classification and characteristics of herbicides. History and Development of herbicides in India
12. Herbicide formulations and herbicide Use Efficiency
13. Herbicide protectants adjuvants and antidotes. Herbicide mixtures in India
14. Mode and mechanism of action of herbicides and their selectivity
15. Herbicide resistant weeds and their impact on weed management
16. Herbicide residue management
- 17. Mid semester examination**
18. Development of transgenic herbicide resistant crops. Success of herbicide resistant crops (HRC) in world and Indian agriculture
19. Water resources of India and Tamil Nadu
20. Role and importance of irrigation water in crop production
21. Soil- water- plant relationship
22. Soil moisture constant – soil water movement
23. Soil moisture extraction pattern – evapotranspiration

24. Water requirement of horticultural crops and critical stages for irrigation - Brinjal, Tomato, Chilli, Bhendi and Cucurbits
25. Water requirement of horticultural crops and critical stages for irrigation - Mango, Sapota, Guava and Banana
26. Irrigation scheduling: different approaches; Soil moisture regime, climatological and plant indices.
27. Different methods of irrigation - Surface and subsurface method of irrigation
28. Advance methods – drip, sprinkler, green house and landscape irrigations
29. Fertigation and its importance
30. Water use efficiency – Agronomic practices for enhancing WUE
31. Role and importance of deficit irrigation
32. Quality of irrigation water
33. Management practices for use of poor quality water for irrigation
34. Drainage: definition, scope, importance and various methods.

Practical schedule:

1. Identification and classification of wet land and garden land weeds
2. Identification and classification of dry land and hilly weeds
3. Practising Skill development on mechanical weed management
4. Identification and classification of herbicides
5. Practising Skill development on herbicide application techniques
6. Practising Skill development on spray equipments and spray fluid calibration
7. Calculation of herbicide quantity and recommendation
8. Economic evaluation of weed control methods in horticultural crops and cropping systems.
9. Estimation of soil moisture content by gravimetric method and instrumentation technique
10. Estimation of field capacity and permanent wilting point
11. Methods of irrigation and acquiring skill in landscaping for different surface irrigation methods.
12. Measurement of irrigation water, estimation of evapo transpiration, estimation of crop water requirement and calculation of irrigation efficiency
13. Design and layout of micro irrigation systems for different horticultural crops
14. Working out economics of drip and sprinkler irrigation systems
15. Developing fertigation schedule for horticultural crops

16. Estimation of water quality and drainage

17. Practical Examination

REFERENCES

7. Das, T.K. 2008. Weed Science - Basics and Applications. Jain Brothers, New Delhi
8. Gupta, O.P. 2007. Weed Management - Principles and Practices. Agrobios.
9. Jayakumar, R. and R. Jagannathan, R. 2003. Weed Science Principles, Kalyani Publishers, Ludhiana.
10. Davis Twomey. 2016. Irrigation and Water Management. Syrawood Publishing House. New York, USA.
11. Michael, A.M. 2015. Irrigation Theory and Practices. Vikas publishing house Pvt., Ltd.
12. Carr, M.K.V. and Elias Fereres. 2012. Advances in Irrigation Agronomy. Cambridge University Press.
13. Goyal, M.R. 2015. Sustainable micro irrigation design systems for agricultural crops. Taylor and Francis.

23 AGM 101 Fundamentals of Microbiology 2 + 1

Theory

Unit I Introduction

Definition and scope of Microbiology. Milestones in Microbiology; biogenesis and abiogenesis theory; contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman. Germ theory of diseases and fermentation.

Unit II Microbiological Techniques

General principles of light microscopy - magnification, resolving power and numerical aperture. Different types of light and electron microscopes; three dimensional imaging - Atomic force and Confocal scanning laser microscopy. Staining techniques - principle and types of stains; simple, negative, differential and structural staining. Sterilization and disinfection techniques; principles and methods of sterilization - physical methods - heat, filters and radiation; chemical methods. Isolation, enrichment and purification techniques of bacteria, yeast, molds and actinobacteria. Preservation of microbial cultures.

Unit III Microbial World

Evolutionary relationship among the living organisms. Whittaker's five kingdom concept of living organism and Carl Woese systems. Procaryotic and eukaryotic microorganisms. Three domains of life - similarities and differences; Modern approach to the bacterial systematics. Bergey's Manual of Systematic Bacteriology. Bacteria - bacterial size, shape and arrangement; bacterial cell structure and function. Morphology of fungi and algae. General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages.

Unit IV Microbial Growth and Metabolism

Bacterial growth- population growth- growth cycles of population; environment on growth - temperature, oxygen, pH and salts; nutritional classification - chemoautotrophy and photo autotroph. Energy generation in bacteria. Aerobic and anaerobic respiration and fermentation in bacteria.

Unit V Microbial Genetics and Immunology

Central dogma of life. Genetic elements of bacteria; bacterial chromosomal DNA, plasmids, IS elements and transposons; Mutation - types and mutagens. Genetic recombinations; transformation, transduction and conjugation. Genetic engineering - an introduction. Basic concepts of immunology - antigen - antibody reactions and vaccines.

Practical

Microbiological safety in the laboratory; introduction to microbiology laboratory and its equipments. Microscopes- handling with microscope. Micrometry. Methods of sterilization and equipments used for sterilization. Nutritional media and their preparations. Enumeration of microbial population - bacteria, fungi and actinobacteria. Methods of purification and preservation of microbial cultures. Staining and microscopic observations; simple and differential staining - spore staining. Measurement of bacterial growth. Identification of microorganisms - morphological identification of yeasts, molds and algae. Identification- cultural, physiological and biochemical tests for bacteria and actinobacteria. Isolation of bacteriophages. Isolation of mutants employing physical or chemical mutagens.

Theory - Lecture Schedule

1. Scope of Microbiology- Role of microbes in Agriculture, food and environment.
2. Contributions of Antony Van Leeuwenhoek, Refutation of abiogenesis, Louis Pasteur
3. John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman.
4. Landmark achievements in 20th century: proposal of one gene one enzyme hypothesis: discovery of double helix structure of DNA: discovery of recombinant DNA technology
5. Evolutionary relationship - concepts and developments in classification of microorganisms
6. Groups of Microorganisms, Differentiate between prokaryotes and eukaryotes.
7. Microscopy; principles - resolving power and magnification. Light microscopy
8. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence
9. Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
10. Staining techniques - principle and types of stains, staining techniques- simple, negative, differential and structural methods
11. Sterilization - principle - physical agents and chemical methods
12. Isolation, Purification and enrichment culture techniques; preservation techniques
13. Bacteria: size, shape and arrangement,
14. Bacteria: Cell structure and its components
15. Reproduction in bacteria - Bacterial growth, population growth and growth cycle- generation time and specific growth rate
16. Batch and continuous culture -chemostat and turbidostat; synchronous culture, Diauxic growth

17. Mid Semester Examination

18. Factors influencing growth -temperature requirements - aerobes and anaerobes – methods of assessment of growth
19. Nutritional types of bacteria; Energetics in bacteria. Metabolic pathways of bacteria
20. Aerobic respiration and Anaerobic respiration
21. Fermentative mode of respiration
22. Bacterial photosynthesis; green and purple bacteria
23. Genetic elements in bacteria – Bacterial chromosome and plasmid
24. Transposons and its types
25. Mutation in bacteria – principles and types,
26. Mutagens – physical, chemical and biological
27. Genetic recombination – Transformation
28. Genetic recombination -Transduction – generalized and specialized
29. Genetic recombination –Conjugation
30. Achaea: ecology, cell wall, cell membrane and Major Groups of archaea
31. Algae: Ultra structure and classification of algae, reproduction of algae.
32. General structure of cyanobacteria and its economic importance in Agriculture
33. Viruses: General properties of viruses: Structure and classification of virus
34. Bacterial viruses, overview of bacteriophages; Lytic and lysogenic cycles; lytic and temperate phages.

Practical Schedule

1. Safety in Microbiology laboratory: Microscopy-Handling of light Microscope
2. Aseptic Techniques: Working with equipments and apparatus
3. Preparation of growth media for bacteria, fungi and actinobacteria
4. Isolation of microorganisms by serial dilution and plating technique
5. Isolation of microorganisms by Enrichment culture technique
6. Purification of bacteria, fungi and Actinobacteria
7. Preservation of bacteria, fungi and Actinobacteria
8. Staining Technique: Positive and Negative Staining
9. Staining Technique: Differential and Capsule Staining

10. Assessment of microbial growth by Turbidometry
11. Morphological and Physiological characteristics of bacteria
12. Biochemical Characterization of bacteria
13. Isolation of bacteriophages
14. Isolation of Cyanobacteria
15. Isolation of Genomic DNA from bacteria
16. Isolation of bacterial mutants by UV irradiation

17. Final Practical Examination

Reference :

1. Michael T. Madigan , Kelly S. Bender Daniel H. Buckley , W. Matthew Sattley, David A. Stahl2017. Brock Biology of Microorganisms, 15th edition
2. ebook.:Prescott, Harley and Klein, 2013. Microbiology, 9th edition, McGraw Hill Publishing
3. ebook: Michael J. Leboffee and Burton E.Pierce 2011. A photographic Atlas for theMicrobiology Laboratory 4th edition, Marton Publishing Company
4. Hans G. Schlegel, 2012. General Microbiology, 7th edition
5. Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
6. Tortora, G.J., B.R.Funke and C.L. Case, 2009. Microbiology- An Introduction, 9th edition
7. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., PrenticeHall of India Pvt. Ltd., New Delhi.

23 CRP 101 Fundamentals of Crop Physiology 2 + 1

Course Objectives:

- To introduce the students to crop physiology and biochemical changes during crop development.
- To impart knowledge on transport system in plants, photosynthesis and respiration
- To understand growth and growth characteristics

Course Outcome:

- Knowledge gained on different aspects of crop physiology.
- Learned detailed understanding of the physiological mechanisms involved in the uptake and transport of water and the translocation of food by plants.
- Study growth pattern of plants and growth parameters in crop production.

Theory

Unit I : Introduction to Crop Physiology and importance of Crop Physiology in Agriculture

– Plant cell: an overview, organelles- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole, Structure and role of water, water potential and its components, diffusion and osmosis; imbibition, plasmolysis, Field Capacity and Permanent Wilting Point, Absorption of water, Mechanisms of water absorption, Pathways of water movement, Apoplast and symplast, Translocation of water, ascent of sap and its mechanisms - Transpiration and Stomatal physiology: structure of stomatal pore, mechanisms of stomatal opening and closing, guttation, antitranspirants.

Unit II : Mineral nutrition of plants

Criteria of essentiality, classification of nutrients, macro, micro, mobile, immobile and beneficial elements, Physiological functions and deficiency symptoms of nutrients, nutrient uptake mechanism; Hidden hunger, Foliar nutrition, root feeding and fertigation, sand culture, hydroponics and aeroponics.

Unit III : Photosynthesis

Light and dark reactions, Photosystems, red drop and Emerson enhancement effect, Photolysis of water and photophosphorylation, Z scheme, C₃, C₄ and CAM plants; Photosynthetic pathways of C₃, C₄ and CAM plants, difference between three pathways, Factors affecting photosynthesis, Photorespiration – pathway and its significance, Phloem transport, Munch hypothesis, Phloem loading and unloading, Source and sink strength and their manipulations. Respiration: Glycolysis, TCA cycle and electron transport chain; Oxidative phosphorylation – difference between photo and oxidative phosphorylation -- energy budgeting - respiratory quotient. Fat metabolism: fatty acid synthesis and breakdown.

Unit IV: Plant growth regulators

Physiological roles and agricultural uses, Hormones- classifications - Biosynthetic pathway and role of auxins, gibberellins, cytokinins, ethylene and ABA, Novel and new generation PGRs, Brassinosteroids and salicylic acid, Growth retardants, Commercial uses of PGRs. Photoperiodism - short, long and day neutral plants, Chailakhyan's theory of flowering, Forms of phytochrome, Pr and Pfr, regulation of flowering, Vernalisation - Theories of vernalisation, Lysenko theories, Seed germination - physiological and biochemical changes, seed dormancy and breaking methods, Senescence and abscission, physiological and biochemical changes, Physiology of fruit ripening, climacteric and non-climacteric fruits, factors affecting ripening, Manipulations. Physiological aspects of growth and development of major crops: growth analysis, role of physiological growth parameters in crop productivity.

Unit V: Stress Physiology

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation - compatible osmolytes - membrane properties - compartmentalization - stress alleviation - Global warming - green house gases - physiological effects on crops - Carbon Sequestration.

Practical

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

Theory lecture schedule:

1. Introduction and importance of Crop Physiology in Agriculture, an over view of Plant cell.
2. Structure and role of water -water potential and its components - Diffusion - Osmosis - imbibitions - Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption - Pathways of water movement - Apoplast and symplast
4. Translocation of water - ascent of sap - mechanisms of xylem transport
5. Transpiration - significance - Stomatal physiology: structure of stomata with mechanisms of stomatal opening and closing - guttation - antitranspirants
6. Mineral nutrition of plants - criteria of essentiality - classification of nutrients - macro, micro, mobile and immobile - beneficial elements, mechanism of nutrient uptake
7. Physiological functions and disorders of macronutrients, Hidden hunger
8. Physiological functions and disorders of micronutrients
9. Foliar nutrition- root feeding and fertigation - sand culture, hydroponics and aeroponics
10. Light reaction of photosynthesis - photolysis of water and photophosphorylation - Z scheme
11. Dark Reaction of photosynthesis - C₃, C₄ and CAM pathways and differences.
12. Factors affecting photosynthesis - Photorespiration - pathway and its significance

13. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations
14. Respiration - Glycolysis – TCA cycle.
15. Photo and oxidative phosphorylation - Electron transport chain - energy budgeting - respiratory quotient.
16. Fat metabolism: fatty acid synthesis and breakdown
- 17. Mid Semester Examination**
18. Growth – phases of growth – factors affecting growth.
19. Hormones and plant growth regulators (PGR): physiological roles and agricultural uses - Biosynthetic pathway and role of auxins and gibberellins
20. Plant growth regulators (PGR): physiological roles and agricultural uses - Biosynthetic pathway and role of cytokinin, ethylene and ABA
21. Novel growth regulators viz., Brassinosteroids and salicylic acid – New Generation PGRs - Growth retardants and inhibitors -commercial uses of PGRs
22. Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering
23. Forms of phytochrome - Pr and Pfr - regulation of flowering
24. Vernalisation - theories of vernalisation – Lysenko and Hormonal theories – devernalization
25. Physiological aspects of growth and development of major crops
26. Growth analysis – role of physiological growth parameters in crop productivity
27. Seed germination - physiological and biochemical changes - seed dormancy and breaking methods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non climacteric fruits - factors affecting ripening and manipulations
30. Drought - physiological changes - adaptation – compatible osmolytes - alleviation
31. High and low temperature stress – physiological changes - membrane properties - adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses – physiological changes - adaptation
34. Global warming – green house gases --physiological effects on crop productivity- Carbon

Practical schedule:

1. Preparation of solutions
2. Study of leaf epidermal, xylem and phloem cells
3. Determination of stomatal index and stomatal frequency
4. Measurement of plant water potential
5. Measurement of water imbibition by seed mass test
6. Estimation of photosynthetic pigments
7. Determination of photosynthetic efficiency in crops
8. Transpiration & Photosynthesis by IRGA
9. Diagnosis of nutritional and physiological disorders
10. Rapid tissue test for mineral nutrients
11. Estimation of relative water content

12. Measurement of osmosis and plasmolysis
13. Growth Analysis
14. Bioassay for gibberellin and cytokinin
15. Estimation of chlorophyll stability index
16. Estimation of proline content
17. Final Practical Examination

Text books

2. Pandey, S. N. and B. K.Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
3. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand& Company Ltd., New Delhi.
4. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

23 FSN 111 Principles of Food Science And Nutrition (1+1)

Course objectives

- To equip the students to study the various processes involved in the development of products.
- To understand the correct unit operation for each product.
- To acquire knowledge on selection of suitable equipments for product development.

Course outcome

- The students will understand various processes involved in the development of products.
- The students will be able to identify suitable unit operation for processed product.
- The students will be able to evaluate selection of suitable equipments for product development.

Theory

Unit I - Principles of food science and nutrition

Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid. Methods of cooking - moist, dry and microwave - principles, merits and demerits. Importance and scope of nutrition – relation of nutrition to health.

Unit II - Carbohydrate, protein and fat

Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA). Energy value of foods – determination. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention. Deficiency states of protein, carbohydrate and fat nutrition – signs and symptoms.

Unit III - Vitamin and mineral nutrition

Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements.

Unit IV- Food preservation and processing

Introduction – preservation by sugar - processing of jam, squash, jelly, marmalade and beverages. Preservation by using salt, chemicals, dehydration technology, canning technology, preservation by low temperature and irradiation techniques. Processing of puffed, flaked and extruded products. Quality control of raw and processed products.

Unit V Food quality and safety

Food packaging materials – requirements- methods – nutrition labeling. Food adulterants and their detection methods. Food laws and regulations and quality control standards - FSSAI,ISO, EU standards, FDA, HACCP and Codex Alimentarius commission

Practical:

Cooking tests for cereals and pulses. Determination of energy value of food. Estimation of Moisture, Protein, Fat, Ascorbic acid, Iron and Crude fibre. Processing of Jam and Jelly, Processing of Squash and RTS. Puffing of pulses. Extrusion of cereals and millets. Canning of fruits and Vegetables. Processing of dehydrated fruit and vegetable products. Identification of common food adulterants. Visit to Food processing Unit and Quality control lab

Lecture schedule

1. Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid.
2. Methods of cooking - moist, dry and microwave - principles, merits and demerits.
3. Importance and scope of nutrition – relation of nutrition to health.
4. Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA), Deficiency. Energy value of foods – determination.
5. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Deficiency
6. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention.
7. Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency.
8. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements.

9. Mid Semester Examination

10. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements.
11. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements
12. Preservation by sugar - processing of jam, squash, jelly, marmalade and beverages
13. Preservation by using salt, chemicals, dehydration technology, canning technology
14. Preservation by low temperature and irradiation techniques
15. Processing of puffed, flaked and extruded products. Quality control of raw and processed products. Food packaging materials – requirements - methods – nutrition labeling
16. Food adulterants and their detection methods.

17. Food laws and regulations and quality control standards - FSSAI, ISO, EU standards, FDA, HACCP and Codex Alimentarius commission

Practical schedule

18. Cooking tests for cereals and pulses
19. Determination of energy value of food
20. Estimation of Moisture
21. Estimation of Protein
22. Estimation of Fat
23. Estimation of Ascorbic acid
24. Estimation of Iron
25. Estimation of Crude fibre
26. Processing of Jam and Jelly
27. Processing of Squash and RTS
28. Puffing of pulses
29. Extrusion of cereals and millets
30. Canning of fruits and Vegetables
31. Processing of dehydrated fruit and vegetable products
32. Identification of common food adulterants
33. Visit to Food processing Unit and Quality control lab
- 34. Final Practical Examination**

Text books

8. Gaurav Tewari and Vijay K. Juneja. (2007). Advances in Thermal and Non-Thermal Food Preservation. Blackwell Publishing, Ames, Iowa, USA.
9. James G. Brennan. (2006). Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, PP 1-602.
10. M. Shafiur Rahman. (2007). Handbook of Food Preservation, 2nd Ed. CRC Press, Boca Raton, FL, USA, PP 1-1088.
11. Marcus Karel and Darvl B. Lund. (2003). Physical Principles of Food Preservation, 2nd Ed. Marcel Dekker, Inc., NY, USA, PP 1-640.
12. Norman N. Potter and Joseph H. Hotchkiss. (1995). Food Science, 5th Ed. Chapman & Hall, NY, USA.
13. Srilakshmi, B. (2018). Food Science (7th Ed). New Age International Ltd, publishers, New Delhi, India, PP 1-512.
14. Stavros Yanniotis. (2008). Solving Problems in Food Engineering. Springer Science + Business Media, NY, USA.

23 AEX 102 Fundamentals of Agriculture Extension Education 2 + 1

Objective:

Outcome:

Unit I-Extension education and programme planning

Education- meaning, definition & types; extension education –meaning, definition, scope and process; objectives and principles of extension education. Programme planning – definition, meaning, process, principles and steps in programme development

Unit II-Extension System in India

Extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development scheme, Gurgaon Experiment, etc.) Post – independence era (Etawah pilot project, Nilokheri Experiment, etc.) Various extension/ agricultural development programmes launched by ICAR/Govt. of India(IADP, IAAP, HYVP,KVK, ORP, ND, NATP, NAIP etc.)

Unit III-Rural Development, Administration, monitoring and evaluation

Rural Development –Concept, meaning, definition: various rural development programmes launched by Govt. of India. Community development –meaning, definition, concepts and principles, physiology of community development. Rural leadership: concept and definition, types of leaders in rural context: extension administration: meaning, concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes

Unit IV-New Trends in Agricultural Extension

New trends in agricultural extension –Privatization of extension, Cyber extension/ E-extension, (Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Village Knowledge Centre (VKC), DEMIC, Geographical Information System (GIS), market led extension, farmer led extension, expert systems etc.,

Unit V-Transfer of Technology, Diffusion of Innovations and extension methods

Transfer of technology concept, models, capacity building of extension personnel, extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies: communication: meaning, definition, models elements, characteristics and barriers to communication Agricultural Journalism: Agricultural journalism (Print media) - definition, principles, importance, ABC of news, types of news. Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; 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 newstories 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 and types;Extension education – meaning, definition, scope and process; objectives and principles and function of extension education.
- 2.Programme planning – definition, meaning, process, principles and steps in programme planning / development
- 3.Extension efforts in pre-independence era (IVP, Sriniketan, Marthandam, Firka Development scheme, Sevagram, Gurgaon Experiment, Baroda Village Reconstruction Project Grow more Food Campaign, IVS , Firka Vikas Yojana etc.) Post – independence era (Etawah pilot project, Nilokheri Experiment,
- 4.Extension/ agricultural development programmes launched by ICAR/Govt. of India ICAR Programmes – National demonstration, ORP, Lap to Land Programme, FTC.,
- 5.Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Agricultural Technology Management Agency (ATMA); Firstline Extension System – KVK, IVLP, ATIC, Frontline demonstrations.
- 6.Rural Development – meaning, definition, concept and importance. Rural Development in India. Democratic Decentralization –Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.
- 7.Community Development Programme (CDP), National Extension Service (NES), Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP) - their strengths and weaknesses
- 8.High Yielding Variety Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), Integrated Rural Development Programme (IRDP) - their strengths and weaknesses.
- 9.National Agricultural Technology Project (NATP), Integrated Tribal Development Agency (ITDA), Small Farmers Development Agency (SFDA), Marginal Farmers and Agricultural Labourers Development Agency (MFAL) - their strengths and weaknesses
- 10..National Rural Employment Programme (NREP), Rural landless Employment Guarantee Programme (RLEGP), Drought Prone Area Programme (DPAP), Command Area Development

Programme (CADP), Food for Work Programme (FFW), Jawahar Rozgar Yojana (JRY), Employment Assurance Scheme (EAS),

11. Indira Awaas Yojana (IAY), Swarnajayanthi Gram Swarozgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY), Swarna Jayanthi Shahari Rozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY), ARYA -their strengths and weaknesses.

12. Sampurna Grameen Rozgar Yojana (SGRY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Providing Urban Amenities to Rural Areas (PURA), National Agricultural Innovation Project (NAIP), NADP (RKVY) - their strengths and weaknesses

13. Community development -meaning, definition, concepts and principles, physiology of community development

14. Rural leadership: concept and definition, types of leaders in rural context and selection of leaders.

15. Extension administration: meaning, concept, scope, principles and functions.

16. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes, types and evaluation

17. MID SEMESTER EXAMINATION

18. New trends in agricultural extension -Privatization of Agricultural extension- Meaning-definition-importance in Agricultural Extension.

19. Cyber extension/ E-extension, (Internet, cyber cafes, video and teleconferencing, web streaming and multimedia.

20. Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Village Knowledge Centre (VKC), DEMIC, Geographical Information System (GIS),

21. Market led extension, farmer led extension : Meaning, definition, challenges and importance in agricultural extension.

22. Expert systems -meaning, definition, application in agriculture.

23. Transfer of technology concept, models, PTD, FSRE.

24. Capacity building of extension personnel- Training- definition, need for training, training process, models, strategies, steps in conducting training programmes

25. Training need assessment, building up of training programme- trainer roles: training institute for extension personnel- KVK, EEL, MANAGE, NAARM.

26. Extension teaching methods: meaning, classification; Individual methods- Farm and Home, Personal letter, Official call, observation and Result demonstration

27. Group Contact- Method demonstration, meeting, lecture, debate, workshop, seminar, forum, conference, symposium, panel, brain storming, buzz session, role playing and simulation games.

28. Mass contact methods- Campaign, exhibition, farmers day and field trip- purpose procedure, merit and demerits and media mix strategies

29. Communication – meaning, definition, types, elements and characteristics

30. Communication models (Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker) – elements and their characteristics; Barriers in communication

31. Agricultural Journalism: Agricultural journalism (Print media) - definition, principles, importance, ABC of news, types of news.

32. Diffusion of Innovations – definition, elements; Innovation – definition, attributes;

33. Adoption – meaning, steps in adoption process, stages, adopter categories, factors influencing adoption of innovations ;Consequences of innovations

34. Final Examination

Practical schedule

1. Visit to State department of Agri/ Horti to understand the organizational setup, roles, functions and various schemes.
2. Study the organizational set up and functions of DRDA.
3. Visit to NGO and learning from their experience in rural development
4. Visit to KVK to study the mandated activities
5. To study the ToT system of SAUs / Agricultural colleges
6. Exercise on practicing group discussion technique and presentation skills
7. Study on Art of Photography, Video techniques and preparing multimedia presentations and handling of AV aids and LCD projectors
8. Preparation of Posters, charts, leaflet, folder, booklet and Pamphlet
9. Preparation of news stories and success stories.
10. Exercise on practicing Art of Public Speaking (micro teaching skills)
11. To visit the village and understand the socio cultural and agricultural related problems being encountered by the villagers/ farmers
12. Practicing selected PRA techniques in a village setting
13. Visit to Community Radio/ Educational Media Centre to understand the process of programme production.
14. Exercise on Script writing for Radio and TV programme
15. Visit to All India Radio Station / TV to study the various activities & programmes.
16. Visit to the News Agency /TNAU press to study the process

17. Final Practical Examination

Text books:

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. Neela Mukherjee. 1993. Participatory Rural Appraisal: Methodology and Applications, Concept Publishing Co.

23 MAT 111 Elementary Mathematics (2+0)

Course objectives:

4. Improving the mathematical knowledge of students who have come from a science background
5. Imparting higher secondary level mathematics so that they can understand mathematical formulas applicable for other courses
6. Interlinking mathematics with science

Course outcome:

7. Derive formulas for straight lines
8. Apply the knowledge gained in designing fields
9. Acquire interest to utilize calculus in agriculture
10. Integrate product of functions and define matrices and determinants
11. Link mathematics with agricultural engineering

Unit I- Algebra

Permutation and Combination -meaning of nPr and nCr (simple problems). Matrices- Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation.

Unit II-Analytical geometry in 2D

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 straight lines, Angles between two straight lines, Parallel lines, Perpendicular lines.

Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameter is line joining two points (x_1, y_1) & (x_2, y_2) .

Unit III- 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. Partial differentiation with first and second order -Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x_1, x_2)$ (Simple problems based on it).

Unit -IV-Integral calculus

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

Unit V-Mathematical models

Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

Theory schedule:

35. Permutation and Combination -meaning of nPr and nCr .
36. Simple problems in Permutation and Combination.
37. Matrices- Definition of Matrices- Types of Matrices- Addition, Subtraction, Multiplication, Transpose
38. Problems in Addition, Subtraction, Multiplication and Transpose of a matrix
39. Determinants-Properties of determinants -up to 3^{rd} order evaluation and inverse up to 3^{rd} order by adjoint method.
40. Problems in determinants and Inverse up to 3^{rd} order by adjoint method.
41. 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.
42. Problems in Straight lines using 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.
43. Forms of equation of Line-Slope-intercept form -Slope one point form - Two point form - Intercept form.
44. Problems in Slope-intercept form of equation of line, Slope-point form of equation of line, two point forms of equation of line, Intercept form of equation of line.
45. Normal form of equation of line- General form of equation of line- Point of intersection of two straight lines.
46. Problems in Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines.
47. Angles between two straight lines- Parallel lines- Perpendicular lines- Angle of bisectors between two lines.
48. Problems in Angles between two straight lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines.
49. 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) .

50. Problems in 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) .

51. Mid Semester Examination

52. Differential Calculus - Definition of function, limit and continuity- Simple problems on limit and continuity.

53. Simple problems in limit and continuity.

54. Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle-Derivatives of sum, difference, product and quotient of two functions- Differentiation using functions of function rule (Simple problem based on it)

55. Problems in differentiation of x^n , e^x , $\sin x$ & $\cos x$, derivatives of sum, difference, product, quotient of two functions and differentiation of functions of functions.

56. Logarithmic differentiation (Simple problem based on it)- Differentiation by substitution method and simple problems based on it- Differentiation of Inverse Trigonometric functions

57. Simple problem based on Logarithmic differentiation and differentiation by substitution method.

58. Maxima and Minima of the functions of the form $y=f(x)$ and $y=f(x_1, x_2)$ (Simple problems based on it).

59. Problems in Maxima and Minima of the functions of the form $y=f(x)$ and $y=f(x_1, x_2)$

60. Integral Calculus - Integration of simple functions and Product of two functions- Definite Integral (simple problems based on it)

61. Problems in integration of simple functions and product of two functions using integration by parts-Definite Integral.

62. Integration by substitution method- Area under simple well-known curves (simple problems based on it).

63. Integration by substitution method-Problems in Area under simple well-known curves

64. Agricultural systems - Mathematical models - classification of mathematical models- Linear model.

65. Problems in fitting linear models to experimental data

66. Quadratic and Exponential models- applications of mathematical models in agriculture.

67. Problems in fitting Quadratic models to experimental data.

68. Problems in fitting Exponential models to experimental data.

References books

5. Harikishan. 2006. *Coordinate Geometry of two dimensions*. Delhi: Atlantic Publisher. pp. 1- 137

6. Manickavasagam, P. T. K. & Narayanan. S 1997. *Calculus*. Vol I Madras: Viswanathan Publications. pp. 1-433
7. Mehta, B. C. & G. M. K. Madnani. 2008. (9th ed.). *Mathematics for Economists*. New Delhi: Sultan Chand & Sons. pp.1 - 731
8. Sharma, A. K. 2004. *Textbook of Matrix*. New Delhi: Discovery Publishing House. pp. 1-333

Semester II

S. No	Course Code	Course Title	Credit Hours	Total Credits
45.	23FSC101	Tropical and subtropical fruits	2+1	3
46.	23PSM101	Spices and condiments	2+1	3
47.	23AGR102	Introductory Agro-Meteorology and Climate Change	1+1	2
48.	23AGR103	Weed and water management of Horticulture crops	1+1	2
49.	23AGM101	Fundamentals of Microbiology	2+1	3
50.	23CRP111	Fundamentals of Crop Physiology	2+1	3
51.	23FSN111	Principles of Food Science and Nutrition	1+1	2
52.	23AEX101	Fundamentals of Agricultural Extension Education	2+1	3
53.	23MAT111	Elementary Mathematics	2+0	2
Total			15+8	23
54.	23 NSS/ NCC 101	NSS or NCC	0+1#	1#
55.	23 PED 101	Physical Education and Yoga Practices	0+1#	1#

#Registered in Semester I and Evaluation in Semester IV

23FSC 101 Tropical and subtropical Fruit Crops (2 + 1)

Objective

- Summarize the knowledge on varieties and cultivation technologies of tropical and subtropical fruit crops
- Describe the knowledge on high density planting of tropical and subtropical fruit crops
- Identify the physiological disorders in tropical and subtropical fruit crops
- Outline the harvest and post-harvest handling of tropical and subtropical fruit crops

Outcomes:

- Outline the scope, importance and classification of fruit crops
- Describe the training and pruning practices in tropical fruit crops
- Explain different high planting density followed in tropical and subtropical fruit crops
- Paraphrase the cultivation aspects of tropical and subtropical fruit crops.
- Summarize post-harvest handling of tropical and subtropical fruit crops

THEORY

Unit I Scope and importance of tropical and sub tropical fruits

Scope and importance – Classification of tropical and sub tropical fruits. Tropical and subtropical zones of India and Tamil Nadu – Area, production, productivity and export standards

Unit II Tropical fruits (mango, banana and guava)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – HDP – after care – nutrients, water and weed management – training and pruning – canopy management – bearing behavior – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage – production constraints.

Unit III Tropical fruits (papaya, sapota, grapes, acid lime and sweet orange)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – after care – nutrients, water and weed management – training and pruning – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage – production constraints.

Unit IV Subtropical fruits (mandarin orange, jack fruit, avocado, pineapple, mangosteen, litchi and loquat)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – after care – nutrients, water and weed management – training and pruning – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage – production constraints.

Unit V Subtropical fruits (rambutan, carambola, durian, bilimbi, passion fruit, breadfruit and rose apple)

Composition and uses – origin and distribution – species and cultivars. climate and soil requirements – propagation techniques – rootstocks – main field preparation – spacing, planting density – cropping systems – after care – nutrients, water and weed management – training and pruning – special horticultural techniques including use of plant growth regulators – Physiological disorders and remedies – plant protection – maturity indices and harvesting, grading, packing and storage.

Practical

Description and identification of varieties of Mango, banana and grapes, citrus, papaya, sapota, guava, pine apple, pomegranate, avocado, litchi, jack fruit, passion fruit, carambola, durian and mangosteen and minor fruits; arid zone and semi-arid zone fruits. Training and Pruning of Grapes, Mango, Guava and Citrus. Pre-treatment of Banana suckers and de-suckering in Banana - sex forms in Papaya. Use of plastics in fruit production - Visit to commercial orchards and cold storage units - Manure and fertilizer application in different fruit crops Use of growth regulators and its application in fruit crops. Seed production in Papaya, latex extraction and preparation of crude papain Post harvest handling and production economics for tropical and sub- tropical fruits.

Lecture Schedule

1. Scope and importance of tropical and subtropical fruit cultivation
2. Classification of tropical and sub tropical fruits
3. Tropical and sub-tropical zones of India and Tamil Nadu
4. Area, production, productivity and export standards of tropical and subtropical fruit crops
5. Mango – Composition and uses – origin and distribution – species and cultivars. soil and climatic requirements - propagation techniques - main field preparation – spacing, planting density and cropping systems – HDP – Planting and after care - nutrients, water and weed management – training and pruning
6. Mango – Flowering and bearing behavior – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints – off season mango production.
7. Banana – Composition and uses – origin and distribution – genomic classification – Hill banana – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care
8. Banana – Nutrients, water and weed management – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints.

9. Guava – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management

10. Guava – Training and pruning – crop regulation – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints

11. Papaya – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management

12. Papaya – Flowering, pollination and fruit set – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints

13. Sapota – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems.

14. Sapota – Planting and after care – nutrients, water and weed management. Training and pruning – use of plant growth regulators – maturity indices, harvesting and yield – production constraints

15. Grapes – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management

16. Grapes – Training and pruning – Bud forecasting - flowering, pollination and fruit set – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints.

17. Mid- semester examination

18. Acid lime – Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management

19. Acid lime – Training and pruning – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints.

Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements – propagation techniques – main field preparation – spacing, planting density and cropping systems. Planting and after care – nutrients, water and weed management – training and pruning – use of plant growth regulators – Physiological disorders and remedies – maturity indices, harvesting and yield – production constraints for the following crops

20. Sweet orange

21. Mandarin

22. Jackfruit

23. Avocado
24. Pineapple
25. Mangosteen
26. Litchi
27. Loquat
28. Rambutan
29. Carambola
30. Durian
31. Bilimbi and Rose apple
32. Passion fruit and Bread fruit
33. Bread fruit
34. Rose apple

Practical Schedule

1. Description and identification of mango varieties
2. Practices in propagation, planting and training and pruning in mango
3. Description and identification of banana varieties, their genome classification and scoring techniques
4. Selection, pre-treatment, planting and special intercultural operations in banana
5. Description and identification of guava varieties, propagation techniques, training and pruning, special intercultural operations
6. Description and identification of papaya varieties, sex forms, propagation, thinning and papain extraction
7. Description and identification of sapota varieties, propagation, training and pruning
8. Description and identification of grape varieties, propagation techniques, training and pruning
9. Description and identification of varieties, propagation techniques, training and pruning of acid lime, sweet orange and mandarin
10. Manures, fertilizers, biofertilizers and PGR application in major tropical fruit crops
11. Physiological disorders and remedies in major tropical and subtropical fruit crops
12. Description and identification of varieties of jack fruit, avocado, pineapple and litchi
13. Study of propagation techniques, planting systems, training and pruning in major sub tropical fruit crops
14. Study of maturity indices in major tropical and sub tropical fruit crops

15. Production economics for major tropical fruit crops
16. Visit to tropical fruit orchards/sub-tropical fruit zones
17. Practical Examination

Textbooks

1. Chadha, K.L. (2019). Handbook of Horticulture. Vol. I (2nd revised edition) New Delhi: ICAR. pp. 1 - 299.
2. Chattopadhyay, T.K. (2014). A text book on Pomology. Vol. II (Tropical fruits). Ludhiana: Kalyani Publishers. pp. 1 - 334.
3. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). New Delhi: Oxford & I.B.H. Publishing. pp. 1 - 452
4. Prasad, S & Bhardwaj, R. L. (2015). Production technology of fruit crops. India: Agrobios. pp. 1 - 438.
5. Dhillon, W.S. (2013). Fruit production in India. Delhi: Narendra Publishing House. pp. 1-704.
6. Mazumdar and Bibhas Chandra (2017) Minor fruits crops of India (Tropical and Subtropical fruits), Daya Publishing House.
7. Singh, Jagendra Pratap and Tomar (2020), Fundamental of Fruits Crops, Associated Publishing Company, India.

23PSM101 Spices and Condiments (2+1)

Objective:

- Understand the scope and importance of spices and condiments
- Explain the nursery management and propagation techniques of spices and condiments
- Determine the field management of spices and condiments
- Summarize the post-harvest technology and processing of spices and condiments
- Paraphrase the knowledge on value addition of spices and condiments

Outcome:

- Explain nursery management of various spices and condiments
- Discuss propagation techniques of various spices and condiments
- Summarize the package and practices of spices and condiments
- Determine the pre and post-harvest technique of various spices and condiments

THEORY

Unit I: Importance and classification of spices and condiments

Introduction, history of spices, definition of spices and condiments, important spice crops of India, importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle. Role of spices board, Pepper Export Promotion Council, Institutes working on spices and condiments, role of organizations for improvement of spices and condiments.

Unit II: Production technology of major spice crops

Origin and distribution, area and production, uses, botany, varieties, soil and climate, propagation, intercrop and mixed crop, shade and shade regulation, training and pruning, role of growth regulators, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology and value added products.

Crops: Black pepper, Betel vine, Cardamom, Turmeric and Ginger.

Unit III: Production technology of tree spices

Importance, origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing, storage and value added products.

Crops: Clove, Nutmeg, Cinnamon, All spice, Curry leaf and Tamarind

Unit IV: Production technology seed spices

Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products.

Crops: Coriander, Fenugreek, Fennel, Cumin, Dill, Celery, Bishop weed

Unit V: Production technology herbal and other spices

Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products.

Crops: Rosemary, Thyme, Vanilla, Saffron and Asafoetida

Practical

Identification of varieties, propagation, seed treatment, sowing, layout, planting, hoeing and earthing up, manuring and use of weedicides, training and pruning, fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

Theory – Lecture Schedule

1. Introduction, history of spices, definition of spices and condiments, important spice crops of India (List of the crops with Common name, Botanical name and family), importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy.
2. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle.
3. Institutes working on spices and condiments, role of organizations for improvement of spices and condiments like IISR, ICAR, DCASD and Spices Board.
4. Black Pepper – Origin, distribution, area, production, uses, botany, varieties, intercropping and mixed cropping techniques
5. Black Pepper – Production technology, processing techniques, packing, storage and value added products
6. Betel vine – Origin, distribution, area, production, uses, botany, varieties, production technology, harvesting, post harvest technology.
7. Cardamom – Origin, distribution, area, production, uses, botany, varieties
8. Cardamom – Production technology, processing techniques and value added products
9. Ginger – Origin, distribution, area, production, uses, botany, varieties
10. Ginger – Production technology, processing techniques and value added products
11. Turmeric – Origin, distribution, area, production, uses, botany, varieties
12. Turmeric- Production technology, processing techniques, storage, packing and value added products
13. Clove – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products like clove bud oil, clove stem oil, clove leaf oil, clove root oil, oil of mother clove.
14. Nutmeg – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
15. Cinnamon – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
16. All Spice – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products like berry oil, leaf oil, oleoresin
- 17. Mid-semester examination**
18. Curry Leaf- Origin, distribution, area, production, uses, botany, varieties, production technology and post harvest technology

19. Tamarind – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
20. Coriander - Origin, distribution, area, production, uses, botany, varieties
21. Coriander – Production technology, processing techniques and value added products
22. Fenugreek – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
23. Fennel – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
24. Cumin – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
25. Dill – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
26. Celery – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products
27. Bishops weed (Ajwain) – Origin, distribution, area, production, uses, botany, varieties, technology, production, processing techniques and value added products
28. Rosemary – Origin, distribution, area, production, uses, botany, varieties, production technology.
29. Thyme – Origin, distribution, area, production, uses, botany, varieties, propagation, production technology
30. Vanilla – Origin, distribution, area, production, uses, botany, varieties, propagation techniques
31. Vanilla – Production technology, constraints of production, processing techniques, storage, packing and value added products
32. Saffron – Origin, distribution, area, production, uses, botany, varieties, propagation
33. Saffron – Production technology, processing techniques and value added products
34. Asafoetida – Origin, distribution, area, production, uses, botany, varieties, production technology, processing techniques and value added products

Practical Schedule

1. Identification of species and varieties and rapid multiplication technique of black pepper
2. Identification of varieties and propagation of Cardamom
3. Curing and processing of Turmeric
4. Description of varieties and rapid multiplication technique of Ginger
5. Seed treatment, field preparation and sowing of Coriander and Fenugreek under shade net
6. Seed treatment, field preparation and sowing of Fennel and Cumin
7. Varieties description, harvesting and processing of Cinnamon and Clove

8. Practices in propagation and top working of Nutmeg and Allspice
9. Varieties description, practices in propagation, nursery preparation of Curry leaf and Tamarind
10. Propagation, harvesting and processing of Thyme and Rosemary
11. Propagation, training and pruning of Vanilla
12. Grading of spice crops
13. Techniques in extraction of essential oil and oleoresin from important spices
14. Economics of spice crops
15. Visit to Spice Board and IISR, Calicut
16. Visit to processing unit/ essential oil and oleoresin extraction units
17. Practical Examination

Textbooks

1. Kumar, N. (2018). Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. CBS Publishers; 2nd edition. pp 1-351
2. Jitendra Singh (2008). Spices and Plantation Crops. Aavishkar Publishers and Distributors, Jaipur. pp 1-465
3. Nybe, E.V., N. Miniraj and Peter, K.V. (2007). Spices – Horticulture Science Series Vol. 5. New India Publishing Agency, New Delhi. pp 1-320
4. Sharangi, A. (2018). Indian Spices: The Legacy, Production and Processing of India's Treasured Export. Springer International Publishing. pp1-461
5. Padma Lakshmi (2016), The Encyclopedia of Spices and Herbs, Ecco Publisher, India.
6. S. P. Kanaujia, Raj Narayan, Akali Sema and Moakala (2021), Spice Production, Today and Tomorrow publisher, India.
7. Christopher, E.P. (2015). Introductory Horticulture, Biotech Books, New Delhi. pp1-490

23 AGR 102 Introductory Agro-Meteorology & Climate Change (1+1)

Course objectives:

- Explain the importance of agro-meteorology and its uses in agricultural field
- Discuss about climate change and its impact on agriculture.
- Illustrate the relationship between crop and weather to predict various crop yields

Course outcome:

- Appreciate the importance of weather variables in agriculture
- Comprehend the role solar radiation in crop growth
- Analyze various forms of precipitation
- Interpret the role of weather hazards and climate change in crop growth
- Understand the correlation between weather and agriculture
- Measure weather parameters essential for crop growth

Theory

Unit I- Climate and weather

Meteorology - Agricultural Meteorology - Importance and scope in crop production - Co-ordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere (stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu and climatic characteristics of India.

Unit II- Solar radiation, RH and Wind

Solar radiation - Light intensity, quality, direction and duration - Air and Soil temperature - Diurnal variation - importance in crop production. Heat unit and its importance in agriculture. Relative Humidity and its importance - vapor pressure deficit and its importance - Wind and its effect on crops.

Unit III- Atmospheric pressure and precipitation

Atmospheric pressure - cyclones, anticyclones, tornado, hurricane and storms - Wind systems of the world -. Clouds - types and their classification. Precipitation - forms - monsoon - Seasons of India- rainfall variability drought, flood and their effect - Cloud seeding - Evaporation - transpiration - Evapotranspiration - PET.

Unit IV- Agroclimatic zones and remote sensing

Agro climatic Zones of India and Tamil Nadu - Agro climatic normals - Weather forecasting - synoptic chart - crop weather calendar - Remote sensing - Impact of climate and weather on crop production and pest and diseases.

Unit V- Climate change

Climate change- climate variability - definition and causes of climate change - Impact of climate change on Agriculture.

Practical:

Site selection and layout for Agromet Observatory and calculation of local time. Measurements of solar radiation, sunshine hours, air and soil temperature, grass minimum thermometer, humidity wind direction and wind speed, atmospheric pressure, rainfall, evaporation . Heat Unit concept. Probability analysis of rainfall for crop planning. Synoptic charts and weather calendars. Length of growing periods using weekly rainfall data. Water balance studies. Identification of efficient

cropping zone- RYI, RSI. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.

Lecture schedule

35. Meteorology - Agricultural Meteorology - Definition, their importance and scope in crop production.
36. Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
37. Climate and weather - Factors affecting climate and weather. Macroclimate - Meso climate - Microclimate - Definition and their importance - Different climates of India and Tamil Nadu and their characterization.
38. Solar radiation - Radiation balance - Wave length characteristics and their effect on crop production - Light - effect of intensity, quality, direction and duration on crop production.
39. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature - Isotherm, Heat unit and its use - Heat and cold injuries.
40. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
41. Humidity - Types - Dew point temperature - Vapour pressure deficit - Diurnal variation in Relative humidity and its effect on crop production - Wind and its role on crop production.
42. Atmospheric pressure, diurnal and seasonal variation - Isobar - cyclone, hurricane, tornado and storms.
43. **Mid Semester Examination.**
44. Wind systems of the world - wind speed in different seasons -. Clouds and their classification - Concepts of cloud seeding - present status.
45. Precipitation - Forms of precipitation - Isohyte - Monsoon - Different monsoons of India - Rainfall variability - Drought and flood - Impact on crop production.
46. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration - Definition and their importance in agricultural production. Agroclimatic zones of Tamil Nadu - Agroclimatic normals for field crops.
47. Weather forecasting - Types, importance, Agro Advisory Services - Synoptic chart - Crop weather calendar.
48. Remote sensing and its application in agriculture.
49. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.
50. Climate change, climate variability - definition and causes of climate change.
51. Impact of climate change on Agriculture.

Practical schedule

35. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements.
36. Measurements of solar radiation (pyranometers), sunshine hours (sunshine recorder) - working out weekly and monthly mean for graphical representation.
37. Measurement of air and soil temperature and grass minimum thermometers and thermographs - drawing isolines.
38. Humidity measurements - use of wet and dry bulb thermometers - Psychrometers - Hygrograph - Measurement of wind direction and wind speed and conversion (KMPH, KNOT, and M/Sec.) -Beaufort's scale.
39. Measurement of atmospheric pressure - barograph - Fortein-s barometer - Isobars based on past data for different seasons.
40. Measurement of rainfall - Ordinary and self-recording rain gauges - Measurement of Dew - dew gauge- study of Automatic weather station.
41. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data-Measurement of Evapotranspiration- Lysimeter.
42. Heat Unit concept- GDD, HTU, PTU for fixing time of sowing.
43. Probability analysis of rainfall for crop planning.
44. Drawing Synoptic charts for understanding weather.
45. Preparation of crop weather calendars and forecast based agro advisories.
46. Preparation pest weather calendar and pest forewarning.
47. Estimation of length of growing periods using weekly rainfall data.
48. Water balance studies.
49. Identification of efficient cropping zone- RYI, RSI.
50. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
51. **Final Practical Examination.**

Text books

13. Mahi, G.S. and Kingra, P.K. 2015. Fundamentals of Agrometeorology. Kalyani Publishers, New Delhi.
14. Reddy, S.R. and Reddy, D.S. 2014. Agrometeorology, Kalyani Publishers New Delhi.
15. John Warren Smith. 2007. Agricultural Meteorology: The Effect of Weather on Crops. Macmillan publishers, UK.
16. Sahu, DD. 2007. Agrometeorology and Remote Sensing: Principles and Practices, Agrobios, Jodhpur.

17. Mavi, HS and Tupper GJ. 2004. Agrometeorology: Principles and Application of Climate Studies in Agriculture, Haworth Press.
18. Varshneya, MC. and Balakrishana Pillai P. 2003. Textbook of Agricultural Meteorology, ICAR.

23AGR103 Weed and Water Management of Horticultural Crops 2 + 1

Course Objective:

To impart knowledge on different weed management practices and irrigation methods, water requirement of crops and irrigation scheduling considering various approaches

Course Outcome:

5. Understand the ecology of weed species, crop-weed interactions and different weed control methods
6. Realize the herbicide mode of action and compatibility
7. Understand and Identify factors that influence soil water plant relationship and various irrigation techniques, requirements of the crops
8. Plan irrigation measures for plant growth, development and effective drainage management

Theory:

Unit I - Introduction to weeds

Weeds – Definition, classification and characteristics of weeds – Weed ecology - Principles and methods of weed management: preventive, cultural, mechanical, chemical, biological and alternate methods – IWM for horticultural crops (Brinjal, Tomato, Chilli, Bhendi, Cucurbits Mango, Sapota, Guava and Banana) - management of problematic, parasitic and aquatic weeds.

Unit II - Herbicides

Herbicides: Classification, characteristics, formulations, methods of application, advantages and equipment's – Adjuvants – Herbicide mixture - Advantages and limitation of herbicide usage in India.

Unit III - Herbicide Selectivity

Mode and mechanism of action of herbicides - Herbicide selectivity - Principles of herbicide selectivity .Herbicide resistant weeds and crops – Principles and concepts - Herbicide residue management - Development of transgenic herbicide resistant crops – Success of herbicide resistant crops (HRC) in World and Indian agriculture.

Unit IV - Water Resources

Water resources of India and Tamil Nadu, Importance of irrigation water – soilwater- plant relationship – soil moisture constant – soil water movement – soil moisture extraction pattern – evapotranspiration – water requirement of horticultural crops (Brinjal, Tomato, Chilli, Bhendi,

Cucurbits Mango, Sapota, Guava and Banana) – critical stages for irrigation and scheduling of irrigation.

Unit V - Irrigation methods

Irrigation methods – surface, sub-surface and advance methods – drip, sprinkler and green house and landscape irrigations – Fertigation – Water use efficiency – Deficit irrigation – Quality of irrigation water – Management of problem waters – Drainage

Practical:

Identification of weeds in wet, garden, dry land and hilly ecosystems – Weed control tools and implements – Characteristics of important herbicides – Herbicide spray equipments– Herbicide application techniques – Spray fluid calibration – Effect of herbicide on soil microflora – Economic evaluation of weed control methods in horticultural crops and cropping systems – Soil moisture content by gravimetric method and instrumentation technique – field capacity and permanent wilting point – Methods of irrigation – landscaping for different surface irrigation methods – Measurement of irrigation water, evapotranspiration, crop water requirement – irrigation efficiency – Design and layout of micro irrigation systems – Economics of drip and sprinkler irrigation systems – Fertigation schedule for horticultural crops – water quality and drainage

Theory Lecture schedule:

35. Weeds – Definitions and characteristics of weeds- weed ecology and biology
36. Weed seed dormancy -- dissemination of weeds
37. Classification and characteristics of different agro ecosystem weeds
38. Classification and characteristics of problematic, parasitic and aquatic weeds
39. Crop weed interactions – Critical crop weed competition, competitive and allelopathic effects of weeds and horticultural crops.
40. Principles and methods of weed management- Preventive, cultural and mechanical
41. Principles and methods of weed management- Chemical, biological and alternate methods
42. IWM in horticultural crops and cropping systems – Brinjal, Tomato, Chilli, Bhendi and Cucurbits
43. IWM in horticultural crops and cropping systems – Mango, Sapota, Guava and Banana
44. Management of problematic, parasitic and aquatic weeds.
45. Classification and characteristics of herbicides. History and Development of herbicides in India
46. Herbicide formulations and herbicide Use Efficiency
47. Herbicide protectants adjuvants and antidotes. Herbicide mixtures in India
48. Mode and mechanism of action of herbicides and their selectivity

49. Herbicide resistant weeds and their impact on weed management

50. Herbicide residue management

51. Mid semester examination

52. Development of transgenic herbicide resistant crops. Success of herbicide resistant crops (HRC) in world and Indian agriculture

53. Water resources of India and Tamil Nadu

54. Role and importance of irrigation water in crop production

55. Soil- water- plant relationship

56. Soil moisture constant – soil water movement

57. Soil moisture extraction pattern – evapotranspiration

58. Water requirement of horticultural crops and critical stages for irrigation - Brinjal, Tomato, Chilli, Bhendi and Cucurbits

59. Water requirement of horticultural crops and critical stages for irrigation - Mango, Sapota, Guava and Banana

60. Irrigation scheduling: different approaches; Soil moisture regime, climatological and plant indices.

61. Different methods of irrigation - Surface and subsurface method of irrigation

62. Advance methods – drip, sprinkler, green house and landscape irrigations

63. Fertigation and its importance

64. Water use efficiency – Agronomic practices for enhancing WUE

65. Role and importance of deficit irrigation

66. Quality of irrigation water

67. Management practices for use of poor quality water for irrigation

68. Drainage: definition, scope, importance and various methods.

Practical schedule:

1. Identification and classification of wet land and garden land weeds

2. Identification and classification of dry land and hilly weeds

3. Practising Skill development on mechanical weed management

4. Identification and classification of herbicides

5. Practising Skill development on herbicide application techniques

6. Practising Skill development on spray equipments and spray fluid calibration

7. Calculation of herbicide quantity and recommendation

8. Economic evaluation of weed control methods in horticultural crops and cropping systems.
9. Estimation of soil moisture content by gravimetric method and instrumentation technique
10. Estimation of field capacity and permanent wilting point
11. Methods of irrigation and acquiring skill in landscaping for different surface irrigation methods.
12. Measurement of irrigation water, estimation of evapo transpiration, estimation of crop water requirement and calculation of irrigation efficiency
13. Design and layout of micro irrigation systems for different horticultural crops
14. Working out economics of drip and sprinkler irrigation systems
15. Developing fertigation schedule for horticultural crops
16. Estimation of water quality and drainage

17. Practical Examination

REFERENCES

14. Das, T.K. 2008. Weed Science - Basics and Applications. Jain Brothers, New Delhi
15. Gupta, O.P. 2007. Weed Management - Principles and Practices. Agrobios.
16. Jayakumar, R. and R. Jagannathan, R. 2003. Weed Science Principles, Kalyani Publishers, Ludhiana.
17. Davis Twomey. 2016. Irrigation and Water Management. Syrawood Publishing House. New York, USA.
18. Michael, A.M. 2015. Irrigation Theory and Practices. Vikas publishing house Pvt., Ltd.
19. Carr, M.K.V. and Elias Fereres. 2012. Advances in Irrigation Agronomy. Cambridge University Press.
20. Goyal, M.R. 2015. Sustainable micro irrigation design systems for agricultural crops. Taylor and Francis.

23 AGM 101 Fundamentals of Microbiology 2 + 1

Theory

Unit I Introduction

Definition and scope of Microbiology. Milestones in Microbiology; biogenesis and abiogenesis theory; contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman. Germ theory of diseases and fermentation.

Unit II Microbiological Techniques

General principles of light microscopy - magnification, resolving power and numerical aperture. Different types of light and electron microscopes; three dimensional imaging - Atomic force and Confocal scanning laser microscopy. Staining techniques - principle and types of stains; simple, negative, differential and structural staining. Sterilization and disinfection techniques; principles and methods of sterilization - physical methods - heat, filters and radiation; chemical methods. Isolation, enrichment and purification techniques of bacteria, yeast, molds and actinobacteria. Preservation of microbial cultures.

Unit III Microbial World

Evolutionary relationship among the living organisms. Whittaker's five kingdom concept of living organism and Carl Woese systems. Procaryotic and eukaryotic microorganisms. Three domains of life - similarities and differences; Modern approach to the bacterial systematics. Bergey's Manual of Systematic Bacteriology. Bacteria - bacterial size, shape and arrangement; bacterial cell structure and function. Morphology of fungi and algae. General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages.

Unit IV Microbial Growth and Metabolism

Bacterial growth- population growth- growth cycles of population; environment on growth - temperature, oxygen, pH and salts; nutritional classification - chemoautotrophy and photo autotroph. Energy generation in bacteria. Aerobic and anaerobic respiration and fermentation in bacteria.

Unit V Microbial Genetics and Immunology

Central dogma of life. Genetic elements of bacteria; bacterial chromosomal DNA, plasmids, IS elements and transposons; Mutation - types and mutagens. Genetic recombinations; transformation, transduction and conjugation. Genetic engineering - an introduction. Basic concepts of immunology - antigen - antibody reactions and vaccines.

Practical

Microbiological safety in the laboratory; introduction to microbiology laboratory and its equipments.Microscopes- handling with microscope.Micrometry.Methods of sterilization and equipments used for sterilization. Nutritional media and their preparations.Enumeration of microbial population - bacteria, fungi and actinobacteria. Methods of purification and preservation of microbial cultures. Staining and microscopic observations; simple and differential staining - spore staining. Measurement of bacterial growth. Identification of microorganisms - morphological identification of yeasts, molds and algae. Identification- cultural, physiological and biochemical tests for bacteria and actinobacteria..Isolation of bacteriophages.Isolation of mutants employing physical or chemical mutagens.

Theory - Lecture Schedule

1. Scope of Microbiology- Role of microbes in Agriculture, food and environment.
2. Contributions of Antony Van Leeuwenhoek, Refutation of abiogenesis, Louis Pasteur
3. John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman.
4. Landmark achievements in 20th century: proposal of one gene one enzyme hypothesis: discovery of double helix structure of DNA: discovery of recombinant DNA technology
5. Evolutionary relationship - concepts and developments in classification of microorganisms
6. Groups of Microorganisms, Differentiate between prokaryotes and eukaryotes.
7. Microscopy; principles - resolving power and magnification. Light microscopy
8. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence
9. Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
10. Staining techniques - principle and types of stains, staining techniques- simple, negative, differential and structural methods
11. Sterilization - principle - physical agents and chemical methods
12. Isolation, Purification and enrichment culture techniques; preservation techniques
13. Bacteria: size, shape and arrangement,
14. Bacteria: Cell structure and its components
15. Reproduction in bacteria - Bacterial growth, population growth and growth cycle- generation time and specific growth rate
16. Batch and continuous culture -chemostat and turbidostat; synchronous culture, Diauxic growth

17. Mid Semester Examination

18. Factors influencing growth -temperature requirements - aerobes and anaerobes – methods of assessment of growth
19. Nutritional types of bacteria; Energetics in bacteria. Metabolic pathways of bacteria
20. Aerobic respiration and Anaerobic respiration
21. Fermentative mode of respiration
22. Bacterial photosynthesis; green and purple bacteria
23. Genetic elements in bacteria – Bacterial chromosome and plasmid
24. Transposons and its types
25. Mutation in bacteria – principles and types,
26. Mutagens – physical, chemical and biological
27. Genetic recombination – Transformation
28. Genetic recombination -Transduction – generalized and specialized
29. Genetic recombination –Conjugation
30. Achaea: ecology, cell wall, cell membrane and Major Groups of archaea
31. Algae: Ultra structure and classification of algae, reproduction of algae.
32. General structure of cyanobacteria and its economic importance in Agriculture
33. Viruses: General properties of viruses: Structure and classification of virus
34. Bacterial viruses, overview of bacteriophages; Lytic and lysogenic cycles; lytic and temperate phages.

Practical Schedule

1. Safety in Microbiology laboratory: Microscopy-Handling of light Microscope
2. Aseptic Techniques: Working with equipments and apparatus
3. Preparation of growth media for bacteria, fungi and actinobacteria
4. Isolation of microorganisms by serial dilution and plating technique
5. Isolation of microorganisms by Enrichment culture technique
6. Purification of bacteria, fungi and Actinobacteria
7. Preservation of bacteria, fungi and Actinobacteria
8. Staining Technique: Positive and Negative Staining
9. Staining Technique: Differential and Capsule Staining

10. Assessment of microbial growth by Turbidometry
11. Morphological and Physiological characteristics of bacteria
12. Biochemical Characterization of bacteria
13. Isolation of bacteriophages
14. Isolation of Cyanobacteria
15. Isolation of Genomic DNA from bacteria
16. Isolation of bacterial mutants by UV irradiation

17. Final Practical Examination

Reference :

8. Michael T. Madigan , Kelly S. Bender Daniel H. Buckley , W. Matthew Sattley, David A. Stahl2017. Brock Biology of Microorganisms, 15th edition
9. ebook.:Prescott, Harley and Klein, 2013. Microbiology, 9th edition, McGraw Hill Publishing
- 10.ebook: Michael J. Leboffee and Burton E.Pierce 2011. A photographic Atlas for theMicrobiology Laboratory 4th edition, Marton Publishing Company
- 11.Hans G. Schlegel, 2012. General Microbiology, 7th edition
- 12.Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
- 13.Tortora, G.J., B.R.Funke and C.L. Case, 2009. Microbiology- An Introduction, 9th edition
- 14.Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., PrenticeHall of India Pvt. Ltd., New Delhi.

23 CRP 101 Fundamentals of Crop Physiology 2 + 1

Course Objectives:

- To introduce the students to crop physiology and biochemical changes during crop development.
- To impart knowledge on transport system in plants, photosynthesis and respiration
- To understand growth and growth characteristics

Course Outcome:

- Knowledge gained on different aspects of crop physiology.
- Learned detailed understanding of the physiological mechanisms involved in the uptake and transport of water and the translocation of food by plants.
- Study growth pattern of plants and growth parameters in crop production.

Theory

Unit I : Introduction to Crop Physiology and importance of Crop Physiology in Agriculture

– Plant cell: an overview, organelles- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole, Structure and role of water, water potential and its components, diffusion and osmosis; imbibition, plasmolysis, Field Capacity and Permanent Wilting Point, Absorption of water, Mechanisms of water absorption, Pathways of water movement, Apoplast and symplast, Translocation of water, ascent of sap and its mechanisms - Transpiration and Stomatal physiology: structure of stomatal pore, mechanisms of stomatal opening and closing, guttation, antitranspirants.

Unit II : Mineral nutrition of plants

Criteria of essentiality, classification of nutrients, macro, micro, mobile, immobile and beneficial elements, Physiological functions and deficiency symptoms of nutrients, nutrient uptake mechanism; Hidden hunger, Foliar nutrition, root feeding and fertigation, sand culture, hydroponics and aeroponics.

Unit III : Photosynthesis

Light and dark reactions, Photosystems, red drop and Emerson enhancement effect, Photolysis of water and photophosphorylation, Z scheme, C₃, C₄ and CAM plants; Photosynthetic pathways of C₃, C₄ and CAM plants, difference between three pathways, Factors affecting photosynthesis, Photorespiration – pathway and its significance, Phloem transport, Munch hypothesis, Phloem loading and unloading, Source and sink strength and their manipulations. Respiration: Glycolysis, TCA cycle and electron transport chain; Oxidative phosphorylation – difference between photo and oxidative phosphorylation -- energy budgeting - respiratory quotient. Fat metabolism: fatty acid synthesis and breakdown.

Unit IV: Plant growth regulators

Physiological roles and agricultural uses, Hormones- classifications - Biosynthetic pathway and role of auxins, gibberellins, cytokinins, ethylene and ABA, Novel and new generation PGRs, Brassinosteroids and salicylic acid, Growth retardants, Commercial uses of PGRs. Photoperiodism - short, long and day neutral plants, Chailakhyan's theory of flowering, Forms of phytochrome, Pr and Pfr, regulation of flowering, Vernalisation - Theories of vernalisation, Lysenko theories, Seed germination - physiological and biochemical changes, seed dormancy and breaking methods, Senescence and abscission, physiological and biochemical changes, Physiology of fruit ripening, climacteric and non-climacteric fruits, factors affecting ripening, Manipulations. Physiological aspects of growth and development of major crops: growth analysis, role of physiological growth parameters in crop productivity.

Unit V: Stress Physiology

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation - compatible osmolytes - membrane properties - compartmentalization - stress alleviation - Global warming - green house gases - physiological effects on crops - Carbon Sequestration.

Practical

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

Theory lecture schedule:

35. Introduction and importance of Crop Physiology in Agriculture, an over view of Plant cell.
36. Structure and role of water -water potential and its components - Diffusion - Osmosis - imbibitions - Plasmolysis - Field Capacity and Permanent Wilting Point
37. Mechanisms of water absorption - Pathways of water movement - Apoplast and symplast
38. Translocation of water - ascent of sap - mechanisms of xylem transport
39. Transpiration - significance - Stomatal physiology: structure of stomata with mechanisms of stomatal opening and closing - guttation - antitranspirants
40. Mineral nutrition of plants - criteria of essentiality - classification of nutrients - macro, micro, mobile and immobile - beneficial elements, mechanism of nutrient uptake
41. Physiological functions and disorders of macronutrients, Hidden hunger
42. Physiological functions and disorders of micronutrients
43. Foliar nutrition- root feeding and fertigation - sand culture, hydroponics and aeroponics
44. Light reaction of photosynthesis - photolysis of water and photophosphorylation - Z scheme
45. Dark Reaction of photosynthesis - C₃, C₄ and CAM pathways and differences.
46. Factors affecting photosynthesis - Photorespiration - pathway and its significance

47. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations
48. Respiration - Glycolysis – TCA cycle.
49. Photo and oxidative phosphorylation - Electron transport chain - energy budgeting - respiratory quotient.
50. Fat metabolism: fatty acid synthesis and breakdown
- 51. Mid Semester Examination**
52. Growth – phases of growth – factors affecting growth.
53. Hormones and plant growth regulators (PGR): physiological roles and agricultural uses - Biosynthetic pathway and role of auxins and gibberellins
54. Plant growth regulators (PGR): physiological roles and agricultural uses - Biosynthetic pathway and role of cytokinin, ethylene and ABA
55. Novel growth regulators viz., Brassinosteroids and salicylic acid – New Generation PGRs - Growth retardants and inhibitors -commercial uses of PGRs
56. Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering
57. Forms of phytochrome - Pr and Pfr - regulation of flowering
58. Vernalisation - theories of vernalisation – Lysenko and Hormonal theories – devernalization
59. Physiological aspects of growth and development of major crops
60. Growth analysis – role of physiological growth parameters in crop productivity
61. Seed germination - physiological and biochemical changes - seed dormancy and breaking methods
62. Senescence and abscission – physiological and biochemical changes
63. Physiology of fruit ripening- climacteric and non climacteric fruits - factors affecting ripening and manipulations
64. Drought - physiological changes - adaptation – compatible osmolytes - alleviation
65. High and low temperature stress – physiological changes - membrane properties - adaptation
66. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
67. Flooding and UV radiation stresses – physiological changes - adaptation
68. Global warming – green house gases --physiological effects on crop productivity- Carbon

Practical schedule:

18. Preparation of solutions
19. Study of leaf epidermal, xylem and phloem cells
20. Determination of stomatal index and stomatal frequency
21. Measurement of plant water potential
22. Measurement of water imbibition by seed mass test
23. Estimation of photosynthetic pigments
24. Determination of photosynthetic efficiency in crops
25. Transpiration & Photosynthesis by IRGA
26. Diagnosis of nutritional and physiological disorders
27. Rapid tissue test for mineral nutrients
28. Estimation of relative water content

29. Measurement of osmosis and plasmolysis
30. Growth Analysis
31. Bioassay for gibberellin and cytokinin
32. Estimation of chlorophyll stability index
33. Estimation of proline content
34. Final Practical Examination

Text books

6. Pandey, S. N. and B. K.Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
7. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand& Company Ltd., New Delhi.
8. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
9. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

23 FSN 111 Principles of Food Science And Nutrition (1+1)

Course objectives

- To equip the students to study the various processes involved in the development of products.
- To understand the correct unit operation for each product.
- To acquire knowledge on selection of suitable equipments for product development.

Course outcome

- The students will understand various processes involved in the development of products.
- The students will be able to identify suitable unit operation for processed product.
- The students will be able to evaluate selection of suitable equipments for product development.

Theory

Unit I - Principles of food science and nutrition

Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid. Methods of cooking - moist, dry and microwave - principles, merits and demerits. Importance and scope of nutrition – relation of nutrition to health.

Unit II - Carbohydrate, protein and fat

Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA). Energy value of foods – determination. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention. Deficiency states of protein, carbohydrate and fat nutrition – signs and symptoms.

Unit III - Vitamin and mineral nutrition

Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements.

Unit IV- Food preservation and processing

Introduction – preservation by sugar - processing of jam, squash, jelly, marmalade and beverages. Preservation by using salt, chemicals, dehydration technology, canning technology, preservation by low temperature and irradiation techniques. Processing of puffed, flaked and extruded products. Quality control of raw and processed products.

Unit V Food quality and safety

Food packaging materials – requirements- methods – nutrition labeling. Food adulterants and their detection methods. Food laws and regulations and quality control standards - FSSAI,ISO, EU standards, FDA, HACCP and Codex Alimentarius commission

Practical:

Cooking tests for cereals and pulses. Determination of energy value of food. Estimation of Moisture, Protein, Fat, Ascorbic acid, Iron and Crude fibre. Processing of Jam and Jelly, Processing of Squash and RTS. Puffing of pulses. Extrusion of cereals and millets. Canning of fruits and Vegetables. Processing of dehydrated fruit and vegetable products. Identification of common food adulterants. Visit to Food processing Unit and Quality control lab

Lecture schedule

1. Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid.
2. Methods of cooking - moist, dry and microwave - principles, merits and demerits.
3. Importance and scope of nutrition – relation of nutrition to health.
4. Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA), Deficiency. Energy value of foods – determination.
5. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Deficiency
6. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention.
7. Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency.
8. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements.

9. Mid Semester Examination

10. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements.
11. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements
12. Preservation by sugar - processing of jam, squash, jelly, marmalade and beverages
13. Preservation by using salt, chemicals, dehydration technology, canning technology
14. Preservation by low temperature and irradiation techniques
15. Processing of puffed, flaked and extruded products. Quality control of raw and processed products. Food packaging materials – requirements - methods – nutrition labeling
16. Food adulterants and their detection methods.

17. Food laws and regulations and quality control standards - FSSAI, ISO, EU standards, FDA, HACCP and Codex Alimentarius commission

Practical schedule

35. Cooking tests for cereals and pulses
36. Determination of energy value of food
37. Estimation of Moisture
38. Estimation of Protein
39. Estimation of Fat
40. Estimation of Ascorbic acid
41. Estimation of Iron
42. Estimation of Crude fibre
43. Processing of Jam and Jelly
44. Processing of Squash and RTS
45. Puffing of pulses
46. Extrusion of cereals and millets
47. Canning of fruits and Vegetables
48. Processing of dehydrated fruit and vegetable products
49. Identification of common food adulterants
50. Visit to Food processing Unit and Quality control lab
- 51. Final Practical Examination**

Text books

15. Gaurav Tewari and Vijay K. Juneja. (2007). Advances in Thermal and Non-Thermal Food Preservation. Blackwell Publishing, Ames, Iowa, USA.
16. James G. Brennan. (2006). Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, PP 1-602.
17. M. Shafiur Rahman. (2007). Handbook of Food Preservation, 2nd Ed. CRC Press, Boca Raton, FL, USA, PP 1-1088.
18. Marcus Karel and Darvl B. Lund. (2003). Physical Principles of Food Preservation, 2nd Ed. Marcel Dekker, Inc., NY, USA, PP 1-640.
19. Norman N. Potter and Joseph H. Hotchkiss. (1995). Food Science, 5th Ed. Chapman & Hall, NY, USA.
20. Srilakshmi, B. (2018). Food Science (7th Ed). New Age International Ltd, publishers, New Delhi, India, PP 1-512.
21. Stavros Yanniotis. (2008). Solving Problems in Food Engineering. Springer Science + Business Media, NY, USA.

23 AEX 102 Fundamentals of Agriculture Extension Education 2 + 1

Objective:

Outcome:

Unit I-Extension education and programme planning

Education- meaning, definition & types; extension education –meaning, definition, scope and process; objectives and principles of extension education. Programme planning – definition, meaning, process, principles and steps in programme development

Unit II-Extension System in India

Extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development scheme, Gurgaon Experiment, etc.) Post – independence era (Etawah pilot project, Nilokheri Experiment, etc.) Various extension/ agricultural development programmes launched by ICAR/Govt. of India(IADP, IAAP, HYVP,KVK, ORP, ND, NATP, NAIP etc.)

Unit III-Rural Development, Administration, monitoring and evaluation

Rural Development –Concept, meaning, definition: various rural development programmes launched by Govt. of India. Community development –meaning, definition, concepts and principles, physiology of community development. Rural leadership: concept and definition, types of leaders in rural context: extension administration: meaning, concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes

Unit IV-New Trends in Agricultural Extension

New trends in agricultural extension –Privatization of extension, Cyber extension/ E-extension, (Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Village Knowledge Centre (VKC), DEMIC, Geographical Information System (GIS), market led extension, farmer led extension, expert systems etc.,

Unit V-Transfer of Technology, Diffusion of Innovations and extension methods

Transfer of technology concept, models, capacity building of extension personnel, extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies: communication: meaning, definition, models elements, characteristics and barriers to communication Agricultural Journalism: Agricultural journalism (Print media) - definition, principles, importance, ABC of news, types of news. Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; 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 newstories 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 and types;Extension education – meaning, definition, scope and process; objectives and principles and function of extension education.
- 2.Programme planning – definition, meaning, process, principles and steps in programme planning / development
- 3.Extension efforts in pre-independence era (IVP, Sriniketan, Marthandam, Firka Development scheme, Sevagram, Gurgaon Experiment, Baroda Village Reconstruction Project Grow more Food Campaign, IVS , Firka Vikas Yojana etc.) Post – independence era (Etawah pilot project, Nilokheri Experiment,
- 4.Extension/ agricultural development programmes launched by ICAR/Govt. of India ICAR Programmes – National demonstration, ORP, Lap to Land Programme, FTC.,
- 5.Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Agricultural Technology Management Agency (ATMA); Firstline Extension System – KVK, IVLP, ATIC, Frontline demonstrations.
- 6.Rural Development – meaning, definition, concept and importance. Rural Development in India. Democratic Decentralization –Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.
- 7.Community Development Programme (CDP), National Extension Service (NES), Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP) - their strengths and weaknesses
- 8.High Yielding Variety Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), Integrated Rural Development Programme (IRDP) - their strengths and weaknesses.
- 9.National Agricultural Technology Project (NATP), Integrated Tribal Development Agency (ITDA), Small Farmers Development Agency (SFDA), Marginal Farmers and Agricultural Labourers Development Agency (MFAL) - their strengths and weaknesses
- 10..National Rural Employment Programme (NREP), Rural landless Employment Guarantee Programme (RLEGP), Drought Prone Area Programme (DPAP), Command Area Development

Programme (CADP), Food for Work Programme (FFW), Jawahar Rozgar Yojana (JRY), Employment Assurance Scheme (EAS),

11. Indira Awaas Yojana (IAY), Swarnajayanthi Gram Swarozgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY), Swarna Jayanthi Shahari Rozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY), ARYA -their strengths and weaknesses.

12. Sampurna Grameen Rozgar Yojana (SGRY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Providing Urban Amenities to Rural Areas (PURA), National Agricultural Innovation Project (NAIP), NADP (RKVY) - their strengths and weaknesses

13. Community development -meaning, definition, concepts and principles, physiology of community development

14. Rural leadership: concept and definition, types of leaders in rural context and selection of leaders.

15. Extension administration: meaning, concept, scope, principles and functions.

16. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes, types and evaluation

17. MID SEMESTER EXAMINATION

18. New trends in agricultural extension -Privatization of Agricultural extension- Meaning-definition-importance in Agricultural Extension.

19. Cyber extension/ E-extension, (Internet, cyber cafes, video and teleconferencing, web streaming and multimedia.

20. Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Village Knowledge Centre (VKC), DEMIC, Geographical Information System (GIS),

21. Market led extension, farmer led extension : Meaning, definition, challenges and importance in agricultural extension.

22. Expert systems -meaning, definition, application in agriculture.

23. Transfer of technology concept, models, PTD, FSRE.

24. Capacity building of extension personnel- Training- definition, need for training, training process, models, strategies, steps in conducting training programmes

25. Training need assessment, building up of training programme- trainer roles: training institute for extension personnel- KVK, EEL, MANAGE, NAARM.

26. Extension teaching methods: meaning, classification; Individual methods- Farm and Home, Personal letter, Official call, observation and Result demonstration

27. Group Contact- Method demonstration, meeting, lecture, debate, workshop, seminar, forum, conference, symposium, panel, brain storming, buzz session, role playing and simulation games.

28. Mass contact methods- Campaign, exhibition, farmers day and field trip- purpose procedure, merit and demerits and media mix strategies

29. Communication – meaning, definition, types, elements and characteristics

30. Communication models (Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker) – elements and their characteristics; Barriers in communication

31. Agricultural Journalism: Agricultural journalism (Print media) - definition, principles, importance, ABC of news, types of news.

32. Diffusion of Innovations – definition, elements; Innovation – definition, attributes;

33. Adoption – meaning, steps in adoption process, stages, adopter categories, factors influencing adoption of innovations ;Consequences of innovations

34. Final Examination

Practical schedule

1. Visit to State department of Agri/ Horti to understand the organizational setup, roles, functions and various schemes.
2. Study the organizational set up and functions of DRDA.
3. Visit to NGO and learning from their experience in rural development
4. Visit to KVK to study the mandated activities
5. To study the ToT system of SAUs / Agricultural colleges
6. Exercise on practicing group discussion technique and presentation skills
7. Study on Art of Photography, Video techniques and preparing multimedia presentations and handling of AV aids and LCD projectors
8. Preparation of Posters, charts, leaflet, folder, booklet and Pamphlet
9. Preparation of news stories and success stories.
10. Exercise on practicing Art of Public Speaking (micro teaching skills)
11. To visit the village and understand the socio cultural and agricultural related problems being encountered by the villagers/ farmers
12. Practicing selected PRA techniques in a village setting
13. Visit to Community Radio/ Educational Media Centre to understand the process of programme production.
14. Exercise on Script writing for Radio and TV programme
15. Visit to All India Radio Station / TV to study the various activities & programmes.
16. Visit to the News Agency /TNAU press to study the process

17. Final Practical Examination

Text books:

13. Dipak de, Basavaprabhu Jirli. 2010. A Handbook of Extension Education, Agrobios, India.
14. Katar Singh. 1999. Rural Development - Principles, Policies and Management, Sage Publications India Pvt. Ltd., New Delhi.
15. Kelsey, L.D and C.C. Hearne. 1967. Cooperative Extension Work, Cornell University Press, New York.
16. Manoharan Muthiah, P. and R. Arunachalam. 2003. Agricultural Extension, Himalaya Publishing House, Mumbai.
17. Narayanasamy, N. 2009. Participatory Rural Appraisal Principles, Methods and Application, Sage Publications India Pvt. Ltd., New Delhi.
18. Neela Mukherjee. 1993. Participatory Rural Appraisal: Methodology and Applications, Concept Publishing Co.

23 MAT 111 Elementary Mathematics (2+0)

Course objectives:

7. Improving the mathematical knowledge of students who have come from a science background
8. Imparting higher secondary level mathematics so that they can understand mathematical formulas applicable for other courses
9. Interlinking mathematics with science

Course outcome:

12. Derive formulas for straight lines
13. Apply the knowledge gained in designing fields
14. Acquire interest to utilize calculus in agriculture
15. Integrate product of functions and define matrices and determinants
16. Link mathematics with agricultural engineering

Unit I- Algebra

Permutation and Combination -meaning of nPr and nCr (simple problems). Matrices- Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation.

Unit II-Analytical geometry in 2D

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 straight lines, Angles between two straight lines, Parallel lines, Perpendicular lines.

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) .

Unit III- 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. Partial differentiation with first and second order -Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x_1, x_2)$ (Simple problems based on it).

Unit -IV-Integral calculus

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

Unit V-Mathematical models

Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

Theory schedule:

69. Permutation and Combination -meaning of nPr and nCr .
70. Simple problems in Permutation and Combination.
71. Matrices- Definition of Matrices- Types of Matrices- Addition, Subtraction, Multiplication, Transpose
72. Problems in Addition, Subtraction, Multiplication and Transpose of a matrix
73. Determinants-Properties of determinants -up to 3^{rd} order evaluation and inverse up to 3^{rd} order by adjoint method.
74. Problems in determinants and Inverse up to 3^{rd} order by adjoint method.
75. 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.
76. Problems in Straight lines using 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.
77. Forms of equation of Line-Slope-intercept form -Slope one point form - Two point form - Intercept form.
78. Problems in Slope-intercept form of equation of line, Slope-point form of equation of line, two point forms of equation of line, Intercept form of equation of line.
79. Normal form of equation of line- General form of equation of line- Point of intersection of two straight lines.
80. Problems in Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines.
81. Angles between two straight lines- Parallel lines- Perpendicular lines- Angle of bisectors between two lines.
82. Problems in Angles between two straight lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines.
83. 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) .

84. Problems in 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) .

85. Mid Semester Examination

86. Differential Calculus - Definition of function, limit and continuity- Simple problems on limit and continuity.

87. Simple problems in limit and continuity.

88. Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle-Derivatives of sum, difference, product and quotient of two functions- Differentiation using functions of function rule (Simple problem based on it)

89. Problems in differentiation of x^n , e^x , $\sin x$ & $\cos x$, derivatives of sum, difference, product, quotient of two functions and differentiation of functions of functions.

90. Logarithmic differentiation (Simple problem based on it)- Differentiation by substitution method and simple problems based on it- Differentiation of Inverse Trigonometric functions

91. Simple problem based on Logarithmic differentiation and differentiation by substitution method.

92. Maxima and Minima of the functions of the form $y=f(x)$ and $y=f(x_1, x_2)$ (Simple problems based on it).

93. Problems in Maxima and Minima of the functions of the form $y=f(x)$ and $y=f(x_1, x_2)$

94. Integral Calculus - Integration of simple functions and Product of two functions- Definite Integral (simple problems based on it)

95. Problems in integration of simple functions and product of two functions using integration by parts-Definite Integral.

96. Integration by substitution method- Area under simple well-known curves (simple problems based on it).

97. Integration by substitution method-Problems in Area under simple well-known curves

98. Agricultural systems - Mathematical models - classification of mathematical models- Linear model.

99. Problems in fitting linear models to experimental data

100. Quadratic and Exponential models- applications of mathematical models in agriculture.

101. Problems in fitting Quadratic models to experimental data.

102. Problems in fitting Exponential models to experimental data.

References books

9. Harikishan. 2006. *Coordinate Geometry of two dimensions*. Delhi: Atlantic Publisher. pp. 1- 137

10. Manickavasagam, P. T. K. & Narayanan. S 1997. *Calculus*. Vol I Madras: Viswanathan Publications. pp. 1-433
11. Mehta, B. C. & G. M. K. Madnani. 2008. (9th ed.). *Mathematics for Economists*. New Delhi: Sultan Chand & Sons. pp. 1 - 731
12. Sharma, A. K. 2004. *Textbook of Matrix*. New Delhi: Discovery Publishing House. pp. 1-333

Semester III

S. No.	Course Code	Course Title	Credit Hours	Total Credits
1.	23HOR201	Growth and development of horticultural crops	1+1	2
2.	23VSC201	Temperate vegetable crops	1+1	2
3.	23FSC201	Temperate fruit crops	1+1	2
4.	23FLG201	Commercial floriculture	2+1	3
5.	23AEN201**	Fundamentals of Entomology	2+1	3
6.	23FMP111**	Farm Machinery and Power	1+1	2
7.	23STA201	Statistical Methods and Computer application	2+1	3
8.	23PBG201**	Fundamentals of genetics	2+1	3
9.	23PAT201**	Fundamentals of Plant Pathology	2+1	3
		Total	14+9	23
10.	23HOR202	Study Tour*	0+1*	1*
11.	23NSS/NCC 101	NSS or NCC	0+1#	1#
12.	23PED101	Physical Education and Yoga Practices	0+1#	1#

23HOR201 Growth and development of horticultural crops (1+1)

Course objective

- Define the physiological pattern of horticultural crops and their management in relation to yield
- Explain the growth physiology of horticultural crops
- Describe the plant growth regulator and its applications
- Summarize the knowledge on plant growth parameters
- Understand the modification of the canopy architecture

Course outcome

- Predict the growth and development with physiological pattern of horticultural crops
- Interpret the data on growth parameters
- Determine the usage of various natural and synthetic growth hormones in the regulation of growth and development
- Apply the technical skill to manipulate the various physiological process

- Illustrate the preparation of suitable hormonal formulation and their application

THEORY

Unit I - Growth physiology

Growth and development – definitions, components, Leaf Area Index (LAI) – optimum LAI in horticultural crops. Canopy development: Different stages of growth, growth curves, growth analysis in horticultural crops. Plant hormones - auxin, gibberellin, cytokinin, ethylene, ABA and retardants - basic functions, its role in crop growth and development. New generation plant growth regulators

Unit II - Physiology of propagation

Seed germination - Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of root formation in cuttings, layering and stock - scion relationship

Unit III - Physiology of canopy management

Pruning and training, physiological basis of training and pruning - canopy management - PGR in canopy management - source and sink relationship - translocation of assimilates – partitioning of assimilates

Unit IV - Physiology of flowering

Flowering - physiology of flowering - photoperiodism - long day, short day and day neutral plants, Phytochrome - off-season flowering - PGRs in flowering - Factors affecting flowering - vernalization and its application in horticulture

Unit V – Post harvest physiology

Physiology of fruit growth and development, fruit setting, fruit thinning, fruit drop - factors affecting fruit set and development, Ripening - physiology of fruit ripening – climacteric and non-climacteric fruits. Physiology of pre and post-harvest management of fruits, vegetables and flower crops

Practical:

Estimation of photosynthetic pigments, photosynthetic efficiency in horticulture crops. Measurement of leaf area following various methods. Growth analysis. Identification of synthetic plant hormones and growth retardants. Assessment of hormonal influence on induction of rooting of cuttings, control of flower and fruit drop, physiological changes during fruit ripening. Estimation of ascorbic acid and lycopene content in fruits. Identification of physiological and nutritional disorders in horticultural crops. Seed viability by tetrazolium test

Theory - Lecture Schedule

1. Growth and development: definitions, components, Leaf Area Index (LAI) and optimum LAI in horticultural crops
2. Canopy development: different stages of growth, growth curves, growth analysis and factors affecting growth and development of horticultural crops
3. Growth hormones: auxins, gibberellins, cytokinins - basic functions – role in crop growth
4. Growth hormones: ethylene, abscisic acid and brassinosteroids – basic functions – role in crop growth

5. Growth inhibitors and retardants – new generation plant growth regulators -physiological role in crop regulations
6. Seed germination - physiology of seed development and maturation
7. Dormancy in seeds and buds – factors causing dormancy in seeds– types of dormancy in seeds– methods for breaking dormancy in seeds
8. Physiology of root formation in cutting, layering and stock - scion relationship

9. Mid-semester Examination

10. Pruning and training - physiological basis of training and pruning - canopy management - PGRs in canopy management
11. Source – Sink relationship – translocation of assimilates – partitioning of assimilates
12. Flowering - physiology of flowering – photoperiodism- photoperiodic induction
13. Phytochrome - off season flowering - PGRs in flowering - factors affecting flowering
14. Vernalization - Perception of cold stimulus- presence of floral hormone – mechanism of vernalization- factors affecting – devernialization – practical utility
15. Physiology of fruit growth and development, fruit setting, fruit thinning, fruit drop - factors affecting fruit set and development
16. Ripening – climacteric and non - climacteric fruits- physiology of abscission and senescence
17. Physiology of pre and post-harvest management of fruits, vegetables and flower crops

Practical Schedule

1. Estimation of photosynthetic pigments
2. Estimation of photosynthetic efficiency in horticulture crops
3. Measurement of leaf area following various methods
4. Growth analysis
5. Identification of synthetic plant hormones and growth retardants
6. Preparation of hormonal formulations
7. Assessment of hormonal influence on induction of rooting of cuttings
8. Assessment of hormonal influence on control of flower and fruit drop
9. Assessment of physiological changes during fruit ripening
10. Estimation of ascorbic acid content in fruits
11. Estimation of lycopene content in fruit
12. Identification of physiological and nutritional disorders in horticultural crops
13. Preparation of suitable formulations for the correction of physiological and nutritional disorders
14. Seed viability by tetrazolium test
15. Preparation of suitable hormonal formulations for breaking dormancy
16. Visit to commercial orchard

17. University Practical Examination

Text Books

1. Vipin Kumar, Satya Parkash, Arvind Kumar, R.K. Naresh and B.S. Tomar. (2021). Growth and Development of Horticultural crops. Jaya Publishing house. New Delhi. pp. 1-226.

2. Hopkins, W.G. and N.P.A. Huner, (2008). Introduction to Plant Physiology (4th ed.,). USA, John Wiley & Sons. pp.1-523.
3. Jain, V.K. (2017). Fundamentals of Plant Physiology (19th ed.,), New Delhi, S. Chand & Company Ltd. pp.1-736.
4. Pandey, S. N. and B. K. Sinha, (2006). Plant Physiology. New Delhi, Vikas Publishing House Private Limited. pp.1-704.
5. Taiz, L. and E. Zeiger, (2014). Plant Physiology (6th ed.,). Massachusetts, USA, Oxford University Press, Sinauer Associates, Inc. pp.1-761.

23VSC201 Temperate Vegetable Crops (1 + 1)

Course objective

- Explain vegetable crop production in temperate regions
- Summarize the crop management practices in temperate vegetables
- Paraphrase the potential of value chain technology in commercial crop production
- Describe the managerial practices for nutrient and physiological disorders

Course outcome

- Understand the scope and importance of temperate vegetables in nutrition and economy
- Outline the commercial cultivation of temperate vegetables
- Discuss a plan of suitable vegetable cultivation technology for a particular region
- Describe the temperate vegetable varieties to grow in tropical climates or in accordance with seasons
- Identify and control the pests, diseases and physiological disorders in temperate vegetables

Theory

Unit I - Introduction

Area, production, world scenario, industrial importance, export of temperate vegetable crops – classification of vegetable crops - climate, soil, water and nutrients on vegetable crop production and their management– cropping systems – seed production techniques and constraints in temperate vegetable crops

Unit II - Cruciferous vegetables

Composition and uses- origin and distribution- area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate –nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest– yield

Crops: cabbage, cauliflower, brussels sprouts, sprouting broccoli and chinese cabbage.

Unit III - Potato, peas, beans and chow chow

Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – preparation of field -spacing - planting

systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield – use of TPS in potato

Crops: potato, peas, beans, and chow chow.

Unit IV - Root crops

Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – preparation of field -spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield

Crops: carrot, beet root, radish and turnip.

Unit V - Salad vegetables

Composition and uses - area and production- climate and soil requirements –season - varieties and hybrids -seed rate – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation -nutrient deficiencies – physiological disorders - use of chemicals and growth regulators -cropping systems – constraints in production - harvest – yield

Crops: Kale, cress, celery, rhubarb, asparagus, artichoke, leek, lettuce and spinach.

Practical

Identification and description of temperate vegetable crops –nursery practices and for transplanted vegetable crops- preparation of field and sowing/planting for direct sown/transplanted vegetable crops- herbicide use in vegetable cultivation - top dressing of fertilizers and intercultural operations – use of growth regulators – identification of nutrient deficiencies - physiological disorders- maturity indices and harvesting -working out cost of cultivation for temperate vegetable crops - visit to temperate vegetable farms, research stations, commercial farm.

Theory - Lecture Schedule

1. Area, production, world scenario, industrial importance, export of temperate vegetable crops.
2. Climate, soil, water and nutrients on temperate vegetable crop production and their management. Cropping systems. Organic farming and GAP in temperate vegetable crops. Export standards for temperate vegetable crops

Composition and uses - area and production- climate and soil requirements – season – warm winter types- varieties and hybrids -seed rate –nursery practices – containerized transplant production and transplanting preparation of field - spacing - planting systems - planting – water and weed management, Nutrient requirement-fertigation, nutrient deficiencies –physiological disorders - use of chemicals and growth regulators - cropping system – constraints in production - harvest – yield for the following crops:

3. Cabbage
4. Cauliflower
5. Brussels sprouts and Sprouting broccoli
6. Chinese cabbage
7. Potato
8. Peas

9. Mid semester examination

10. Beans
11. Chow chow
12. Carrot and Beet root
13. Radish, Turnip and Knol khol
14. Rhubarb and Asparagus
15. Lettuce & Spinach
16. Artichoke and Leek
17. Kale, Cress and Celery

Practical

1. Nursery preparation and sowing transplanted temperate vegetables
2. Field preparation for direct sown temperate vegetables
3. Soil water conservation, contour planting, crop geometry
4. Use of herbicides, preparation of herbicide solution and its application
5. Water management practices
6. Nutritional requirement, including major and micro nutrients
7. Scheduling of nutrients for temperate vegetables through drip fertigation
8. Use of growth regulators, preparation of solution and application in temperate vegetables
9. Identification of physiological disorders and nutritional disorders
10. Maturity indices and harvesting
11. Protected cultivation of temperate vegetables
12. Organic practices, GAP, precision farming in temperate vegetables
13. Visit to commercial farms - I
14. Visit to commercial farms - II
15. Visit to cold storage units / markets
16. Project preparation and working out economics

17. University Practical Examination

Text books

1. Sunil Prajapati, Nitin Saratkar and Rameshi Meena. (2020). A textbook of cool season vegetable crops. Vital Biotech Publication. Rajasthan.
2. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. (2010). "Modern technology in vegetable production". New India Publishing Agency, New Delhi.
3. Prem Singh Arya and S. Prakash (2002). "Vegetable growing in India", Kalyani publishers, New Delhi

4. Bose, T. K., J., Kabir, T. K., Maity V. A., Parthasarathy and M. G., Som (2002). Vegetable Crops Vol. II & III Naya Prokash, Kolkata.
5. Srinivas. J. (2022). Production technology of temperate vegetables, potato and tuber crops. Narendra Publishing House. New Delhi.

23FSC201 Temperate fruit crops (1+1)

Course objective

- Scope, importance and export of temperate fruit crops
- Describe the knowledge on varieties and cultivation technologies of temperate fruit crops
- Discuss the physiological disorders in temperate fruit crops
- Explain the knowledge on the high density planting of temperate fruit crops
- Recognize the benefits of post-harvest handling of temperate fruit crops

Course outcome

- Training and pruning practices in temperate fruit crops
- Explain different planting system followed in temperate fruit crops
- Describe the cultivation aspects in temperate fruit crops.
- Summarize the post-harvest handling techniques in temperate fruit crops

THEORY

Unit I - Scope and importance of temperate fruit crops

Introduction to temperate fruit crops – classification of temperate fruits – area, production, productivity and export of temperate fruit crops

Unit II - Production technology of apple, pear, peach, plum

Composition and uses - origin and distribution – species and varieties -soil and climate with reference to chilling requirement for flowering, warm winter varieties - propagation – rootstocks-main field preparation – spacing, planting density and cropping systems. HDP and meadow orchards - planting and after care - nutrients, water and weed management - training and pruning – canopy management – incompatibility - pollinizers –flowering and pollination use of plant growth regulators – physiological disorders and remedies – maturity indices and harvest - post harvest handling and storage

Unit III - Production technology of cherry, strawberry, apricot, persimmon, kiwi, almond

Composition and uses – origin and distribution – species and cultivars – varieties- soil and climatic requirements – propagation techniques– rootstock influence- main field preparation – spacing - planting density - planting and after care – cropping systems - nutrients, water and weed management – training and pruning – flowering, pollination and fruit set – use of plant growth regulators – physiological disorders and remedies – maturity indices and harvest – post harvest handling – ripening and storage

Unit IV - Production technology of walnut, macadamia nut, pecan nut, pistachio nut, hazel nut and chest nut

Composition and uses – origin and distribution – species and cultivars – varieties- soil and climatic requirements – propagation techniques– rootstock influence- main field preparation – spacing - planting density - planting and after care – cropping systems - nutrients, water and weed management – training and pruning – flowering, pollination and fruit set – use of plant growth regulators – physiological disorders and remedies – maturity indices and harvest – post harvest handling – ripening and storage

Unit V Production problems in temperate fruit crops

Re-planting problems - rejuvenation and special production problems - control of pre-harvest fruit drop - plant protection measures in temperate fruit crops

Practical:

Description and identification of varieties of apple, planting systems and root stock characteristics of apple, description and identification of varieties of pear and peach, plum and cherry, strawberry, kiwi and persimmon, apricot and almond, walnut, pecan nut and pistachio nut, hazel nut, chest nut and queens land nut, nursery management practices for temperate fruit crops, training and pruning practices followed in temperate fruit crops, nutrient management in temperate fruit crops, use of growth regulators in temperate fruit crops, physiological disorders in temperate fruit crops, visit to temperate fruit orchards, economics for cultivation of temperate fruit crops

Theory - Lecture schedule

1. Introduction to temperate fruit crops – classification of temperate fruits – area, production, productivity and export of temperate fruit crops.
2. Apple: introduction- origin and distribution - composition and uses - area and production – varieties - climate and soil requirements - root stocks (dwarf, semi-dwarf, vigorous and other root stocks) – propagation - planting methods
3. Apple: training and pruning - manures and fertilizers - after care - flowering - induction of early flowering - use of growth regulators in flowering - pre harvest drop - blossom and fruit thinning – factors effecting colour development - maturity indices - harvesting - post- harvest handling - different grades - storage - physiological disorders

Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility - pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage for the following crops:

4. Pear
5. Peach
6. Plum
7. Cherry
8. Strawberry

9. Mid semester examination

10. Apricot
11. Kiwi and Persimmon
12. Almond
13. Walnut
14. Queens land nut (Macadamia nut) and pecan nut
15. Pistachio nut, Hazel nut and chest nut
16. Re-planting problems - Rejuvenation and special production problems - control of pre-harvest fruit drop –
17. Important insect pests and diseases – Plant protection measures in temperate fruit crops

Practical Schedule

1. Description and identification of varieties of apple
2. Planting systems and root stock characteristics of apple
3. Description and identification of varieties of pear and peach
4. Description and identification of varieties of plum and cherry
5. Description and identification of varieties of strawberry
6. Description and identification of varieties of kiwi and persimmon
7. Description and identification of varieties of apricot and almond
8. Description and identification of varieties of walnut, pecan nut and pistachio nut
9. Description and identification of varieties of hazel nut, chest nut and queens land nut
10. Nursery management practices for temperate fruit crops
11. Training and pruning practices followed in temperate fruit crops
12. Nutrient management in temperate fruit crops
13. Use of growth regulators in temperate fruit crops
14. Physiological disorders in temperate fruit crops
15. Visit to temperate fruit orchards
16. Economics for cultivation of temperate fruit crops

17. University Practical Examination

Text Books

1. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). Oxford & I.B.H. Publishing. New Delhi.
2. Chadha, K.L. (2019). Handbook of Horticulture. Vol. I (2nd revised edition). ICAR. New Delhi: pp 1 - 299.
3. Prasad, S and R. L. Bhardwaj. (2015). Production technology of fruit crops. Jodhpur: Agrobios. pp. 1 – 438.
4. Chattopadhyay T.K. (2013). A text book on Pomology. Vol. IV (Devoted to Temperate fruits). Kalyani Publishers, New Delhi
5. Sharma. R. and R, Hare Krishna. (2018). Textbook of temperate fruits. CBS Publishers Distributors Private Limited. New Delhi.

23FLG201 Commercial floriculture (2+1)

Course objective

- Understand the scope and importance of commercial flower crops
- Describe the loose flowers, cut flowers, foliage and flowering fillers
- Discuss the production technology of different flower crops
- Explain the knowledge on cultivation of flower crops under protected cultivation
- Understand the post-harvest handling of flower crops

Course outcome

- Explain the crop management of commercial flower crops
- Describe the flower forcing techniques
- Recognize the floral concrete extraction from the commercial flowers
- Explain the flower arrangements and dry flower techniques

THEORY

Unit I – Production technology of major loose flower crops (rose, jasmine, chrysanthemum, tuberose and marigold)

Scope and importance, scenario of international and national floriculture industry, institutions and developmental agencies involved in promotion of floriculture- TANFLORA, NHM, NHB, APEDA, GI tags, export potential, Cropping system in flower crops

Origin and distribution, area and production, varieties and hybrids, soil and climate, propagation, planting systems and methods, training and pruning, special horticultural practices, weed, nutrient and water management, growth regulators, harvest and yield, post-harvest and value addition, plant protection

Unit II – Production technology of minor loose flower crops (crossandra, nerium, gomphrena, celosia and barlaria)

Origin and distribution, area and production, varieties and hybrids, soil and climate, propagation, planting systems and methods, training and pruning, special horticultural practices, weed, nutrient and water management, growth regulators, harvest and yield, post-harvest and value addition, plant protection

Unit III – Production technology of cut flowers in protected cultivation (dutch rose, carnation, gerbera, cut chrysanthemum, orchids, anthurium and lilium)

Scope and importance, origin and distribution, area and production, varieties and hybrids, soil and climate, media and environment- fumigation - field preparation - planting systems – nutrition and fertigation - weed management – training and pruning – special horticultural practices - role of growth regulators- flower forcing techniques - physiological disorders and its control measures- harvest index and yield, post-harvest and value addition, plant protection

Unit IV – Production technology of cut flowers in open cultivation (gladiolus, china aster, dahlia, bird of paradise, heliconia and alstroemeria)

Introduction and uses – varieties – media and environment- fumigation - field preparation - planting systems – nutrition and fertigation - weed management – training and pruning – special

horticultural practices - role of growth regulators, flower forcing techniques - physiological disorders and its control measures- harvest index and yield-post harvest and value addition-plant protection

UNIT V – Production technology of cut foliage and fillers

Introduction and uses -varieties and hybrids, soil and climate, propagation, planting systems and methods, training and pruning, special horticultural practices, nutrient and water management, growth regulators, inter cultivation, harvest and yield, post-harvest and value addition, plant protection, dry flower production

Practical:

Identification and description of species/varieties – media preparation – planting- special intercultural operation for rose, jasmine, chrysanthemum, marigold and tuberose, crossandra, nerium and gomphrena, dutch rose, cut chrysanthemum, carnation and gerbera, gladiolus, anthurium and orchids. Post-harvest handling of cut flowers. Tinting of cut flowers. Drying and preservation of flowers. Visit to flower growing and flower markets areas - loose flowers.

Theory - Lecture Schedule

1. Scope and importance of commercial floriculture in India – area and production – export statistics – Cropping systems in flower crops
2. Industrial importance – floriculture industry in India and Tamil Nadu – Institutions and developmental agencies involved in promotion of floriculture – TANFLORA, NHM, NHB, APEDA, GI tags
3. Rose- introduction and uses – origin and history- species and varieties - soil and climate and planting systems - weed, nutrition and irrigation management – training and pruning
4. Rose– special horticultural practices - role of growth regulators- harvest index and yield- post harvest management and storage- plant protection

Introduction and uses – varieties - soil and climate and planting systems - weed, nutrition and irrigation management – training and pruning – special horticultural practices - role of growth regulators- harvest index and yield- post harvest management and storage- plant protection for the following crops:

5. Jasmine
6. Chrysanthemum
7. Tuberose
8. Marigold
9. Crossandra
10. Gomphrena and Nerium
11. Celosia and Barlaria
12. Flower forcing and factors affecting flower production under controlled atmospheric conditions

13. Dutch rose - introduction and uses – varieties – media and environment- Fumigation - field preparation - planting systems – nutrition and fertigation - weed management – training and pruning
14. Dutch rose- special horticultural practices - role of growth regulators- physiological disorders and its control measures- harvest index and yield- post harvest management and storage- plant protection
15. Carnation- introduction and uses – varieties – media and environment- Fumigation - field preparation - planting systems – nutrition and fertigation - weed management – training and pruning
16. Carnation- special horticultural practices - role of growth regulators- physiological disorders and its control measures- harvest index and yield- post harvest management and storage- plant protection

17. Mid-Semester examination

18. Gerbera - introduction and uses – varieties – media and environment- Fumigation - field preparation - planting systems – nutrition and fertigation - weed management – training and pruning – special horticultural practices - role of growth regulators- physiological disorders and its control measures- harvest index and yield- post harvest management and storage- plant protection
19. Cut Chrysanthemum- introduction and uses – varieties – media and environment- Fumigation - field preparation - planting systems – nutrition and fertigation - weed management- training and pruning
20. Cut Chrysanthemum- - special horticultural practices - role of growth regulators- physiological disorders and its control measures- harvest index and yield- post harvest management and storage- plant protection

Introduction and uses – varieties – media and environment- planting systems – nutrition and fertigation - weed management – training and pruning – special horticultural practices - role of growth regulators- physiological disorders and its control measures- harvest index and yield- post harvest management and storage- plant protection for the following crops:

21. Orchids
22. Anthurium
23. Lillium
24. Gladiolus
25. China Aster and Dahlia
26. Heliconia
27. Bird of Paradise
28. Alstromeria
29. Cut foliages and fillers - Asparagus, Dracaena
30. Flowering fillers- Limonium- Gypsophila
31. Methods of floral concrete extraction

32. Value addition in flower crops
33. Dry Flower Technology- Principles and Techniques.
34. Dry flower Technology- Export potential

Practical Schedule

1. Rose–identification and description of species/varieties – propagation and planting – special intercultural operation
2. Jasmine -identification and description of species/varieties – propagation and planting – special intercultural operation
3. Chrysanthemum - identification and description of species/varieties - propagation and planting- special intercultural operation
4. Marigold and Tuberose - identification and description of species/varieties - propagation and planting -special intercultural operation
5. Crossandra, Nerium and Gomphrena - identification, description of species/varieties, nursery raising and planting
6. Dutch Rose- identification and description of species/varieties – propagation and planting – special intercultural operation
7. Cut Chrysanthemum- identification and description of species/varieties – propagation and planting – special intercultural operation
8. Carnation and Gerbera - identification and description of species/varieties – media – planting- special intercultural operation
9. Gladiolus - identification and description of species/varieties – media – planting- special intercultural operation
10. Anthurium and Orchids – identification and description of species/varieties – media preparation – planting- special intercultural operation
11. Post-harvest handling of cut flowers
12. Tinting of flower crops
13. Drying and preservation of flowers and visit
14. Visit to flower growing and flower markets areas - loose flowers
15. Visit to cut flower production units & markets
16. Preparation of project report for major loose and cut flower production

17. University Practical Examination.

Text Books

1. SachinTyag, I. and Sanjay Sajhay. (2020). Protected cultivation of flowers. New Delhi: NIPA. pp. 1-132.
2. Ponnusamy. V and P. Aruna . (2011). Post Harvest Techniques and Management of dry flowers. New Delhi: NIPA. pp.1-240.
3. Bhattacharjee, S.K., (2010). Advanced commercial floriculture. Vol. I, II Aaviskar. (1st Ed.) pp. 1 – 798.
4. Bose, T.K., L. P. Yadav, P. Pal., V.A. Parthasarathy, and P. Das (2003). Commercial flowers. Vol. I, II and III., Kolkata-6: Nayaudyog.

5. Kannan. M, J. Ravivarman.,M. Kalaimani, A. Vijai Ananth and S. Suganya. (2019). Brillion Publishing. New Delhi

23AEN 201 FUNDAMENTALS OF ENTOMOLOGY (2+1)

Course objective:

- To define entomology and list the contributions of entomologist
- To compare insects with other arthropods of animal kingdom
- To describe insect morphology and anatomy
- To organise insects into different taxonomic categories

Course outcome:

- Recall the basics of entomology and history of entomology in India
- Discuss the position of insects in the animal kingdom
- Explain insect morphology and anatomy
- Appraise insect taxonomy and systematics and analyse different characters of insect orders

THEORY

Unit I- Introduction to entomology and insect morphology

History of Entomology in India. Factors responsible for insect dominance, introduction and classification of phylum arthropoda and class insecta, 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

Unit II- Insect morphology and anatomy

Metamorphosis and diapause in insects. Types of eggs, larvae and pupae. Major sensory organs – Photoreceptros (simple and compound eyes), chemoreceptors and Mechanoreceptors. Structure and functions of digestive system, excretory system, circulatory system and respiratory system of insects

Unit III- Insect anatomy

Structure and functions of nervous, and reproductive system, in insects. Types of reproduction. Glandular system in insects

Unit IV- Insect taxonomy and systematics – apterygote and exopterygote orders

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, and emphasis of families of agricultural importance. Apteriygote orders and Exopterygote orders: Ephemeroptera, Odonata, Plecoptera, Grlloblatodia, Orthoptera (Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae), Phasmida, Dermaptera, Embioptera, Dictyoptera (Mantidae, Blattidae), Isoptera, Zoraptera, Psocoptera, Mallophaga, Siphunculata, Hemiptera (Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae), Thysanoptera

Unit V- Endopterygote orders

Classification of Pterygote orders of insects with special emphasis to orders and families of Agricultural importance like Neuroptera (Chrysopidae); Lepidoptera (Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae); Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae); Hymenoptera: (Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae)

PRACTICAL

External features of Grasshopper/cockroach. Methods of collection and preservation of insects including immature stages. Types of insect antennae. Types of insect mouthparts. Types of insect legs. Types of insect Wing venation, types of wings and wing coupling apparatus. Types of insect eggs, larvae and pupae. Dissection of digestive system in insects. Dissection of male and female reproductive systems in insects. Dissection of nervous system in insects. Dissection of Circulatory system in insects. Dissection of respiratory system in insects. Study of taxonomic characters of orders Lepidoptera, Coleoptera, Hemiptera, Diptera, Orthoptera, Dictyoptera, Isoptera, Odonata, Thysanoptera, Neuroptera and Hymenoptera

Theory - Lecture Schedule

35. Study of insects and their importance in Agriculture.
36. History of Entomology in India
37. Position of insects in the Animal Kingdom and relationship with members of Arthropoda
38. Insect dominance: structural, morphological and physiological factors responsible for dominance
39. Insect body wall: its structure and function
40. Moulting process in insects
41. Structure of insect head, its orientation appendages and functions
42. Structure of insect thorax, appendages and their functions
43. Structure of insect abdomen, abdominal appendages and their functions
44. Metamorphosis and diapause in insects
45. Types of egg, larvae and pupae
46. Major sensory organs — types of sensilla — photoreceptors (simple and compound eyes), chemoreceptors and mechanoreceptors
47. Digestive system in insects — structure of alimentary canal, modifications in certain groups, enzymes, digestion and absorption of nutrients
48. Excretory system in insects — malpighian tubules — accessory excretory organs — physiology of excretion
49. Circulatory system in insects — haemocoel and dorsal vessel — circulation of blood — composition of haemolymph — blood plasma — haemocytes and their functions

50. Respiratory system in insects – structure of trachea – tracheoles – types of respiratory system – types of spiracles – respiration in aquatic and endoparasitic insects

51. Mid Semester Examination

52. Nervous system in insects – structure of neuron – central nervous system – conduction of nerve impulses – axonic and synoptic transmission

53. Male and female reproductive systems in insects – their structures – types of reproduction – oviparous, viviparous, paedogenesis, polyembryony and parthenogenesis

54. Structure of exocrine glands and their location and simple function – effect on metamorphosis and reproduction

55. Structure of endocrine glands and their location and simple function – effect on metamorphosis and reproduction

56. Classification and nomenclature of insects

57. Important characters of Apterygota

58. Important characters of Exopterygote orders: Ephemeroptera, Odonata, Plecoptera, Grylloblattid

59. Important characters of Exopterygote orders: Phasmida, Dermaptera, Embioptera

60. Important characters of Exopterygote orders – Orthoptera and Dictyoptera

61. Important characters of Exopterygote orders – Isoptera, Zoraptera

62. Important characters of Exopterygote orders - Psocoptera, Mallophaga, Siphonculata

63. Important characters of Exopterygote orders – Hemiptera and Thysanoptera

64. Important characters of Endopterygota order- Neuroptera

65. Important characters of Endopterygota order– Lepidoptera and families of agricultural importance with significant characters

66. Important characters of Endopterygota orders – Coleoptera and families of agricultural importance with significant characters

67. Important characters of Endopterygota order- Diptera and families of agricultural importance with significant characters

68. Important characters of Endopterygota order- Hymenoptera and families of agricultural importance with significant characters

Practical schedule:

18. External features of Grasshopper/cockroach

19. Methods of collection and preservation of insects including immature stages

20. Types of insect antennae

21. Types of insect mouthparts

22. Types of insect legs

23. Types of insect Wing venation, types of wings and wing coupling apparatus

24. Types of insect eggs, larvae and pupae

25. Dissection of digestive system in insects

26. Dissection of male and female reproductive systems in insects

27. Dissection of nervous system in insects

28. Dissection of Circulatory system in insects
29. Dissection of respiratory system in insects
30. Study of taxonomic characters of orders Lepidoptera and Coleoptera
31. Study of taxonomic characters of orders Hemiptera and Diptera
32. Study of taxonomic characters of orders Orthoptera, Dictyoptera Isoptera and Odonata
33. Study of taxonomic characters of orders Thysanoptera, Neuroptera and Hymenoptera
34. **University Practical Examination.**

Text books

3. Shanthi. M., T. Senguttuvan, K. Suresh, Z. Kavitha. (2020). Text book on Fundamental Entomology. Agrobios (India).
4. Ragumoorthi K.N., V. Balasubramani, M. R. Srinivasan, N. Natarajan. (2017). Insecta: An Introduction..A.E. Publications.
5. Sehgal, P.K. (2020). Fundamentals of Agricultural Entomology. Kalyani Publisher, Kolkata.
6. Wigglesworth, V.B. (2013). Insect Physiology. Springer, Netherlands.
7. Chapman, R.F. (2003). The Insects: Structure and Fuction. Cambridge University Press. England.

23FMP 211 FARM MACHINERY AND POWER (1+1)

Course objective

The course aims to enable the students to understand the basic principles and parts of internal combustion engine and different tillage, sowing, intercultural, plant protection equipment, working principles of threshers, harvesting of field and horticultural crops

Course outcomes

- To understand the working principle of different systems and parts of internal combustion engines
- To equip the students with technical knowledge and skills required for the operation of Tillage, Sowing and intercultural and plant protection machinery needed for agricultural farms
- To train the students with skills required for the operation, maintenance and evaluation of harvesting, threshing machinery needed for agricultural farms

THEORY

Unit I- Farm power and IC engines

Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of IC engines, comparison of two stroke and four stroke cycle engines , Study of different components of IC engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply

Unit-II- Tractor and functional components

Hydraulic control system of a tractor, Familiarization with Power transmission system clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement

Unit –III- Tillage implements

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture

Unit-IV- Sowing and intercultural implements

Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, implement for intercultural operations

Unit-V- Plant protection and harvesting equipments

Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment

PRACTICAL

Study of different components of I.C. engine - To study air cleaning and cooling system of engine - Familiarization with clutch – Transmission - Differential and final drive of a tractor- Familiarization with lubrication and fuel supply system of engine - Familiarization with brake – Steering -Hydraulic control system of engine - Learning of tractor driving - Familiarization with operation of power tiller- Implements for hill agriculture - Familiarization with different types of primary and secondary tillage implements – Mould board plough - Disc plough and disc harrow - Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration - Planters and transplanter- Familiarization with different types of sprayers and dusters – Familiarization with different inter-cultivation equipment- Familiarization with harvesting and threshing machinery

Theory - Lecture Schedule

1. Farm power in India - sources of farm power and their use in agriculture
2. Working principles of IC Engines-Two stroke and Four stroke engines - applications – comparison-Engine terminology.
3. Components of IC engine and systems of IC engine – air cleaning, cooling, lubricating and fuel supply systems.
4. Tractors- types - transmission system- clutch, gearbox, differential and final drive - hydraulic system.
5. Cost analysis of tractor with attached implement.
6. Tillage, objectives, types –ploughing methods. Primary tillage-mould board plough, disc plough, chisel plough and sub soil plough - components and functions, types, advantages and disadvantages
7. Secondary tillage equipment– cultivators, harrows, levelers, and forming equipment– rotovators –puddlers –manure trawlers and cage wheels, Implements for Hill agriculture
8. Sowing methods - seed drills and planters- seed cum fertilizer drills - components and functions-Calibration

9. Mid Semester Examination

10. Paddy transplanters, types, working principle, field and nursery requirements
11. Implements for inter cultural operations –cultivators, sweep, junior hoe, manual weeders and power operated weeders for wetland and garden land
12. Sprayers and their functions, classification, manually operated sprayers, terminology, Nozzle types
13. Power operated sprayers – Tractor operated boom sprayer, Knapsack mist blower cum duster – Tall tree sprayer-dusters, types and uses
14. Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery
15. Threshing of crop, thresher and its principles of operation - threshing losses
16. Harvesting equipment– reapers - mowers and combine harvesters –types, construction and operation-Balers
17. Harvesting machinery for groundnut, tuber crops, Cotton and sugarcane

Practical schedule

1. Study of working of two and four stroke I.C. engines and their systems with solved problems
2. Study of Tractor clutch, gearbox, differential and final drive. Study of brake, steering and hydraulic control
3. Learning driving of tractor and power tiller
4. Study of tractors and power tillers – their operation and maintenance
5. Study of mould board plough, - methods of ploughing- with solved problems
6. Disc plough and sub soiler and their components- Hitching and adjustment of plough - field operation of different tractor drawn primary tillage machinery
7. Study of cultivator, disc arrows, Rotavator, bund former, ridger, leveler and puddling implements and their operation
8. Study of seed drills, planters and seed-cum-fertilizer drills and their components and metering mechanisms -calibration- simple problems on calibration
9. Study and operation of machinery for rice cultivation –puddling implements- rotary puddlers and cage wheels, tray seeder for rice nursery, transplanters -types operation and maintenance- Drum seeder, cono weeder, power weeder and finger type weeder
10. Study of different inter- cultivation equipment for uplands -manual, animal drawn, power operated -tractor and power tiller operated -field operation
11. Study of plant protection equipment– manually operated sprayers and dusters, knapsack mist blower cum duster, tractor operated sprayers- their operation, adjustment, calibration and safety requirements
12. Study of tools for Hill agriculture and horticultural crops – propagation tools, vegetable transplanter, harvesting tools –lawn mower, hole diggers, tree climber, shredders for crop residue
13. Threshing machinery for paddy and identification of its components- different threshing drums - calculation of efficiency and losses
14. Study of paddy reaper and paddy combine-their systems, method of operation and adjustment

15. Study of harvesters for root crops - turmeric and tapioca and groundnut diggers

16. Problems on cost of operation of tractor operated machinery

17. University Practical Examination

Text books

3. Senthilkumar, T., R. Kavitha and V.M.Duraisamy. (2015). A Text Book of Farm Machinery, Thannambikkai Publications, Coimbatore.
4. Jagadishwar Sahay, (2010). Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi.
5. Sanjay Kumar. (2018). Farm Power and Machinery, Kalyani publisher, New Delhi.
6. Sharma, D.N., Mukesh Jain and Shiv Kumar Lohan. (2021). Farm Power and Machinery Management (Principles & Practices). Jain Brothers publisher, New Delhi
7. Donnell Hunt. (2013). Farm Power and Machinery Management, Medtech Publisher, New Delhi.

23 STA 201 STATISTICAL METHODS AND COMPUTER APPLICATION (2+1)

Course objective:

- The purpose of learning this course is to understand the fundamental concepts and skills
- To calculate Mathematical models applicable to field trails and to apply testing the hypothesis in all problems of horticultural sciences

Course outcome:

- Identify the fundamentals difference between grouped data and ungrouped data
- Apply the testing of hypothesis
- Apply the statistical models in the field
- Explain the techniques related in sampling

Unit I- Descriptive Statistics

Basic concepts – statistics – variable – types and sources of data – classification and tabulation of data - Diagrammatic and graphical representation of data – simple, multiple, component, percentage bar diagrams and pie diagram – frequency polygon, frequency curve, histogram, and ogives. Measures of central tendency: arithmetic mean, median and mode – merits and demerits. Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, and coefficient of variation

Unit II- Tests of Significance

Large sample test - small sample tests- single mean and difference between two means and paired t test – chi-square test for application of attributes in m*n contingency table. Correlation: Scatter diagram – Karl Pearson's correlation coefficient - definition– types of correlation and its properties -simple problems. Regression – properties of regression coefficient- regression equations- simple problems

Unit III- Analysis of variance and experimental designs

Analysis of Variance (ANOVA) - one way and two-way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD) – lay out, analysis, merits, and demerits

Unit IV- Introduction to computer and computer applications

Computer application: Introduction to computers and personal computers, basic concepts, operating system,—~~DOS~~ and Windows, MS Word Features of word processing, creating document and tables and printing of document, MS Excel-Concept of electronic spreadsheet, creating, editing, and saving of spreadsheet, inbuilt statistical functions and formula bar, MS Power point-preparation, presentation of slides and slide show

Unit V- Introduction to computer languages

Introduction to programming languages, ~~BASIC language~~, concepts, basic and programming techniques, MS Office, Win Word, Excel, Power point, introduction to multi-media and its application. ~~Visual basic concepts, basic and programming techniques~~, **programming in python, introduction to R**, introduction to internet **and web designing**

PRACTICAL

Formation of frequency distribution tables – Diagrammatic and graphical representation. Computation of different measures of central tendency and computation of various measures of dispersion for grouped data and ungrouped data – calculation of coefficient of variation (CV) – Large sample test for single mean and difference between two means. t-test for single mean – t-test for testing the significance of two means and paired samples – chi square test for independence of two attributes in a contingency table – calculation of the correlation coefficient – fitting of simple linear regression equation –completely randomized design (CRD) – randomized block design (RBD) – Latin square design (LSD). Innards of computer– Booting and shutdown – Practice of DOS commands: dir, cd, mkdir, rmdir, del, cls, attrib, ren, copy, move, ip config, ping - Software practices –Installation /Uninstallation – Windows apps: Sticky Notes, Steps Recorder, Snipping Tool – Pin and unpin the programs – System tray customization – Shortcut keys - Microsoft Excel- Entering a formula in a cell, Built-in functions: SUM, AVERAGE, MIN, MAX, COUNT, COUNTIF, IF –Import and export data - Charts - Create Bar and Pie charts – PIVOT table - MS-ACCESS: Creating agriculture database – Entering, editing, deleting data – Creating Forms –Query wizard: select, update, delete – Reports.

Theory - Lecture Schedule

1. Basic concepts: statistics, variable, types and sources of data, classification of data
2. Diagrammatic representation of data: simple, multiple, component and percentage bar diagrams, pie diagram
3. Graphical representation of data: frequency polygon, frequency curve, histogram, and ogives
4. Measures of central tendency: arithmetic mean, median and mode –Merits and demerits and its problems
5. Measures of dispersion: Range, Quartile deviation

6. Measures of dispersion: Mean deviation, standard deviation, and coefficient of variation
7. Large sample test: single mean, difference between two means
8. Small sample test: single mean, difference between two means
9. Small sample test: paired t test
10. Chi square test for testing the association of m*n contingency table
11. Correlation: Scatter diagram and properties of correlation
12. Karl Pearson 's: finding correlation coefficient between two variables
13. Regression – properties of regression coefficient
14. Simple linear regression – fitting of simple linear regression equation
15. Analysis of Variance (ANOVA)- assumptions, one way classification
16. Analysis of Variance (ANOVA)- Two-way classification
17. **Mid-Semester Examination**
18. Completely Randomized Design (CRD), merits and demerits
19. Randomized Block Design (RBD), merits and demerits
20. Latin Square Design (LSD), merits and demerits
21. Introduction to Computers –Basic anatomy of the computer system
22. Input devices, CPU, Output devices, Memory: Primary and secondary
23. ~~DOS~~ and Windows, MS Word Features of word processing
24. Creating document and tables and printing of document
25. MS Power point-preparation, presentation of slides and slide show, introduction to multi-media and its application
26. Electronic spreadsheet–Microsoft Excel-Worksheet manipulation: insert, delete, move, copy
27. Hide worksheet– Cell manipulation: copy, edit and format cell data – Charts - Create Bar and Pie charts - PIVOT table
28. DBMS: Database terms: Data, Database, DBMS, RDBMS, Row, Column, Table
29. Database Architecture – Data types: char, varchar (), int, float () – Use of databases in horticulture
30. Introduction to programming languages, basic concepts and programming techniques
31. Introduction to Computer Programming – Programming languages - Translators: Compilers and Interpreters - Algorithm – Flowchart
32. **Programming in python, introduction to R,** ~~Visual basic concepts, basic and programming techniques,~~
33. Introduction to internet
34. **Introduction to web designing**

Practical schedule

1. Computation of Arithmetic mean, Median and Mode
2. Computation of Range, Standard deviation, Mean deviation, variance, coefficient of variance
3. Histogram, frequency polygon, frequency curve, ogives

4. Large sample test – test for single mean and difference between two means
5. Small samples test – t-test for single mean – t test for difference between two sample means
6. Paired t-test
7. Chi square test-Independence of attributes in $m \times n$ contingency table
8. Computation of Karl Pearson 's correlation coefficient
9. Fitting of simple linear regression equation y on x
10. Analysis of Completely Randomised Design (CRD) – for equal replications only
11. Analysis of Randomised Block Design (RBD)
12. Analysis of Latin Square Design (LSD)
13. Innards of computer – Boot and shutdown – Windows apps: Sticky Notes, Steps Recorder, Snipping Tool– Pin and unpin the programs – System tray customization – Shortcut keys
14. Software practices–Installation/Uninstallation
15. Microsoft Excel- Entering a formula in a cell, Built-in functions: SUM, AVERAGE, MIN, MAX, COUNT, COUNTIF, IF–Import and export data -Charts –Create Bar and Pie charts –PIVOT table
16. MS-ACCESS: Creating horticulture database–Entering, editing deleting data–Creating Forms
17. **University Practical Examinations**

Textbooks

6. Gupta, S.P. (2004). *Statistical Method*. New Delhi: Sultan Chand and sons.
7. Vittal P. R. (2012). *Mathematical Statistics*. Chennai: Margham Publications
8. Nageswara Rao, G. (2007). *Statistics for Agricultural Sciences*. Hyderabad: B.S.publications
9. Gupta, S. C. and V. K. Kapoor, (2014). *Fundamentals of Mathematical Statistics*. Sultan Chand and sons. New Delhi
10. Bandari, V. B., (2012). *Fundamentals of Information Technology*. Pearson Education, New Delhi

23PBG 201 FUNDAMENTALS OF GENETICS (2+1)

Course objective:

- Paraphrase the history and evolution of genetics and cytogenetics
- Understand the Chromosome behaviour and effects of their irregularities
- Explain Mendel's principles of heredity
- Recognize the importance of genetics in crop improvement

Course outcome:

- Describe the architecture of the chromosome and its functions
- Interpret the relationship between genotype and phenotype
- Apply the principles of chromosome transmission to predict patterns of inheritance
- Analyse the modern concept of genetics and mutation
- Evaluate scientific data using the rules of probability

THEORY

UNIT I- Cytology and cytogenetics

Definition of genetics, heredity, inheritance, cytology, cytogenetics. History of genetics. Cell division – mitosis- meiosis and their significance – Gametogenesis and syngamy in Plants. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere. Structural and numerical variations in chromosome and their implications. Use of haploids, dihaploids and doubled haploids in Genetics. Special types of chromosomes

UNIT II- Mendelian genetics and heredity

Heredity's Fundamental Characteristics; Pre and Post Mendelian concepts of heredity; Mendelian principles of heredity. Chromosomal theory of inheritance. Mendel's experiments and laws of inheritance - Law of Segregation, Law of Independent Assortment and Law of Dominance. Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1), ii.) Recessive epistasis (9:3:4), iii.) Duplicate and additive epistasis (9:6:1), iv.) Duplicate dominant epistasis (15:1), v) Duplicate recessive epistasis (9:7), vi.) Dominant and recessive epistasis (13:3). Pleiotropy, threshold characters, co-dominance, penetrance and expressivity. Non - Mendelian inheritance – cytoplasmic inheritance

UNIT III- Quantitative inheritance, linkage and crossing over

Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Linkage and genetic mapping, Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments, single cross over, multiple cross over, two-point cross, three-point cross, map distances, gene order, interference and co-efficient of coincidence

UNIT IV- Sex determination and elements of biometry

Sex determination and sex linkage, sex limited and sex influenced traits. Sample and Sampling, Collection and Representation of Data, Measures of Central Tendency - Mean, Median and Mode. Measures of Dispersion - Variance and Standard deviation. Test of Hypothesis - Chi square Test. Probability - Definition and rules

UNIT V- Modern concepts of genetics and mutation

Gene concept: Gene structure, function and regulation. Transcription and translational mechanism of genetic material - protein synthesis. Lac and Trp operons. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Genetic disorders. Nature, structure & replication of genetic material

PRACTICAL

Study of Microscopy. Study of cell structure and function. Preparation of Slide for Mitosis study. Preparation of Slide for Meiosis study. Monohybrid Ratio and its Modification. Dihybrid Ratio and its Modification. Study of Trihybrid Ratio and back cross methods. Experiments on probability and Chi-square test. Gene Interaction. Estimation of Linkage: Two Point Test Cross.

Estimation of Linkage: Three Point Test Cross. 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. Multiple alleles and polygenic inheritance. Studies on sex linked inheritance in Humans and Drosophila

Theory - Lecture Schedule

35. Definition of genetics, heredity, inheritance, cytology, cytogenetic; Brief history of developments in genetics and cytogenetics
36. Physical basis of heredity: Structure and function of cell and cell organelles
37. Differences between Prokaryotes and Eukaryotes. Cell division – mitosis
38. Cell division - meiosis and their significance
39. Gametogenesis and syngamy in Plants-identical and fraternal twins
40. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram
41. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes -polytene, lampbrush, B chromosomes, ring and isochromosomes
42. Chromosomal aberration: Variation in chromosome structure –deletion, duplication, inversion and translocation – genetic and cytological implications
43. Chromosomal aberration: Variation in chromosome number– euploid, aneuploid, types of aneuploids and their origin; Klinefelter syndrome and Turner syndrome.
44. Polyploid- auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, Brassica
45. Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutation theory
46. Mendel's experiments and laws of inheritance. Rediscovery of Mendel's work
47. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid
48. Chromosomal theory of inheritance. Allelic interactions –Dominance vs recessive, complete dominance, codominance, incomplete dominance, threshold characters
49. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio –i.) Dominant epistasis (12:3:1)
50. Recessive epistasis (9:3:4) Duplicate and additive epistasis (9:6:1). iv.) Duplicate dominant epistasis (15:1)
51. **Mid Semester Examination**
52. Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i) to (vi)
53. Lethal genes, Pleiotrophy, penetrance and expressivity, Multiple alleles, blood group in humans, coat colour in rabbits, self-incompatibility in plants; pseudo alleles, isoalleles.

54. Quantitative inheritance – Multiple factor hypothesis – Nilsson-Ehle experiment on wheat kernel colour
55. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers
56. Linkage - coupling and repulsion; Experiment on Bateson and Punnett
57. Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group
58. Crossing over – significance of crossing over; cytological proof for crossing over – Stern's experiment; Factors controlling crossing over
59. Strength of linkage and recombination; Two point and three point test cross
60. Double cross over, interference and coincidence; genetic map, physical map.
61. Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination – different types – sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Sex determination in plants – Melandrium, papaya, maize
62. Genic balance theory of Bridges - Gynandromorphs
63. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance - Genetic disorders
64. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - cytoplasmic male sterility in maize, kappa particles of paramecium
65. DNA, the genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment
66. Structure of DNA – Watson and Crick model Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication. RNA types - mRNA, tRNA, rRNA – Protein synthesis
67. Regulation of gene expression – Operon model of Jacob and Monod – Lac and Trp operons. Cistron, muton and recon
68. Mutation – characteristics of mutation – micro and macro mutation – CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Practical schedule

18. Study of Microscopy.
19. Study of cell structure and function.
20. Preparation of Slide for Mitosis study.
21. Preparation of Slide for Meiosis study.
22. Monohybrid Ratio and its Modification.
23. Dihybrid Ratio and its Modification.
24. Study of Trihybrid Ratio and back cross methods.
25. Experiments on probability and Chi-square test.
26. Gene Interaction.

27. Estimation of Linkage: Two Point Test Cross.
28. Estimation of Linkage: Three Point Test Cross.
29. Simple interaction of genes-comb character in fowls; Dominant epistasis.
30. Recessive epistasis, Duplicate and additive epistasis.
31. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
32. Multiple alleles and polygenic inheritance.
33. Studies on sex linked inheritance in Humans and Drosophila.
- 34. University Practical Examination.**

Text books

6. Gupta P.K. (2007). Cytogenetics. Rastogi Publisher, Meerut, UP
7. Verma, P.S. and V.K. Agarwal. (2007). Genetics. S. Chand and Company Ltd., New Delhi
8. Russel, P.J. (2000). Fundamentals of genetics. Wesley Longman Publishers, USA
9. Singh, B.D. (2004). Fundamentals of genetics. Kalyani Publishers, New Delhi
10. Pundhansingh, (2014). Elements of Genetics. Kalyani Publishers, New Delhi

23PAT 201 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Course objective:

- Detailed study and identification of plant diseases caused by fungal, bacterial and viral pathogens

Course outcome:

- To study about different plant diseases caused by biotic factors
- To study morphology, symptoms, life cycle, reproductive and resting structures of Fungal, bacterial and viral pathogens causing plant disease
- To study the mode of interaction between plant and pathogens
- To identify the plant diseases and their causes

THEORY

Unit I - Plant pathogenic organisms

Introduction- Definition, History of plant pathology, Economic importance of plant diseases. Terms and concepts of Plant Pathology. Classification of plant disease, Factors affecting disease development. Plant Pathogenic organisms: Protozoa, Phytoplasmas, Chromista, Fungi, Bacteria, *Candidatus phytoplasma*, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites

Unit II – Pathogenesis

Pathogenesis, Host pathogen interaction. Mode of infection, pre-penetration, penetration and post penetration, Role of enzymes and toxins on disease development, Plant defense mechanisms. Effect of pathogen on physiological functions of the plants

Unit III - General characters and taxonomy of protozoa, chromista and fungi

General characters definition of fungus, somatic structures, types of fungal thalli, fungal tissues, Resting spores, modifications of thallus, reproduction (asexual and sexual) and symptoms caused by plant pathogenic fungi. Nomenclature: Binomial system of nomenclature, rules of nomenclature, classification of fungi. divisions, sub-divisions, orders and classes. Kingdom: Protozoa, Phylum: *Plasmodiophoromycota*, *Plasmodiophora brassicae.*, Kingdom: Chromista, Phylum: Oomycota; *Pythium*, *Phytophthora*, *Sclerospora*, *Peronosclerospora* and *Albugo* Kingdom: Fungi; Phylum: *Chytridiomycota*- *Synchytrium*; Phylum: *Zygomycota*; *Mucor*, *Rhizopus*

Unit IV - General characters and taxonomy of fungi - ascomycota and basidiomycota

Phylum: Ascomycota and Basidiomycota *Taphrina*, *Capnodium*, *Mycosphaerella*, *Helminthosporium*, *Macrophomina*, *Venturia*, *Lewia*, *Sclerotium*, *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Claviceps*, *Glomerella*, *Magnaporthe* *Gibberella*, *Verticillium*, *Puccinia*, *Uromyces*, *Ustilago*, *Tilletia*, *Ustilaginoides*. *Hemelia*, *Rhizoctonia*, *Exobasidium*, *Ganoderma*, *Agaricus*, *Pleurotus* and *Calocybe*.

Unit V - Bacteria, phytoplasma, virus, viroid, algae, phanerogams, and abiotic disorders

General characters and symptoms- phytopathogenic bacteria, *Candidatus Phytoplasma*, *Spiroplasma*, Fastidious vascular bacteria, viruses, viroids, algae, Phanerogams – Abiotic disorders.

PRACTICAL

Working principle and uses of various laboratory tools and equipment's. Fungi- definition. Study of different morphological structures and fruiting bodies of fungi. Study of symptoms of various plant diseases caused by fungi, bacteria, virus, viroids, algae, phytoplasma, etc. Important characters of representative fungal genera of *Oomycota*- *Sclerospora*, *Plasmopara* and *Albugo*, *Plasmodiophoromycota* and *Oomycota*- *Pythium* and *Phytophthora*, *Zygomycota*-*Rhizopus*, *Mucor*, *Ascomycota*-*Taphrina*, *Capnodium*, *Cercospora*, *Botryodiplodia*, *Drechslera* and *Alternaria*, *Ascomycota*-*Eurotium*, *Penicillium*, *Fusarium*, *Claviceps* and *Verticillium*, *Ascomycota*- *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uninula*, *Podosphaera* and *Sphaerotheca*, *Ascomycota*-*Colletotrichum*, *Pestalotia*, *Pyricularia*, *Sarocladium* and *Macrosporium*, *Basidiomycota*- *Puccinia*, *Uromyces* and *Hemileia*, *Basidiomycota*- *Ustilago*, *Spacelotheca*, *Tolyposporium* and *Exobasidium*. Study of bacterial diseases –leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot. Symptoms and vectors of viral diseases mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunched top. Transmission of plant viruses. Plant phanerogamic parasites. Field visit

Theory Lecture schedule

35. Plant Pathology - Introduction, definition, and history
36. Terms and concepts of plant pathology.
37. Classification of plant diseases and factors affecting disease development.

38. Plant Pathogenic organisms: Protozoa, Chromista, Fungi, Bacteria, and Phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites.
39. Host pathogen interaction, Mode of infection, pre-penetration, penetration and post penetration
40. Survival and dispersal of plant pathogens
41. Effect of Pathogen on physiological functions of the plants
42. Role of enzymes
43. Role of toxins
44. General characters of fungi
45. Different morphological structures of fungi
46. Mode of nutrition in fungi
47. Asexual Reproduction in fungi
48. Sexual Reproduction in fungi
49. Parasitism in fungi, Mode of nutrition
50. Classification of *Plasmodiophoromycota*- *Plasmodiophora brassicae*
51. **Mid Semester Examination**
52. Classification of *Chromista*- Oomycota; *Pythium*, *Phytophthora*, *Sclerospora*, *Peronosclerospora* and *Albugo*
53. Classification, general characters symptoms and life cycle of *Chytridiomycota*-*Synchytrium*
54. Classification, general characters symptoms and life cycle of *Zygomycota* - *Mucor*, *Rhizopus*
55. Classification, general characters symptoms and life cycle of *Taphrina*, *Capnodium*, *Mycosphaerella*, *Helminthosporium*, *Macrophomina*, *Venturia*,
56. Classification, general characters symptoms and life cycle of *Ascomycota* *Lewia*, *Sclerotium*, *Eurotium*, *Talaromyces*
57. Classification, general characters symptoms and life cycle of *Ascomycota* *Erysiphe*, *Leveillula* and *Phyllactina*
58. Classification, general characters symptoms and life cycle of *Ascomycota* *Claviceps*, *Glomerella*, *Magnaporthe* *Gibberella*, *Verticillium*, *Ustilaginoidea*.
59. Classification, general characters symptoms and life cycle of *Basidiomycota*- *Puccinia*, *Uromyces*, *Ustilago*, *Tilletia*,
60. Classification, general characters symptoms and life cycle of *Basidiomycota*- *Agaricus*, *Pleurotus* and *Calocybe*.
61. Classification, general characters symptoms and life cycle of *Basidiomycota* -*Rhizoctonia*, *Exobasidium*, *Ganoderma*,
62. Classification of bacteria, General characters of bacteria and their symptoms.
63. Phytoplasma, spiroplasma, fastidious vascular bacteria and their symptoms.
64. General characters and Properties of virus
65. Symptoms of viruses.
66. General characters and symptoms of viroids

67. General characters and symptoms of Phanerogamic parasites and algae.
68. Abiotic factors and their symptoms.

Practical schedule

18. Working principle and uses of various laboratory tools and equipment's.
19. Fungi- definition. Study of different morphological structures and fruiting bodies of fungi.
20. Study of symptoms of various plant diseases caused by fungi, bacteria, virus, viroids, algae, phytoplasma, etc.
21. Important characters of representative fungal genera of *Oomycota*- *Sclerospora*, *Plasmopara* and *Albugo*
22. Important characters of representative fungal genera of *Plasmodiophoromycota* and *Oomycota*- *Pythium* and *Phytophthora*
23. Important characters of representative fungal genera *Zygomycota*-*Rhizopus*, *Mucor*
24. Important characters of representative fungal genera of *Ascomycota*.-*Taphrina*, *Capnodium*, *Cercospora*, *Botryodiplodia*, *Drechslera* and *Alternaria*
25. Important characters of representative fungal genera of *Ascomycota*.-*Eurotium*, *Penicillium*, *Fusarium*, *Claviceps* and *Verticillium*
26. Important characters of representative fungal genera of *Ascomycota*.- *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uninula*, *Podosphaera* and *Sphaerotheca*
27. Important characters of representative fungal genera of *Ascomycota*.-*Colletotrichum*, *Pestalotia*, *Pyricularia*, *Sarocladium* and *Macrosporium*
28. Important characters of representative fungal genera of *Basidiomycota*- *Puccinia*, *Uromyces* and *Hemileia*
29. Important characters of representative fungal genera of *Basidiomycota*- *Ustilago*, *Spacelotheca*, *Tolyposporium* and *Exobasidium*.
30. Study of bacterial diseases –leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
31. Symptoms and vectors of viral diseases mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top. Transmission of plant viruses.
32. Plant phanerogamic parasites.
33. Field visit
34. **Final Practical Examination**

Note: Students should submit fifty well preserved disease specimens

Text books

5. Agrios, G.N. (2005). *Plant Pathology* (5th Ed). New York: Academic Press. pp. 1-922.
6. Alice, D., and C. Jeyalakshmi. (2014). *Plant Pathology*. Coimbatore: A.E Publications. pp. 1-375.
7. Dube, H.C. (2013). *An introduction to Fungi*. India: Scientific publisher. pp. 1-603.
8. Singh, R.P. (2012). *Plant pathology*. India: Kalyani publishers. pp. 1-724.

9. Ravichandra. N.G.(2013).Fundamentals of plant pathology. PHI publishers. New Delhi.s

23HOR 202 Study Tour (0 + 1)

The students will undertake the short tour during third semester for seven days covering KVK's, Research stations and ICAR institutes in the southern part of Tamil Nadu. The study tour will provide an exposure to the students to know about the soil, climatic conditions and cropping patterns in the respective agro-climatic zones. The students will also have first-hand information on latest technologies on various crops and allied activities.

Practical:

Visit to places of commercial cultivation of flower crops, spices and plantation crops (other than coffee and tea) in Tamil Nadu – study of cropping system – varieties –adoption of scientific crop production technology – constraints in production –marketing – economic analysis.

Semester IV

S. No.	Course Code	Course Title	Credit Hours	Total Credits
1.	23FSC202	Dry land Horticulture	1+1	2
2.	23FSC203	Orchard and estate management	1+1	2
3.	23FLG202	Ornamental Horticulture	1+1	2
4.	23PSM201	Plantation Crops	2+1	3
5.	23AEN202	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Plants	2+1	3
6.	23AEC201	Economics and Marketing of Horticulture Crops	2+1	3
7.	23AEX201**	Communication Skills and Personality Development	1+1	2
8.	23PBG202**	Fundamentals of Plant Breeding	2+1	3
9.	23PAT202	Diseases of Fruit, Plantation, Medicinal and Aromatic Plants	2+1	3
		Total	14+9	23
10.	23NSS/NCC 101**	NSS or NCC	0+1#	1#
11.	23PED101**	Physical Education and Yoga Practices	0+1#	1#

23FSC202 Dry land Horticulture (1+1)

Course objective

- Outline the scope and importance of dry land horticulture
- Describe the production practices for dry land horticultural crops
- Define the various soil and water conservation measures
- Explain the techniques involved in fruit cultivation for dry land fruit crops
- Summarize the horticultural crops adapted for dry land cultivation

Course outcome

- Explain different cropping systems followed in dry land horticulture
- Recall different crops that are suitable to dry land areas
- Identify different dry land farming techniques
- Understand the present status of dry land horticulture
- Explain drought and erosion management problems

THEORY

Unit I - Introduction to dry land horticulture

Dry land horticulture – introduction and definition - Scope and importance of dry land horticulture - Characteristics of dry land horticulture - Dry climates and their classification - Problems of crop production in dry lands. Rainfall patterns in dry regions.

Unit II - Resource management

Drought - definition, types and management - Soil erosion - types, factors affecting erosion - Efficient cropping systems, normal and contingency crop planning under aberrant weather conditions. Evapo-transpiration – measures to reduce evaporation and transpiration.

Unit III - Watershed management

Watershed management – objectives and approaches, steps in watershed planning. Land use capability and classification. Soil and water conservation measures in watershed areas. Water harvesting and lifesaving irrigation. Problems and prospects under watersheds. Dry land horticultural crops based alternate land use systems.

Unit IV - Dry land fruit crops (aonla, ber, pomegranate, date palm, fig, phalsa and custard apple)

Composition and uses - origin and distribution - climate and soil requirements – varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds – special horticultural practices – use of plant growth regulators – harvest and yield-production constraints - post harvest handling.

Unit V - Dry land fruit crops (jamun, bael, wood apple, West Indian cherry, carissa and manila tamarind)

Composition and uses - origin and distribution - climate and soil requirements – varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds – special horticultural practices – use of plant growth regulators – harvest and yield-production constraints - post harvest handling.

Practical:

Analysis of rainfall, temperature and evaporation data and its interpretation. Study of dry farming implements, agronomic measures of soil and moisture conservation, mulches and antitranspirants. Preparation of contingent crop planning for aberrant weather conditions. Fertilizer use in dry land horticultural crops, inorganic, organic and biofertilizers. Collection of biometric data on crop and its interpretation. Study of varieties, propagation techniques, training and pruning for aonla and ber, pomegranate, fig and phalsa, custard apple, Jamun, bael and West Indian cherry, Carissa and manila tamarind. Assessment of maturity standards for dry land fruit crops. Visit to watershed areas and dry land fruit crop fields.

Theory lecture schedule

1. Dry land horticulture – introduction and definition - Scope and importance of dry land horticulture
2. Characteristics of dry land horticulture - Dry climates and their classification.
3. Problems of crop production in dry lands. Rainfall patterns in dry regions.

4. Drought - definition, types and management - Soil erosion - types, factors affecting erosion
5. Efficient cropping systems, normal and contingency crop planning under aberrant weather conditions. Evapo-transpiration – measures to reduce evaporation and transpiration.
6. Watershed management – objectives and approaches, steps in watershed planning. Land use capability and classification.
7. Soil and water conservation measures in watershed areas.
8. Water harvesting and lifesaving irrigation. Dry land horticultural crops based alternate land use systems.

9. Mid-Semester Examination

Composition and uses - origin and distribution - climate and soil requirements – varieties -spacing and planting patterns - cropping systems - management of nutrients, water, weeds – special horticultural practices – use of plant growth regulators – harvest and yield-production constraints - post harvest handling for the following crops:

10. Aonla
11. Ber
12. Pomegranate
13. Custard apple and fig
14. Date palm and Carissa
15. Jamun and Bael
16. Phalsa and West Indian cherry
17. Manila tamarind and wood apple

Practical schedule

1. Analysis of rainfall data and its interpretation.
2. Collection and interpretation of data on temperature and evaporation.
3. Study of dry farming implements.
4. Study of agronomic measures of soil and moisture conservation.
5. Study of mulches and antitranspirants.
6. Study of erosion problems in field.
7. Preparation of contingent crop planning for aberrant weather conditions.
8. Fertilizer use in dry land horticultural crops, inorganic, organic and biofertilizers.
9. Collection of biometric data on crop and its interpretation.
10. Study of varieties, propagation techniques, training and pruning for aonla and ber
11. Study of varieties and propagation techniques for pomegranate, fig and phalsa.
12. Study of varieties and propagation techniques for custard apple, Jamun, bael and West Indian cherry.
13. Study of varieties and propagation techniques for Carissa and manila tamarind.
14. Assessment of maturity standards for dry land fruit crops.
15. Practices in harvesting and postharvest handling of dry land fruit crops.
16. Visit to watershed areas and dry land fruit crop fields.
17. University practical examination.

Text Books

1. Chadha, K.L. (2019). Handbook of Horticulture. Vol. I (2nd revised edition). New Delhi: ICAR. pp 1 – 299.
2. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). New Delhi: Oxford & I.B.H. Publishing. pp. 1 – 452.
3. Panda, S.C. (2010). Agrometeorology and contingent crop planning. Jodhpur: Agrobios. pp. 1 – 574.
4. Panda, S.C. (2014). Dry land agriculture. Jodhpur: Agrobios.
5. Yellamanda Reddy, T. (2017). Dry land Agriculture: Principles and practices. New Delhi: Kalyani publishers.

23FSC203 Orchard and Estate Management (1+1)

Course objective

- Outline the orchard and estate management
- Recall practical experience on mulching, nutrient and cropping systems
- Understand the irrigation and soil management practices
- Describe the rejuvenation techniques
- Summarize the fruitfulness and unfruitfulness in fruit crops

Course outcome

- Paraphrase the objectives and importance of orchard and estate management
- Discuss the cropping systems
- Demonstrate the irrigation and soil management
- Describe the resource utilization methods
- Determine the crop models and crop regulation
- Recognize the orchard management

THEORY

Unit I - Introduction to orchard and estate management

Orchard and estate management, Importance and objectives; cultivation methods and their merits and demerits

Unit II - Mulching and cropping systems

Orchard and estate management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. Tropical, subtropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems.

Unit III - Irrigation and soil management

Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties.

Unit IV – Rejuvenation of orchards and resource utilization

Rejuvenation of old orchards, top working, frame working, Integrated nutrient and pest management. Utilization of resources, constraints in existing systems.

Unit V - Crop model and crop regulation

Crop model and crop regulation in relation to cropping systems, High Density Planting and canopy management in orchards, Climate aberrations and mitigation measures of Horticultural crops.

Practical:

Planning and layout of orchard - Orchard components- Records maintenance in orchard, different planting systems of orchard, Study of clean cultivation, Inter cropping systems in orchards, cover cropping, mixed cropping, filler crops in orchards-characteristics of a filler plant. Visit to different local fruit orchards. Study of use of organic and inorganic mulches in fruit orchard, layout of surface irrigation system, layout of sub-surface irrigation system, layout of overhead irrigation system, moisture conservation methods and observations on soil moisture content under mulches, Observations on weed growth under different systems of management, Use of different weedicides in orchards

Theory - Lecture Schedule

1. Definition of orchard and estate – Objectives and importance of orchard and estate management.
2. Planning - Layout of orchard- Planting methods - Vertical Row planting- Alternate row planting- Planting distance- Planting season.
3. Clean cultivation –Sod culture – Characteristics of ideal sod – Methods of growing – Types of sod culture – Sod pasture method – Sod mulch method –Temporary sod – Merits and Demerits.
4. Weed management in orchard – Cultural (mechanical) methods – Biological methods - Chemical methods – Guidelines for using herbicides in orchard – Herbicides used for weed control.
5. Mulching in orchard – Definition of mulch and mulching – Objectives of mulching –Types of mulches – Organic mulches - Inorganic mulches - Merits and Demerits of Mulching.
6. Cropping Systems – Tropical and subtropical Horticultural Systems – Mono cropping – Multiple cropping – Inter cropping – Factors determining choice of inter crop – Mixed cropping – Ratoon cropping – Multi story or Multi-tier cropping –Temperate Horticultural Systems – Medium High density planting – Optimum high density planting viz., - Tatura trellis – Pyramid system Cordon system – Curtain system – Hedge row system – Ultra High Density planting viz., Meadow orchard – Mechanized system – Intensive system.
7. Plant Interaction – Types of Interactions in cropping systems – Competitive interaction – above ground and below ground – Complimentary Interactions– Annidation in space and time Allelopathy and its effects.

8. Soil Management in relation to soil organisms – Ploughing and tillage – Continuous cultivation – crop rotation – Irrigation – Liming – Gypsum – Fertilizers and manures– Oil cakes – Soil Aggregation.

9. Mid - semester examination

10. Soil management in relation to Nutrient uptake – Soil physical conditions – Soil Fertility – Soil reaction – Climatic factors – Crop factors – Soil management in relation to water uptake – Soil water – Factors influencing infiltration – Soil properties –Tillage – Inter cultivation – Soil management on soil environment – Soil temperature and plant growth.
11. Systems of Irrigation – Surface systems. Merits and Demerits.
12. Sub surface systems – Merits and Demerits Over Head System – sprinkler system of irrigation – different types and mechanism- merits and demerits.
13. Integrated Nutrient Management (INM) – concept – need for INM – components of INM – mineral fertilizer – organic sources – biological sources – merits of INM -method of application of fertilizers in orchards – surface application –trench application – foliar application – fertigation and integrated pest management.
14. Rejuvenation of old orchard, top working and frame working – utilization of resources constraints in existing systems.
15. Crop models in horticulture crops, crop regulations in relation to cropping systems – crop regulation in Pine apple, Fig, Aonla, Bahar treatment, Citrus, Guava, Pomegranate.
16. High Density Planting in orchards, canopy management in Mango, Guava, Apple, Plum, Pear, Peach.
17. Climate aberration and mitigation measures of horticultural crops

Practical Schedule

1. Planning and layout of orchard - orchard components- Records maintenance in orchard
2. Planting and lay out of different planting systems of orchard
3. Study of clean cultivation
4. Study of Inter cropping systems in orchards
5. Study of cover cropping with suitable examples
6. Study of mixed cropping with suitable examples
7. Study of filler crops in orchards-characteristics of a filler plant
8. Visit to different local fruit orchards
9. Study of use of organic mulches in fruit orchard
10. Study of use of inorganic mulches in fruit orchard
11. Study on layout of surface irrigation system
12. Study on layout of sub-surface irrigation system
13. Study on layout of overhead irrigation system
14. Study of moisture conservation methods and observations on soil moisture content under mulches
15. Observations on weed growth under different systems of management
16. Use of different weedicides in orchards

17. University Practical Examination

Text Books

1. Dhillon, W.S. (2013). Fruit production in India. New Delhi: Narendra Publishing House. pp. 1 – 704.
2. Kumar, N. (2020). Introduction to Horticulture (7th revised edition). New Delhi: Oxford & I.B.H. Publishing. pp. 1 – 452.
3. Mazumdar, B.C. (2004). Principles and Methods of Orchard Establishment. New Delhi: Daya Publishing House. pp. 1 – 310.
4. Sharma, R. R. (2006). Fruit production, problems and solutions. Lucknow: IBDC.
5. Akash Kumar and H.S. Baweja. (2021). Text Book on Orchard and Estate Management. AkiNik Publication, New Delhi.

23FLG202 Ornamental Horticulture (1+1)

Course objective

- Understand the scope and importance of ornamental flower crops
- Describe the plant and non plant components
- Identify the flower crops
- Perform flower arrangements
- Perform the bonsai techniques
- Summarize the special types of garden

Course outcome

- Identify the ornamental plants
- Describe the plant and non plant components.
- Describe the different use of plants in a garden
- Interpret the bonsai techniques
- Recall the flower arrangement techniques.
- Identify different styles of garden.

Theory

Unit I - Importance and scope

Importance and scope of gardening – historical background - gardens in India – definition, principles and concepts of landscape gardening –aesthetic values- Floriculture industry, Importance, area and production, industrial importance of ornamental plants and flowers.

Unit II – Garden plants for landscaping

Study of foliage and flowering plants and their design and values in landscaping –general cultivation- ornamental annuals - shrubs - trees – herbaceous perennials – climbers and creepers – palms and palmatum- ferns and fernery – cacti and succulents-Indoor plants- Ornamental grasses and bulbous plants.

Unit III- Garden components

Garden components and adornments – importance and designing – plant components and non-plant components - rosary, topiary, trophy, rockery, pond, sunken garden, flower beds,

arboretum, conservatory, roads, walks, paths, hedges, edges, carpet garden, arch, pergola, arbour, fountains, cascades, garden seats, statues, hanging baskets, trellies, ornamental vases, ornamental urns and window boxes.

Unit IV – Special types of garden and lawn making

Special types of gardens - principles and design – dish, terrarium, water and bog garden, traffic islands, terrace garden, rockery, vertical garden, thematic gardens and tree transplanting- Lawn types- establishment and maintenance.

Unit V – Flower arrangement and bonsai making

Flower arrangement – principles, designs and styles –ikebana, moribana - bouquet making - bonsai - methods, styles and maintenance.

Practical:

Identification and description of annuals, biennials and herbaceous perennials, trees and shrubs, climbers and ground covers, palms, cycads, ferns and selaginellas, cacti, succulents and Indoor plants. Description and designing of garden components. Planning and designing of hedge, edge and rockery, water garden, carpet bedding, shade garden and roof garden, terrariums, vertical garden, lawn, different types of flower arrangement, floral bouquets, bonsai. Preparation of floral rangoli and veni. Visit to nurseries and floriculture units

Theory - Lecture Schedule

1. History, development, scope and importance of gardening.
2. Definition and basic principles of gardening.
3. Study of annuals and herbaceous perennials in landscape gardening.
4. Study of trees, shrubs and their role in landscape Gardening.
5. Study of climbers and ground covers in landscape gardening.
6. Study of palms and cycad, ferns and selaginellas.
7. Study of cacti and succulents.
8. Study of indoor plants, ornamental grasses and bulbous plants.

9. Mid- Semester Examination

10. Study of principles and designing of plant components.
11. Study of principles and designing of nonplant components.
12. Study of special types of gardens - dish, terrarium, water garden and bog gardens.
13. Study of special types of gardens – roof garden, rockery, vertical garden, thematic gardens and traffic islands.
14. Principles and method of tree transplanting – Burlapping.
15. Lawn types, establishment and maintenance.
16. Study of principles and methods of flower arrangement.
17. Study of styles and types of bonsai making.

Practical Schedule

1. Identification and description of annuals, biennials and herbaceous perennials.
2. Identification and description of trees and shrubs.

3. Identification of climbers and ground covers.
4. Identification of palms, cycads, ferns and selaginellas.
5. Identification of cacti, succulents and Indoor plants.
6. Description and designing of garden components – arches, bowers, pergolas, paths, walks, bridges, fountains and statues.
7. Planning and designing of hedge, edge and rockery.
8. Planning and designing of water garden, carpet bedding, shade garden and roof garden.
9. Planning and designing of terrariums.
10. Planning and designing of vertical garden.
11. Planning and designing of lawn.
12. Practice of different types of flower arrangement.
13. Preparation of floral bouquets.
14. Designing and practice of bonsai.
15. Preparation of floral rangoli and veni.
16. Visit to nurseries and floriculture units

17. University Practical examination.

Text Books

1. Arora, J.S. (2006). Introductory Ornamental Horticulture. Ludhiana: Kalyani Publishers. (pp.1-188).
2. Bhattacharjee, S.K. (2004). Landscape Gardening and Design with plants. Jaipur : Aavishkar Publishers and Distributors.
3. Dharmendra Kaulani and Arati Joshi. (2018). A textbook of Ornamental Horticulture. Nepal, Heritage Publishers.
4. Peter, K. V. (2009). Ornamental plants. New Delhi: New India publishing agency.
5. Prasad, S. and U. Kumar. (2013). A handbook of Floriculture. Jodhpur: Agrobios.

23PSM201 Plantation crops (2+1)

Course objective

- Outline the scope and importance of plantation crops
- Describe the production technology of important plantation crops
- Define the nursery management and propagation techniques of plantation crops
- Define the field management of plantation crops
- Summarize the post-harvest technology and processing of plantation crops

Course outcome

- Recall the commercial production techniques of plantation crops that can be adopted to specific geographical region
- Perform nursery management of various plantation crops
- Perform propagation techniques of various plantation crops
- Describe the management for package of practices for plantation field

- Perform harvest and post-harvest technique of various plantation crops
- Explain the plantation field and work out the benefit of cost ratio of plantation crops

THEORY

Unit I – Introduction to plantation crops

History, status, scope and importance of plantation crops – area and production - National and State scenario - export and import – Role in national economy – Role of commodity board and other organizations – Industrial importance and byproduct utilization – GAP – Organic production- Carbon sequestration potential.

Unit II – Production technology of coffee, tea and cocoa

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation– seed and vegetative propagation and planting systems - methods – irrigation and nutrient management - weed control –training - pruning - mulching - shade regulation – application of growth regulators – soil management – liming - Special horticultural practices – handling –harvest and yield.

Unit III - Production technology of rubber and cashew

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation– seed and vegetative propagation and planting systems - methods –gap filling - irrigation and nutrient management - weed control – training - pruning - mulching - cover cropping - shade regulation –application of growth regulators - Special horticultural practices – top working – HDP in cashew - handling –harvest and yield

Unit IV - Production technology of coconut and arecanut

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation– nursery management - planting systems and methods – multi-tier cropping systems - gap filling – irrigation, nutrient and micronutrient management - weed control – soil & water conservation measures - mulching - intercropping - application of growth regulators – harvest and yield

Unit V - Production technology of oil palm, palmyrah and post harvest handling

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation– seed and vegetative propagation - planting systems and methods –gap filling - irrigation and nutrient management - weed control – training - pruning - mulching -application of growth regulators –harvest and yield - post harvest handling - processing – value addition and storage of plantation crops.

Practical:

Training and pruning in coffee. Preparation of cuttings and rooting under specialized structure in Tea. Training, centering, pruning, tipping in Tea. Harvesting and processing of Cocoa and Palmyrah. Practice in grafting techniques, HDP and top working in Cashew. Tapping of latex and processing of rubber. Description and identification of Coconut and Arecanut varieties. Preparation of nursery and nursery management, nutritional disorders, Root feeding of Coconut. Preparation of nursery and its management in Arecanut. Working out cost economics of

Coconut/Cashew/Rubber. Visit to Coffee board and Coffee Plantation / Tea board and Tea Plantation. Visit to Research station/ farmers field. Visit to Rubber plantation and processing unit

Theory – Lecture Schedule

1. Plantation crops – history, scope and importance – state, national and global scenario of plantation crops - Area and production of plantation crops- Industrial importance and byproduct utilization.
2. Export and import potentials – role in national and state economy – institutions and commodity boards involved in research and development of plantation crops.
3. GAP for plantation crops, organic production of plantation crops, Carbon sequestration potential.
4. Coffee - Introduction, origin and distribution, area and production, soil, climate, species and climatological differences in arabica and robusta, varieties and propagation.
5. Coffee - Preparation of main field, planting, shade management, irrigation and manuring
6. Coffee - Training and pruning, inter cultural practices, digging, scuffling or soil stirring, trenching, mulching, weeding, liming, flowering- season of flowering, fruit set and control of premature fruit drop, bean disorders.
7. Coffee - Cropping pattern and harvest – types of harvest, processing – preparation of parchment coffee, cherry coffee, types of beans – elephant bean, pea berry, yield and storage.
8. Tea - Introduction, origin and distribution, area and production, types of tea- assam, china and cambod hybrid, soil, location, climate and varieties.
9. Tea - Propagation, method of planting, planting season, mulching, weeding, shade and its management.
10. Tea - Training and pruning, manuring, liming, application of zinc sulphate, irrigation
11. Tea - Leaf plucking, yield of leaves, processing, grading and packing.
12. Cocoa - Introduction, area and production, origin and distribution, uses, varieties, classification, climate, soil, propagation – seed and vegetative propagation.
13. Cocoa - Preparation of land, provision of shade, spacing, planting, shade regulation and inter cropping.
14. Cocoa - Irrigation, manuring, weeding, types of branching, pruning, top-working harvesting, and physiological disorder- cherelle wilt.
15. Cocoa - Processing - fermentation, drying- sun drying, artificial drying, storage of kernels, cocoa products/ byproducts.
16. Rubber - Introduction, origin and distribution, area and production, uses, climate and soil, varieties and types of clones, propagation- seeds, vegetative methods, bud wood nursery for stump planting, planting – season, spacing, manuring, cover crops, irrigation, weeding.

17. Mid-Semester Examination

18. Rubber - Types of planting material, improved clones and polyclonal seed garden, tapping, tapping systems, puncture tapping, slaughter tapping, use of growth regulators for latex flow, rain guarding, latex collection, yield of latex, processing and storage.

19. Cashew Nut - Introduction, area and production, origin and distribution, uses, climate, soils, varieties/ hybrids, propagation – seed, vegetative propagation, epicotyl and softwood grafting and cuttings.
20. Cashew Nut - Planting, HDP, irrigation, weeding, manuring and nutrient deficiency
21. Cashew Nut - Training and pruning, top-working, flowering – season, type of flowers, pollination, fruit and nut development, fruit drop, harvesting and yield.
22. Cashew Nut - Processing methods – CNSL extraction, grading and packing.
23. Coconut- Introduction, importance, area and production, origin and distribution, uses, varieties-tall x dwarf hybrids (TXD), dwarf x tall hybrids (DXT), tall x tall hybrids (T X T).
24. Coconut- Soil, climate, propagation – seed propagation, selection of seed nuts, selection of mother palm, collection of seed nuts, nursery site selection and preparation, sowing of seed nuts, management of nursery, selection of seedling for planting, preparation of pits, spacing and planting,
25. Coconut- planting systems, care of young palm, irrigation, soil moisture conservation, manuring and fertilization, methods of application of fertilizer application and weeding cropping system, physiological disorder, harvesting, yield, storage, deficiency disorders – crown choke and Products / by products.
26. Arecanut - Introduction, importance, area and production, origin and distribution, uses, varieties, soil, climate, nursery raising techniques- selection of mother palms, seed nut selection, primary and secondary nurseries and selection of nursery plant material.
27. Arecanut - Establishment of plantation – spacing, season of planting, plantation management- inter cultural operations- manuring, irrigation, weeding, cropping system, harvesting, processing- dried ripe nuts, chali and kalipak, scented supari, and products/byproducts
28. Oil Palm - Introduction, importance, area and production, origin and distribution, uses - varieties, classification based on fruit structure, seed propagation, nursery practices, raising nursery, climate – sunshine and temperature requirement – oil palm growing areas.
29. Oil Palm - Soil- types of soils for oil palm growing regions, spacing, planting, irrigation, manuring, weeding and mulching, pruning, flowering and pollination, ablation, physiological disorder.
30. Oil Palm - Harvesting, yield and processing – extraction of oil from mesocarp and kernel, products/ byproducts.
31. Palmyrah - Introduction, importance, area and production, origin and distribution, uses, varieties – black and red skin fruit, male and female palms differentiation, soil and climate, propagation – raising nursery-Pre-treatment of seeds, nursery practices – raising seedlings in situ, in mound nursery bed and in masonry bed, transplanting
32. Palmyrah - cultural practices – tending, irrigation, fertilization, tapping, harvesting, yield, processing and products / byproducts.
33. Post harvest handling in plantation crops
34. Processing and value addition of plantation crops

Practical Schedule

1. Training and pruning in coffee.
2. Preparation of cuttings and rooting under specialized structure in Tea
3. Training, centering, pruning, tipping in Tea
4. Harvesting and processing of Cocoa
5. Practice in grafting techniques, HDP and top working in Cashew
6. Tapping of latex and processing of rubber
7. Description and identification of Coconut and Arecanut varieties
8. Preparation of nursery and nursery management of Coconut
9. Study of nutritional disorders and correction in Coconut
10. Root feeding of coconut tonic in Coconut
11. Preparation of nursery and its management in Arecanut
12. Working out cost economics of Coconut/Cashew/Rubber
13. Harvest and processing of Palmyrah
14. Visit to Commodity boards
15. Visit to Research station/ farmers field
16. Visit to plantation and processing unit
17. **University Practical examination**

Text Books

1. Kumar, N. (2018). Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. CBS Publishers; 2nd edition. pp.1-351.
2. Parthasarathy, V.A., P.K. Chattopadhyay and T.K. Bose. (2006). Plantation Crops. Vol I and II. Parthasankarbasu, NayaUdyog, Kolkata. pp. 1-1050.
3. Ponnuswami, V., Kumar, M., Arumugom, V., Ramesh Kumar, S., and Krishnamoorthy, S. (2015). Text Book on Fruit & Plantation Crops. Narendra Publishing House. pp.1-302.
4. Bijendra Singh. (2020). Cultivation of fruits and plantation crops. Rama Publishing house. Uttar Pradesh
5. Parthasarathy, V.A., P.K. Chattopadhyay and T.K. Bose. (2006). Plantation Crops. Vol II and II. Parthasankarbasu, NayaUdyog, Kolkata.

23 AEN 202 Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops (2+1)

Course objective:

- Outline of insect ecology, pests category and cause of pest outbreak
- Describe the economic threshold level (ETL) and economic injury level (EIL), IPM components
- Discuss on cultural, physical, mechanical, legal methods biological and chemical methods of pest control
- Identify the pests of fruit crops, plantation and aromatic crops and their management
- Obtain basic information on major medicinal crop pest and their management

Course outcome :

- Recall the skills on management of fruit crops
- Summarize the bio rational pest management
- Understand the biotechnological pest management methods
- Identify the pests fruit crops, plantation and aromatic crops and their management
- Describe the techniques of major medicinal crop pest and their management
- Explain the Insecticide residue problem in fruits, plantations, medicinal and aromatic crops and their tolerance limits

THEORY**Unit I: Insect ecology and components of pest management**

Insect Ecology- Effect of abiotic and biotic factors on insect population. Pest – definition, categories of pests, factors governing pest outbreaks. Concept of economic threshold level and economic injury level. Principles and components of Pest management

Unit II: Methods of pest control

Cultural, physical, mechanical and legal methods of pest control. Biological control–parasitoids, predators, viruses, bacteria, fungi and nematodes and their role in insect management. Host plant resistance – Types and mechanisms of Resistance. Chemical control – Classification of pesticides, role of insecticides in pest management. Biorational pest management – Semiochemicals – pheromones, allomones, kairomones and synamones – role of pheromones in Pest Management. Insect growth regulators – moult inhibitors, JH mimics, insect antifeedants, repellants and botanicals in pest management. Biotechnology in pest management.

Unit III: Pests of fruits

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Guava, Sapota, Citrus, Banana, Grapevine, Jack, Jamun, Aonla, Pomegranate, Papaya, Ber, Apple, Pear, Peach and Plum, Pineapple.

Unit IV: Pests of plantation crops, medicinal and aromatic plants

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of coconut, arecanut, oilpalm, cinchona, coffee, tea, cashew, rubber, cocoa, cardamom, pepper, betelvine, aswagantha, senna, hemp, Belladonna, pyrethrum, camphor, costus, croton, datura, dioscorea, mint, opium, *Solanum viarum*, Tephrosia, neem, teak, subabul, eucalyptus.

Unit V: Stored product pests

Storage insects, distribution, host range, bioecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed

products. Insecticide residue problem in fruits, Plantations, medicinal and aromatic crops and their tolerance limits.

Practical:

Study of pests of mango, citrus, guava, sapota, banana, grapevine, jamun, pomegranate, anola, ber, pineapple, papaya, apple, pear, peach, plum, coconut, arecanut, oilpalm, coffee, tea, Cashew, rubber, cocoa, ashwagandha, Senna, cardamom, pepper, betelvine, pyretrum, camphor, mint, optimum neem, eucalyptus, dry fruits, nuts and other horticultural products.

Assignment

1. Collection and submission of 50 pests of fruits and plantation and aromatic crops.
2. Rearing a minimum of 20 insect pests and preparation of two riker mounts

Theory – Lecture Schedule

1. Insect Ecology- Effect of abiotic and biotic factors on insect population. Pest – definition, categories of pests, factors governing pest outbreaks.
2. Concept of economic threshold level and economic injury level.
3. Principles and components of pest management.
4. IPM -Cultural, physical, mechanical and legal methods of pest control.
5. Biological control–parasitoids, predators, viruses, bacteria, fungi and nematodes and their role in insect management.
6. Host plant resistance – Types and mechanisms of resistance
7. Chemical control – Classification of pesticides, role of insecticides in pest management.
8. Biorational pest management – Semiochemicals – pheromones, allomones, kairomones and synamones – role of pheromones in pest management.
9. Insect growth regulators – moult inhibitors, JH mimics, insect antifeedants, repellants and botanicals in pest management.
10. Biotechnology in pest management.
11. Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Sapota, Guava
12. Pests of Citrus
13. Pests of Banana, Grapevine, Jack, Jamun and Aonla
14. Pests of Pomegranate, Papaya, Ber and Pineapple
15. Pests of Apple, Pear, Peach and Plum
16. Pests of Coconut
- 17. Mid- semester examination**
18. Pests of Arecanut, Oilpalm
19. Pests of Coffee and Cinchona
20. Pests of Tea
21. Pests of Cashew
22. Pests of Rubber

23. Pests of Cocoa
24. Pests of Cardamom
25. Pests of Pepper and betelvine
26. Pests of Aswagantha and senna
27. Pests of Hemp and Belladonna
28. Pests of Pyrethrum, Camphor, Costus and Crotolaria
29. Pests of Datura, Dioscorea, Mint and Opium
30. Pests of Solanum viarum and Tephrosia
31. Pests of Neem, Teak, Subabul and Eucalyptus.
32. Storage insects, distribution, host range, bioecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products.
33. Insecticide residue problem in fruits, plantations, medicinal and aromatic crops
34. Insecticide residue tolerance limits in fruits, plantations, medicinal and aromatic crops

Practical Schedule

1. Pests of mango
2. Pests of citrus
3. Pests of guava and sapota
4. Pests of banana, grapevine and jamun
5. Pests of pomegranate
6. Pests of anola, ber, pineapple and papaya
7. Pests of apple, pear, peach and plum
8. Pests of coconut, arecanut and oil plam
9. Pest of coffee and tea
10. Pests of cashew, rubber and cocoa
11. Pests of aswagantha and senna
12. Pests of cardamom, pepper and betelvine
13. Pests of pyrethrum and camphor
14. Pests of mint and optium
15. Pests of neem and eucalyptus
16. Pests of dry fruits, nuts and other horticultural products
17. Final Practical Examination

Textbooks

1. David, B.V. (2006). Elements of Economic Entomology. Popular Book Depot, Chennai.pp1-562.

2. Butani, D.K. (2009). Insects and Fruits. Periodical Expert Book Agency, New Delhi.pp1-415.
3. Shravan M Haldhar and Sushil K Maheshwari. (2018). Insect-Pests Management in Arid and Semi-arid Horticultural crops published by ICAR-Central Institute for Arid Horticulture, Bikaner (Rajasthan).pp1-345
4. Rangaswamy Muniappan, Merle Shepard,B and Gerald Carner . (2012). Arthropod pest of horticultural crops in tropical Asia, CABI publication. Pp1-356.
5. Ajay Kumar and Pramod Mall Pandey. (2016). Insect Pests Management of Fruit Crops. Pandey Publisher, New Delhi.

23AEC 201 Economics and Marketing of Horticultural Crops (2+1)

Course objectives:

- To study the significance of horticulture in economic development.
- Expose the students to economics principles and their applications.
- Train the students in economics tools for horticulture decision making
- Students will use economic models in domestic and global contexts to analyze individual decision making, how prices and quantities are determined in product and factor markets, and macroeconomic outcomes.

Course outcome:

- Students will gain knowledge in application of economics tools for horticulture decision making.
- Students will be able to understand the links between household behaviour and the economic models of demand
- Students will use data to describe the relationships among variables in order to analyze economic issues.
- Students will get knowledge of market activities and behaviour: production, distribution, selling, purchasing etc. in relation to horticulture.

Theory

Unit-I Scope of Economics and consumer behaviour

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behaviour, laws of consumption, classification of goods. Wants – their characteristics and classification,

Unit-II Theory of Consumption

Utility and its measurement, cardinal and ordinal, law of diminishing marginal utility, law of equi-marginal utility, indifference curve and its properties, consumer equilibrium. Theory of demand, demand schedule and curve, market demand. Price, income and cross elasticity's, Engel's law of family expenditure – consumer's surplus. Law of supply – supply schedule and elasticity's.

Unit-III Factors production and Macro Economic theory

Factors of production – land and its characteristics, labour and division of labour, theories of population. Capital and its characteristics – classification and capital formation. Enterprises – forms of business organization– merits and demerits. National income: Meaning and importance, concepts of national income accounting and approaches to measurement, Money: meaning and functions of money, classification of money, inflation, Tax: meaning, direct and indirect taxes, VAT/GST.

Unit-IV Theory of Distribution and Marketing

Market equilibrium, distribution – theories of rent, wage, interest and profit. Price determination under various market structures. Marketing- definition – Marketing Process – Need for marketing – Role of marketing — Marketing functions – Classification of markets – Marketing of various channels – Price spread – Marketing Efficiency – Integration – Constraints in marketing of agricultural/Horticultural produce.

Unit-V Marketing Analysis and Finance

Market intelligence – Basic guidelines for preparation of project reports- Bank norms – Insurance– SWOT analysis – Crisis management. Agricultural Finance- meaning, Agricultural credit: meaning, definition, need, classification. Institutional and non-institutional sources, commercial banks and nationalization of commercial banks, Micro financing including KCC. RRBs, RBI, NABARD, World Bank, Credit analysis: 3R's, 7P's and 3C's of credits.

Practical

Law of Diminishing Marginal Utility, Equi-marginal Utility, Indifference Curve analysis, Individual and market demand, Estimation of Consumer surplus, Measurement of National Income, Types and functions of money. Market structure and Price determination Perfect Competition- Monopoly-Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value-added products. Identification of marketing channel– Calculation of Price Spread – Identification of Market Structure – Visit to different Markets, Visit to credit agencies.

Theory Lecture schedule

1. Nature and scope of economics, definition and concepts, Divisions of economics
2. Economic systems, approaches to the study of economics.
3. Consumption – theory of consumer behaviour, laws of consumption, classification of goods.
4. Wants – their characteristics and classification,
5. Utility and its measurement, cardinal and ordinal,
6. Law of diminishing marginal utility, law of equi-marginal utility,
7. Indifference curve and its properties, consumer equilibrium.
8. Theory of demand, demand schedule, market demand.
9. Elasticity of demand- Price, income and cross elasticity's,
10. Engel's law of family expenditure – consumer's surplus.
11. Law of supply – supply schedule and curve elasticity's.
12. Factors of production – land and its characteristics, labour and division of labour, theories of population.

13. Capital and its characteristics – classification and capital formation, Enterprises – forms of business organization– merits and demerits.
14. National Income: Meaning and Importance & concepts
15. National income accounting and approaches to measurement
16. Money: Meaning and functions of money, classification of money, inflation
17. **Mid Semester Examination**
18. Tax: meaning, direct and indirect taxes, VAT/GST
19. Theory of distribution – theories of rent, wage, interest and profit.
20. Price determination under various market structures.
21. Marketing- definition –Need for marketing – Role of marketing of agricultural/horticultural commodities.
22. Marketing functions – Classification of markets
23. Marketing of various channels for fruits – Price spread – Marketing Efficiency
24. Marketing of various channels for Vegetables– Price spread – Marketing Efficiency
25. Integration – Constraints in marketing of agricultural produce
26. Market intelligence – Basic guidelines for preparation of project reports
27. Bank norms – Insurance, SWOT analysis – Crisis management.
28. Agricultural Finance- meaning, Agricultural credit: meaning, definition, need, classification.
29. Institutional and non-institutional sources of credit-Merits and demerits
30. Co-operative credit institutions/RRB
31. Commercial banks and nationalization of commercial banks
32. Micro financing including KCC, SHG
33. Higher financing institutions- RBI, NABARD, World Bank,
34. Credit analysis: 3 R's, 7P's and 3C's of credits.

Practical Schedule

1. Law of Diminishing Marginal Utility.
2. Law of Equi - Marginal Utility.
3. Indifference Curve analysis - Properties, budget line and consumer equilibrium.
4. Individual and market demand - Graphical derivation of individual and market demand.
5. Estimation of Consumer surplus.
6. Computation of National Income
7. Types and functions of money
8. Market Structure and Price determination-Perfect competition
9. Market Structure and Price determination-Monopoly
10. Preparation of Bankable projects for various agricultural/horticultural products and its value added products.
11. Identification of marketing channel for the horticultural commodities
12. Calculation of Price Spread
13. Visit to various markets
14. Visit to various markets

15. Visit to PACCS/RRB
16. Visit to Commercial Bank

17. Practical Examination

Textbooks

1. Kotler Philip and Armstrong, (2021). Principles of Marketing. Prentice-Hall, India
2. Jhingan, M.L. (2012). Macro-Economic Theory. Vrinda publishers, New Delhi.
3. SS Acharya and N L Agarwal. (2005). Agricultural Marketing in India. Oxford and IBH Publishing Co. Pvt. Ltd ,New Delhi
4. Sampat Mukherjee. (2002). Modern Economic Theory. New Age International. Karnataka
5. Subba Reddy, S., P. Raghu Ram, T.V. Neelakanta Sastry, and I. Bhavani Devi. (2010), Agricultural Economics, Oxford & IBH Publishing Co. Private Limited, New Delhi

23AEX201 Communication Skills and Personality Development (1+1)

Course Objective

- Explain the communication skills across settings, purposes, and audiences.
- Describe the knowledge of communication theory and application.
- Discuss critical thinking to develop innovative and well-founded perspectives related to the students' emphases.
- Describe to maintain healthy and effective relationships
- Interpret communication technology effectively in various settings and contexts.

Course Outcome

- Explain critical and innovative thinking
- Identify competence in oral, written, and visual communication
- Recognize effectively to cultural communication differences.
- Describe communicate ethically
- Demonstrate positive group communication exchanges.

THEORY

Unit I - Communication Skills

Communication Skills: meaning and process of communication, verbal and nonverbal communication

Unit II - Listening

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

Unit III - Reading

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting

Unit IV - Speaking

Individual and group presentations, impromptu presentation, public speaking

Unit V - Discussion

Group discussion. Organizing seminars and conferences.

Practical

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

Theory lecture Schedule

1. Communication – meaning and process –Functions and Types of communication
2. Communication models - Aristotle, Shannon and Weaver, Schramm, Berlo Westly and Maclean, Leagan, Rogers and Shoemaker, Littererls model and Dance’s Helical Model – Elements of communication – communication barriers
3. Verbal and Non verbal communication – Verbal communication – definition and meaning – Verbal vs Oral communication – Types – Styles - Barriers to effective verbal communication ;
4. Non verbal communication – definition and meaning – Proxemics, Chronemics, Movement and body position, Posture, Facial Expression, Gestures and Eye Contact – importance of non verbal communication
5. Listening – Definition – Listening vs Hearing – Active listening – Types of listening – Guidelines for effective listening – Developing listening skills - Barriers to listening – Listening misconceptions
6. Writing skill – Importance – Effective writing - Components of writing : Introduction , Audience and format ,Composition and style, Structure, Grammatical errors , Proofing and Conclusion – Ways to improve writing skills – Technical writing
7. Oral presentation skills – Basics of effective oral presentation: Planning , preparing (Introduction, Body and conclusion), Delivery, Body language and Handling anxiety – Strategies for giving oral presentation
8. Field diary – Definition – Components to be included – Parts of field diary – Field diary in social sciences

9. Mid semester examination

- 10.Lab record: Definition –Importance of keeping a lab record - Features of a lab record - Contents of lab record – Guidelines for keeping a lab record

11. Indexing – Definition – Importance – Types of indexing with advantages and limitations
12. Footnote and Bibliographic procedure : Footnote system of citation ; Bibliographic procedures : Citation in Text, Citation in Journal, Citation from Book(One author / Multiple authors), Citation from an Edited Book, Citation of Seminar/Conference Proceedings, Citation from Institutional Publication, Citing Government Publications, Abbreviations for Names of Journals, Paraphrasing, Abbreviations in citations (Art of publication)
13. Reading skills – Definition – Kinds of reading skills – Critical reading skills – Reading readiness skills- Guidelines for effective reading- Extensive reading- Intensive reading. Comprehension : Definition and meaning – Comprehension skills-Readability Index
14. Precise writing – Derivation and Meaning – Skills required – Method or procedure – Guidelines; Summarising – Meaning- Steps to write a summary
15. Abstracting : Definition - Purpose of abstract – Types of abstract - Abstract Styles – Steps for Writing Effective Abstracts- Some Do's Don'ts in preparing abstracts
16. Individual presentation - Meaning –Steps for individual presentation; Group presentation – Meaning – Stages of group presentation ; Impromptu presentation
17. Public speaking : meaning – Points to be considered in public speaking – Effective public speaking: Group Discussion: Meaning –Procedure – Advantages – Limitations ;Seminar Conferences : Definition and meaning – Steps in organizing seminar / conferences / symposium / workshop

Practical Schedule

1. Practicing active listening
2. Exercise on note taking methods
3. Exercise on technical writing and practicing proof correction
4. Practicing oral presentation
5. Exercise on writing field diary and Lab record
6. Visit to library and learn indexing
7. Exercise on preparing foot notes and citations
8. Practice on effective reading skills

9. Comprehension of technical article
10. Comprehension of general article
11. Exercise on precise writing
12. Practice on summarizing articles
13. Practice on preparing abstracts
- 14&15 Developing skill on individual presentation
16. Developing skill on group presentation

17. University Practical Examination

Textbooks

1. G.L. Ray and Sagar mondal. (2010). Journalism –Farm journalism and communication skills. Kalyani publishers, New Delhi
2. Sagar Mondal. (2016). Agricultural extension , Kalyani publishers, New Delhi
3. G. L. Ray. (2007). Extension Communication and Management , Kalyani publishers, New Delhi
4. Jagdeeshan, M. (2021). Communication Skills and Personality Development, New India Publishing Agency, New Delhi.
5. Dhenge, S.A. and Patel. (2018). Communication Skills and Personality Development, Scientific publishers, New Delhi.

23PBG 202 FUNDAMENTALS OF PLANT BREEDING (2+1)

Course objective:

- Describe the reproductive system of crop plants and their importance in plant breeding
- Summarize the knowledge on breeding methods for crop plants according to the mode of pollination
- Discuss the utilization of special breeding methods in crop plants
- Describe the importance of maintenance breeding in crop improvement
- Outline the trait introgression protocols in crop breeding

Course outcome:

- Demonstrate the Plant breeding methods
- Illustrate the development of hybrids
- Recall the breeding methodologies to develop new traits
- Illustrate trait transfer to new genetic background

- Outline the new trends in crop improvement

THEORY

Unit I- Reproductive systems in plant breeding

Objectives and role of plant breeding – historical perspective – activities in Plant Breeding. Centres of origin – contribution of Vavilov, Harlan, and Zhukovsky – law of homologous series. Plant genetic resources – importance – germplasm – types – activities – gene erosion – gene bank – collection – conservation – types of conservation. Germplasm: evaluation – use of descriptors, documentation, utilization; Agencies – national and international; germplasm exchange – quarantine. Modes of reproduction – sexual – asexual – mechanisms promoting self and cross-pollination – significance of pollination. Self-incompatibility – classifications – mechanisms – application – measures to overcome and limitations. Sterility – male sterility – introduction – classification – CMS, GMS, CGMS -inheritance and applications. EGMS – TGMS, PGMS, Gametocides, Transgenic Male sterility and applications. Apomixis – introduction – classification – applications; Parthenocarpy and its types. Polygenic variation- components of variance – phenotypic, genotypic and environmental variance-heritability and genetic advance-combining ability-gene action-mating designs.

Unit II- Breeding methods of self-pollinated crops

Plant introduction as a breeding method – types of introduction – objectives – quarantine – acclimatization – achievements – merits and demerits. Genetic basis of self-pollinated crops – Vilmorin's principle of progeny selection – Johannsen's pure line theory. Breeding methods for self-pollinated crops without involving artificial hybridization: Pure line selection – procedure – merits and demerits – achievements; Mass selection– procedure – types – merits and demerits achievements- comparison of mass and pure line selection. Breeding methods of self-pollinated crops involving artificial hybridization: Creating variability in self-pollinated crops – Hybridization and selection – objectives – steps in hybridization – choice of parents – kinds of emasculation – hybridization- transgressive breeding. Handling segregating generations- Pedigree breeding – procedure – mass, pedigree – merits – demerits – achievements; Bulk breeding – procedure – merits – demerits – achievements. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – procedure – application – merits and demerits. Backcross breeding – genetic basis — procedures for transferring dominant and recessive genes. Back cross-breeding – merits – demerits – multilines- types- procedure- merits and demerits.

Unit III- Breeding methods of cross-pollinated crops and clonally propagated crops

Genetic structure of a population in cross pollinated crops – Hardy Weinberg law – gene frequencies in random mating population. Breeding methods of cross-pollinated crops without involving artificial hybridization: Mass selection in cross-pollinated crops – modified mass selection – Grid selection – progeny selection. Breeding methods of cross-pollinated crops involving artificial hybridization: Recurrent selection principles – types – merits and demerits. Heterosis breeding – theories – genetic basis – hybrid vigor – estimation of heterosis – inbreeding

depression. Heterosis breeding – procedure – development of inbreds- evaluation of inbred lines – top cross method and single cross method-prediction of double cross performance- hybrids – single cross- double cross- three-way cross hybrids. Achievements – merits and demerits. Synthetics and composites - steps in the development of synthetics and composites – achievements – merits and demerits. Genetic characters of asexual reproduction – clonal selection – hybridization and clonal selection – merits and demerits – achievements.

Unit IV- Special breeding methods

Polyploidy breeding – classification – induction of polyploidy - achievements – limitations. Wide hybridization-importance-barriers and techniques for overcoming barriers-utilization- Pre breeding. Mutation breeding: mutation – types – mutagens – breeding procedure – achievements – limitations. Concepts in biotic stress resistance breeding- diseases and pests - gene for gene hypothesis-mechansims of resistance - sources of resistance- multilines-gene pyramiding-gene deployment. Concepts in abiotic stress resistance breeding- drought mechanisms of drought resistance – the basis of drought resistance- morphological and physiological characters- sources of drought resistance-breeding methods.

Unit V- Varietal release, maintenance breeding, markers and IPR

Procedure for release of new varieties-stages in seed multiplication-steps in nucleus and breeder seed production. Introduction to markers – morphological – biochemical- DNA markers – advantages and disadvantages- QTL mapping- marker-assisted selection in plant breeding. Participatory plant breeding- Intellectual Property Rights- Patenting- Plant Breeders and Farmers Rights.

PRACTICAL

Reproduction in plants - Alternation of generation and life cycle. Mode of pollination - Mechanisms enforcing self and cross-pollination in crops- Working out the extent of natural outcrossing. Breeder's kit and its components. Basic techniques for selfing and crossing in crop plants. Emasculation and pollination techniques in field crops. Emasculation and pollination techniques in horticultural crops. Handling of segregating populations- Layout of different yield trials-maintenance of records. Study of Cytoplasmic genic male sterility system in horticultural crops. Study of Genic male sterility system in crops. Mutagenesis study using physical and chemical mutagens. Germplasm collection and conservation. Experimental designs used in plant breeding-RBD analysis. Calculation of mean, range, PCV, GCV, heritability, and genetic advance. Estimation of heterosis and prediction performance of double cross hybrids. Screening techniques for biotic stresses and abiotic stresses.

Theory Lecture schedule

1. Objectives and role of plant breeding - historical perspective – central dogma of plant breeding-phases of plant breeding. Centers of origin – contribution of Vavilov, Harlan, and Zhukovsky – law of homologous series.

2. Plant genetic resources – importance – germplasm – types – activities – gene erosion - gene bank – collection - conservation – types of conservation.
3. Germplasm: evaluation – use of descriptors, documentation, utilization; Agencies – national and international; germplasm exchange – quarantine.
4. Modes of reproduction – sexual – asexual – alternation of generation - mechanisms promoting self and cross-pollination – the significance of pollination.
5. Self-incompatibility – classifications – mechanisms – application – measures to overcome limitations.
6. Sterility – male sterility – introduction – classification – CMS, GMS, CGMS – inheritance, and applications.
7. EGMS - TGMS, PGMS, Gametocides, Transgenic Male sterility and applications.
8. Apomixis – introduction – classification-applications; Parthenocarpy and its types.
9. Polygenic variation-components of variance - phenotypic, genotypic and environmental variance-heritability and genetic advance
10. Plant introduction as a breeding method – types of introduction – objectives – quarantine - acclimatization – achievements - merits and demerits.
11. Genetic basis of self-pollinated crops – Vilmorin's 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– procedure - types – merits and demerits-achievements- comparison of mass and pureline selection.
13. Breeding methods of self-pollinated crops involving artificial hybridization: Creating variability in self-pollinated crops - Hybridization and selection – objectives – steps in hybridization - choice of parents – kinds of emasculation – hybridization- transgressive breeding.
14. Handling segregating generations- 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. Backcross breeding – genetic basis — procedures for transferring dominant and recessive genes-Back cross-breeding – merits – demerits – multilines- types- procedure merits and demerits.

17. Mid-Semester Examination

18. Genetic structure of a population in cross-pollinated crops – Hardy Weinberg law – gene frequencies in random mating population.
19. Breeding methods of cross-pollinated crops without involving artificial hybridization: Mass selection in cross-pollinated crops – modified mass selection – Grid selection – progeny selection
20. Breeding methods of cross-pollinated crops involving artificial hybridization: Recurrent selection principles – types – merits and demerits.
21. Heterosis breeding – theories - genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression.
22. Heterosis breeding – procedure – development of inbreeds- evaluation of inbred lines – top cross method and single cross method- prediction of double cross performance hybrids – single cross-double cross- three way cross hybrids. Achievements – merits and demerits.
23. Synthetics and composites - steps in development of synthetics and composites – achievements – merits and demerits
24. Genetic characters of asexual reproduction – clonal selection – hybridization and clonal selection – merits and demerits – achievements.
25. Polyploidy breeding – classification – induction of polyploidy - achievements – limitations.
26. Wide hybridization-importance-barriers and techniques for overcoming barriers utilization- Pre-breeding.
27. Mutation breeding: mutation – types – mutagens – breeding procedure – achievements – limitations.
28. Concepts in biotic stress resistance breeding- diseases and pests - gene for gene hypothesis- mechanisms of resistance - sources of resistance- multilines-gene pyramiding-gene deployment-breeding methods.
29. Concepts in abiotic stress resistance breeding- drought- mechanisms of drought resistance – basis of drought resistance- morphological and physiological characters sources of drought resistance-breeding methods.

30. Procedure for release of new varieties-stages in seed multiplication-steps in nucleus and breeder seed production.
31. Introduction to markers – morphological – biochemical- DNA markers – advantages and disadvantages.
32. QTL mapping and Marker assisted selection in plant breeding.
33. Participatory plant breeding- Intellectual Property Rights- Patenting
34. PPVFRA - Plant Breeders and Farmers Rights.

Practical schedule

1. Reproduction in plants - Alternation of generation and life cycle.
2. Mode of pollination - Mechanisms enforcing self and cross-pollination in crops- Working out extent of natural out crossing.
3. Germplasm collection and conservation.
4. Breeder's kit and its components
5. Basic techniques for selfing and crossing in crop plants.
6. Emasculation and pollination techniques in field crops.
7. Emasculation and pollination techniques in horticultural crops.
8. Study of male sterility system – CMS, GMS and CGMS
9. Mutagenesis study using physical and chemical mutagens
10. Breeding management system - Handling of segregating populations- maintenance of records.
11. Experimental designs used in plant breeding-RBD analysis
12. Calculation of mean, range, PCV, GCV, heritability, genetic advance
13. Estimation of heterosis and prediction performance of double cross hybrids
14. Pheno typing techniques for biotic stresses and abiotic stresses
15. Marker techniques, Genotyping, and QTL mapping software
16. Procedure for marker assisted selection

17. University Practical examination

Textbooks:

1. Singh, B. D. (2005). Plant breeding - Principles and Methods. Kalyani Publishers, New Delhi.
2. Phundhan Singh. (2001). Essentials of Plant Breeding, Kalyani publishers, New Delhi.
3. Allard, R.(2022) . Principles of Plant Breeding. John Wiley and Sons, New Delhi.
4. D. N. Bharadwaj. (2012). Breeding Field Crops. Agrobios (India), Jodhpur

5. Chahal, G. S. and S. S. Gosal. (2002). Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches. Narosa Publishing House, India

23 PAT 202 - Diseases of fruits, plantation, medicinal and aromatic plants (2+1)

Course objective:

- To study the symptoms and cause of disease
- To understand host pathogen interaction
- Understand the role of environmental factors in disease development
- Gain knowledge on integrated disease management.

Course outcome:

- Diagnosis and distinguish various diseases of fruits, plantation, medicinal and aromatic plants.
- Distinguish the diseases caused by biotic factors and abiotic factors
- Detailed understanding of host parasite relationship, survival and spread
- Plan and recommendation of appropriate management practices

THEORY

Unit I - Diseases of tropical fruit crops – part 1

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of diseases and nematode disease complex of Diseases of Mango- mango malformation, powdery mildew, anthracnose, black tip of mango, algal leaf spot, gray blight, sooty mold, die back, gummosis, root rot; Banana- Panama wilt, Moko wilt, anthracnose, sigatoka leaf spot, freckle leaf spot, cordana leaf spot, tip over disease, banana bunchy top disease, banana streak virus, banana mosaic virus, infectious chlorosis, bract mosaic, nematode diseases; Citrus- citrus canker, citrus tristeza disease, citrus greening, citrus stubborn, citrus die back, citrus wilt, exocortis, root rot.

Unit II - Diseases of tropical fruit crops – part 2

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of diseases and nematode disease complex of Guava- wilt, root rot, gray blight, leaf spot, algal leaf spot, sooty mold; Grapes- anthracnose, rust, powdery mildew, downy mildew, pierce disease, grape fan leaf virus; Pomegranate- bacterial leaf spot, fungal blight, fruit cracking, anthracnose; Papaya- foot rot, fruit rot, papaya ring spot, papaya mosaic, Sapota – gray blight, leaf spot, sooty mold, flat stem; Aonla - powdery mildew, leaf spot, fruit rot; Ber- powdery mildew, Annona- leaf spot, fruit rot, gray blight, and sooty mold; Jackfruit- fruit rot.

Unit III - Diseases of temperate fruit crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of diseases and nematode disease complex of Apple - fire blight of apple, apple canker, anthracnose, apple scab, root rot, etc; Peach – leaf curl, powdery mildew; diseases of Pear, Plum, Almond, Walnut; Pineapple- butt rot, heart rot, wilt; Strawberry – leaf spot, rust, fruit blight, powdery mildew.

Unit IV - Diseases of plantation crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of diseases and nematode disease complex of Coconut -bud rot, stem bleeding, root wilt, leaf blight, Thanjavur wilt, coconut yellows; Arecanut - koleroga/mahali disease, foot rot, stem bleeding, leaf spot, leaf blight; Betelvine – foot rot, wilt, powdery mildew, anthracnose, leaf spot. Oil palm – bud rot, leaf blight, Coffee - anthracnose, rust, root rot, leaf spot, sooty mould; Tea - blister blight, algal leaf spot, gray blight, leaf spot, root rot; Rubber - stem rot, powdery mildew, leaf spot, root rot; Cocoa - black pod rot, charcoal pod rot, gray blight, wilt, root rot, and swollen shoot.

Unit V: Diseases of medicinal and aromatic crops, nematode disease complex, post - harvest diseases

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of diseases and nematode disease complex of Diseases of Aloe vera, Basil, Coleus, Ashwagandha, Periwinkle, Citronella, etc. Post-harvest diseases of fruits.

PRACTICAL

Identification of diseases based on symptoms, microscopic examination of causal organism and study of host parasite relationship and management of major diseases of Mango, Banana, Citrus, Guava, Grapes, Sapota, Pomegranate, Papaya, Aonla, Ber, Annona, Jackfruit, Apple, Peach, Pear, Plum, Almond, Walnut, Pineapple, Strawberry, Coconut, Arecanut, Betel vine, Oil palm, Coffee, Tea, Rubber, Cocoa, Medicinal plants, Aromatic plants and Post-harvest disease of fruits.

Theory Lecture schedule:

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of

1. Diseases of Mango
2. Diseases of Mango
3. Diseases of Banana
4. Diseases of Banana
5. Diseases of Citrus
6. Diseases of Guava
7. Diseases of Grapes
8. Diseases of Sapota
9. Diseases of Pomegranate
10. Diseases of Papaya
11. Diseases of Aonla and Ber.
12. Diseases of Annona and Jack fruit
13. Diseases of Apple
14. Diseases of Peach
15. Diseases of Pear and Plum
16. Diseases of Almond and Walnut.

17. Mid-semester examination

18. Diseases of Pineapple
19. Diseases of Strawberry
20. Diseases of Coconut
21. Diseases of Arecanut
22. Diseases of Oil palm
23. Diseases of Betel vine
24. Diseases of Coffee
25. Diseases of Tea
26. Diseases of Rubber
27. Diseases of Cocoa
28. Diseases of Medicinal plants
29. Diseases of Medicinal plants
30. Diseases of Aromatic plants
31. Diseases of Aromatic plants
32. Nematode disease complex
33. Post-harvest disease of fruits - I
34. Post-harvest disease of fruits - II

Practical schedule:

Symptomatology, host parasite relationship and management of

1. Diseases of Mango,
2. Diseases of Banana
3. Diseases of Citrus
4. Diseases of Guava and Grapes
5. Diseases of Sapota
6. Diseases of Pomegranate and Papaya
7. Diseases of Aonla, Ber, Annona, and Jackfruit
8. Diseases of Apple and Peach
9. Diseases of Pear, Plum, Almond and Walnut
10. Diseases of Pineapple and Strawberry
11. Diseases of Coconut, Arecanut, Betel vine and Oil palm
12. Diseases of Coffee and Tea
13. Diseases of Rubber and Cocoa
14. Diseases of Medicinal plants
15. Diseases of Aromatic plants
16. Post-harvest disease of fruits

17. University Practical Examination

Note: Students should submit 50 well preserved herbarium of diseased specimens

Text Books

1. Sanjeev Kumar. (2015). *Diseases of Horticultural crops, Identification and Management*. New India Publishing Agency. Pai & Sons. pp. 1-296.
2. Chaube. H.S and Pundhir. V.S. (2006). *Crop Diseases and Their Management*. PHI Publishers, New Delhi.
3. Gupta, V.K. (2008). *Diseases of Fruit Crops*. Kalyani Publishers. New Delhi. pp. 1-344.
4. Agrios, G.N. (2005). *Plant Pathology* (5th ed.) New York: Academic Press. pp.1-922.
5. Ravichandra. N.G. (2013). *Fundamentals of plant pathology*. PHI Publishers. New Delhi.