

School of Agricultural Sciences
B.Sc. (Hons) Agriculture (Batch 2021) Curriculum

Department wise distribution of courses

Course Code	Department / Discipline	Number of courses	Credit Hours	Total Credits
Agronomy		10	10+9	19
21 AGR 101	Fundamentals of Agronomy and Agricultural Heritage		2+1	3
21 AGR 102	Introductory Agro-Meteorology and Climate Change		2+1	3
21 AGR 201	Crop Production Technology- I (Kharif Crops)		1+1	2
21 AGR 202	Principles of Weed Management		1+1	2
21 AGR 204	Crop Production Technology- II (Rabi Crops)		1+1	2
21 AGR 205	Rainfed Agriculture and Watershed Management		1+1	2
21 AGR 301	Practical Crop Production- I (Kharif Crops)		0+1	1
21 AGR 302	Farming System and Sustainable Agriculture		1+0	1
21 AGR 303	Practical Crop Production- II (Rabi Crops)		0+1	1
21 AGR 304	Principles of Organic Farming		1+1	2
Genetics and Plant Breeding		4	7+4	11
21 PBG 101	Introduction to Agricultural Botany		1+1	2
21 PBG 201	Fundamentals of Genetics		2+1	3
21 PBG 202	Fundamentals of Plant Breeding		2+1	3
21 PBG 302	Crop Improvement		2+1	3
Seed Science and Technology		1	2+1	3
21 SST 301	Principles of Seed Technology		2+1	3
Soil Science and Agricultural Chemistry		3	6+2	8
21 SAC 101	Fundamentals of Soil Science		2+1	3
21 SAC 201	Problematic soils and their Management		2+0	2
21 SAC 301	Manures, Fertilizers and Soil Fertility Management		2+1	3
Agricultural Entomology		3	6+3	9
21 AEN 201	Fundamentals of Entomology		2+1	3
21 AEN 202	Management of Beneficial and Harmful Insects		2+1	3
21 AEN 301	Pests of Crops and Stored Grain and their Management		2+1	3
Agricultural Social Sciences		9	13+7	20
21 AEC 101	Fundamentals of Agricultural Economics		1+1	2
21 AEC 201	Farm Management, Production and Resource Economics		1+1	2
21 AEC 301	Agricultural Marketing Trade and Prices		2+1	3
21 AEC 302	Agricultural Finance and Co- operation		2+1	3
21 AEC 303	Intellectual Property Rights		1+0	1
21 ARM 301	Entrepreneurship Development and Business Communication		1+1	2

21 AEX 101	Rural Sociology and Educational Psychology	2+0	2
21 AEX 102	Fundamentals of Agricultural Extension Education	2+1	3
21 AEX 201	Communication Skills and Personality Development	1+1	2
Allied Courses		2	2+2
21 STA 211	Statistical Methods	1+1	2
21 COM 211	Agri-informatics	1+1	2
Agricultural Engineering		4	5+4
21 SWE 111	Soil and Water Conservation Engineering	2+1	3
21 FMP 211	Farm Machinery and Power	1+1	2
21 ERG 211	Renewable Energy and Green Technology	1+1	2
21 APE 311	Protected Cultivation and Secondary Agriculture	1+1	2
Horticulture		5	6+5
21 HOR 111	Fundamentals of Horticulture	1+1	2
21 HOR112	Production Technology for Vegetables and Spices	2+1	3
21 HOR 211	Production Technology for Fruit and Plantation Crops	1+1	2
21 HOR 212	Production Technology for Ornamental Crops, MAP and Landscaping	1+1	2
21 HOR 311	Post Harvest Management and Value Addition of Fruits and Vegetables	1+1	2
Plant Pathology		4	7+4
21 PAT 201	Fundamentals of Plant Pathology	2+1	3
21 PAT 202	Principles of Plant Disease Management	1+1	2
21 PAT 301	Diseases of Field and Horticultural Crops and their Management I	2+1	3
21 PAT 302	Diseases of Field and Horticultural Crops and their Management II	2+1	3
Food Science and Technology		1	2+1
21 FSN 111	Principles of Food Science and Nutrition	2+1	3
Supplementary Courses		7	12+7
21 BIC 101	Fundamentals of Plant Biochemistry	2+1	3
21 CRP 101	Fundamentals of Crop Physiology	2+1	3
21 AGM 101	Fundamentals of Microbiology	2+1	3
21 FOR 111	Introduction to Forestry	1+1	2
21 ENS 301	Environmental Studies and Disaster Management	2+1	3
21 RSG 301	Geo-informatics, Nanotechnology and Precision Farming	1+1	2
21 ABT 301	Plant Biotechnology	2+1	3
Animal Production		1	2+1
21 AMP 201	Livestock and Poultry Management	2+1	3
Elective Courses		3	6+3

21 ELC ***	Elective Courses I	2+1	3
21 ELC ***	Elective Course II	2+1	3
21 ELC ***	Elective Course III	2+1	3
Remedial courses		2	2+2
21 LAN 101	Comprehension and Communication Skills in English	1+1	2
21 MAT 111	Elementary Mathematics	1+1	2
	TOTAL	59	88+55
Student READY		4	0+41
21 AEX 401	Rural Agricultural Work Experience and Agro-Industrial Attachment (RAW& AIA)	0+20	20
21 ELP ***	Experiential Learning Programme I	0+10	10
21 ELP ***	Experiential Learning Programme II	0+10	10
21 AGR 401	Project Work	0+1	1
Non- Gradual Courses*		6*	0+6*
21	Human values and ethics*	0+1*	1*
21 NSS/ NCC 101	NSS or NCC*	0+1*	1*
21 PED 101	Physical Education *	0+1*	1*
21 PED 102	Yoga practices*	0+1*	1*
21 AGR 203	Study Tour*	0+1*	1*
21 AEX 402	All India Study Tour*	0+1*	1*
	TOTAL	10	0+45
	Grand Total	69	88+96+6*

Elective Courses

S. No	Course Code	Course Title	Credit Hours	Total Credits	Semester
Elective Course I					
1	21 ELC 201	Agricultural Journalism	2+1	3	IV
2	21 ELC 202	Food Safety and Standards	2+1	3	IV
3	21 ELC 203	Hi-tech Horticulture	2+1	3	IV
Elective Course II					
1	21 ELC 301	Bio Pesticides and Bio Fertilizers	2+1	3	V
2	21 ELC 302	Agribusiness Management	2+1	3	V
3	21 ELC 303	Micro Propagation Technologies	2+1	3	V
Elective Course III					
1	21 ELC 304	Commercial Plant Breeding	2+1	3	VI
2	21 ELC 305	Agrochemicals	2+1	3	VI
3	21 ELC 306	Landscaping	2+1	3	VI

I Semester

S. no.	Course code	New course code	Course title	Course Credits
1	21AGR01	21HOR111	Fundamentals of Horticulture	1+1
2	21AGR02	21BIC 101	Fundamentals of Plant Biochemistry	2+1
3	21AGR03	21SAC 101	Fundamentals of Soil Science	2+1
4	21AGR04	21FOR111	Introduction to Forestry	1+1
5	21AGR05	21LAN101	Comprehension & Communication Skills in English	1+1*
6	21AGR06	21AGR101	Fundamentals of Agronomy and Agricultural Heritage	2+1
7	21AGR07	21PBG101	Introductory to Agricultural Botany	1+1
8	21AGR08	21AEX101	Rural Sociology & Educational Psychology	2+0
9	21AGR09		Human Values & Ethics (non gradial)	0+1**
10	21AGR10		NSS/NCC **	0+1**
11	21AGR11		Physical Education **	0+1**
12	21AGR12		Yoga Practices**	0+1**
TOTAL*R: Remedial course; **NC: Non-gradial courses				12+07 = 19 (04**)

II Semester

S. no.	Course code	New course code	Course Title	Course Credits
1	21AGR13	21SWE111	Soil and Water Conservation Engineering	2+1
2	21AGR14	21CRP101	Fundamentals of Crop Physiology	2+1
3	21AGR15	21AEC101	Fundamentals of Agricultural Economics	2+1
4	21AGR16	21AGM101	Fundamentals of Microbiology	2+1
5	21AGR17	21AEX102	Fundamentals of Agricultural Extension Education	2+1
6	21AGR18	21HOR112	Production Technology for Vegetables and Spices	2+1
7	21AGR19	21AGR 102	Introductory Agro-meteorology & Climate Change	2+1
8	21AGR20	21FSN 111	Principles of Food Science and Nutrition	2+1
9	21AGR21	21MAT111	Elementary Mathematics	1+1*
10	21AGR10		NSS/NCC	0+1**
11	21AGR11		Physical Education	0+1**
			Total	17+8=25
*R: Remedial course; ** Non-gradial courses compulsory courses				

Semester wise distribution of courses

Semester I

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 AGR 101	Fundamentals of Agronomy and Agricultural Heritage	2+1	3
2.	21 SAC 101	Fundamentals of Soil Science	2+1	3
3.	21 HOR 111	Fundamentals of Horticulture	1+1	2
4.	21 AEX 101	Rural Sociology and Educational Psychology	2+0	2
5.	21 BIC 101	Fundamentals of Plant Biochemistry	2+1	3
6.	21 FOR 111	Introduction to Forestry	1+1	2
7.	21 LAN 101	Comprehension and Communication Skills in English	1+1	2
8.	21 PBG 101	Introduction to Agricultural Botany	1+1	2
9.	21	Human values and ethics*	0+1*	1*
10.	21 NSS/ NCC 101	NSS or NCC*	0+1*	1*
11.	21 PED 101	Physical Education *	0+1*	1*
12.	21 PED 102	Yoga practices*	0+1*	1*
		Total	12+11	23

*Non- gradial course

Semester II

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 AGR 102	Introductory Agro-Meteorology and Climate Change	2+1	3
2.	21 AEC 101	Fundamentals of Agricultural Economics	1+1	2
3.	21 SWE 111	Soil and Water Conservation Engineering	2+1	3
4.	21 HOR 112	Production Technology for Vegetables and Spices	2+1	3
5.	21 FSN 111	Principles of Food Science and Nutrition	2+1	3
6.	21 AEX 102	Fundamentals of Agricultural Extension Education	2+1	3
7.	21 CRP 101	Fundamentals of Crop Physiology	2+1	3
8.	21 AGM 101	Fundamentals of Microbiology	2+1	3
9.	21 MAT 111	Elementary Mathematics	1+1	2
		Total	16+9	25
10.	21 NSS/ NCC 101	NSS or NCC*	0+1#*	1#*
11.	21 PED 101	Physical Education and Yoga Practices*	0+1#*	1#*

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

Semester III

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 AGR 201	Crop Production Technology I (Kharif Crops)	1+1	2
2.	21 AGR 202	Principles of Weed Management	1+1	2
3.	21 PBG 201	Fundamentals of Genetics	2+1	3
4.	21 AEN 201	Fundamentals of Entomology	2+1	3
5.	21 AEC 201	Farm Management, Production and Resource Economics	1+1	2
6.	21 FMP 211	Farm Machinery and Power	1+1	2
7.	21 HOR211	Production Technology for Fruit and Plantation Crops	1+1	2
8.	21 PAT 201	Fundamentals of Plant Pathology	2+1	3
9.	21 STA 211	Statistical Methods	1+1	2
10.	21 AMP 201	Livestock and Poultry Management	2+1	3
11.	21 AGR 203	Study Tour*	0+1*	1*
Total			14+11	25
12.	21 NSS/ NCC 101	NSS or NCC	0+1#*	1#*
13.	21 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.	21 PBG 202	Fundamentals of Plant Breeding	2+1	3
1.	21 AGR 204	Crop Production Technology II (Rabi Crops)	1+1	2
2.	21 AGR 205	Rainfed Agriculture and Watershed Management	1+1	2
3.	21 COM 211	Agri-Informatics	1+1	2
4.	21 SAC 201	Problematic soils and their management	2+0	2
5.	21 AEN 202	Management of Beneficial and Harmful Insects	2+1	3
6.	21 ERG 211	Renewable Energy and Green Technology	1+1	2
7.	21 PAT 202	Principles of Plant Disease Management	1+1	2
8.	21 HOR 212	Production Technology for Ornamental Crops, MAP and Landscaping	1+1	2
9.	21 AEX 201	Communication Skills and Personality Development	1+1	2
10.	21 ELC ***	Elective Course I	2+1	3
Total			15+10	25
11.	21 NSS/	NSS or NCC	0+1#*	1#*

	NCC 101			
12.	21 PED 101	Physical Education and Yoga Practices	0+1#*	1#*

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

Semester V

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 SST 301	Principles of Seed Technology	2+1	3
2.	21 AGR 301	Practical Crop Production I (Kharif Crops)	0+1	1
3.	21 AGR 302	Farming System and Sustainable Agriculture	1+0	1
4.	21 SAC 301	Manures, Fertilizers and Soil Fertility Management	2+1	3
5.	21 AEN 301	Pests of Crops and Stored Grain and their Management	2+1	3
6.	21 AEC 301	Agricultural Marketing Trade and Prices	2+1	3
7.	21 APE 311	Protected Cultivation and Secondary Agriculture	1+1	2
8.	21 PAT 301	Diseases of Field and Horticultural Crops and their Management I	2+1	3
9.	21 HOR 311	Post Harvest Management and Value Addition of Fruits and Vegetables	1+1	2
10.	21 ARM 301	Entrepreneurship Development and Business Communication	1+1	2
11.	21 ELC ***	Elective Course II	2+1	3
		Total	16+10	26

Semester VI

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 AGR 303	Practical Crop Production II (Rabi Crops)	0+1	1
2.	21 AGR 304	Principles of Organic farming	1+1	2
3.	21 PBG 302	Crop Improvement	2+1	3
4.	21 AEC 302	Agricultural Finance and Co-operation	2+1	3
5.	21 PAT 302	Diseases of Field and Horticultural Crops and their Management II	2+1	3
6.	21 ABT 301	Plant Biotechnology	2+1	3
7.	21 RSG 301	Geo-informatics, Nanotechnology and Precision Farming	1+1	2
8.	21 AEC 303	Intellectual Property Rights	1+0	1

9.	21 ENS 301	Environmental Studies and Disaster Management	2+1	3
10.	21 ELC ***	Elective Course III	2+1	3
		Total	15+9	24

Semester VII

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 AEX 401	Rural Agricultural Work Experience and Agro- Industrial Attachment (RAW& AIA)	0+20	20
2.	21 AGR 401	Project Work	0+1	1
3.	21 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
1.	21 ELP ***	Experiential Learning Programme I	0+10	10
2.	21 ELP ***	Experiential Learning Programme II	0+10	10
		Total	0+20	20

U.G. DEGREE - B.SC. AGRICULTURE 2021 BATCH
I SEMESTER COURSES

S. no.	Course code	Course title	Credits
1	21AGR101	Fundamentals of Agronomy and Agricultural Heritage	2+1
2	21SAC101	Fundamentals of Soil Science	2+1
3	21HOR111	Fundamentals of Horticulture	1+1
4	21AEX101	Rural Sociology & Educational Psychology	2+0
5	21BIC101	Fundamentals of Plant Biochemistry	2+1
6	21FOR111	Introduction to Forestry	1+1
7	21LAN101	Comprehension & Communication Skills in English	1+1*
8	21PBG101	Introductory to Agricultural Botany	1+1
9	21NSS/NCC 101	NSS/NCC	0+1**
10	21PED101	Physical Education	0+1**
11	21PED102	Yoga Practices	0+1**
12	21PED103	Human Values & Ethics (non gradial)	0+1**
		TOTAL	12+07 = 19
		*R: Remedial course; **NC: Non-gradial courses	(04**)

I Semester

S. no.	Course code	New course code	Course title	Course Credits
1	21AGR01	21HOR111	Fundamentals of Horticulture	1+1
2	21AGR02	21BIC 101	Fundamentals of Plant Biochemistry	2+1
3	21AGR03	21SAC 101	Fundamentals of Soil Science	2+1
4	21AGR04	21FOR111	Introduction to Forestry	1+1
5	21AGR05	21LAN101	Comprehension & Communication Skills in English	1+1*
6	21AGR06	21AGR101	Fundamentals of Agronomy and Agricultural Heritage	2+1
7	21AGR07	21PBG101	Introductory to Agricultural Botany	1+1
8	21AGR08	21AEX101	Rural Sociology & Educational Psychology	2+0
9	21AGR09		Human Values & Ethics (non gradial)	0+1**
10	21AGR10		NSS/NCC **	0+1**
11	21AGR11		Physical Education **	0+1**
12	21AGR12		Yoga Practices**	0+1**
TOTAL*R: Remedial course; **NC: Non-gradial courses				12+07 = 19 (04**)

21AGR101 / 21AGR06 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. Balasubramaniyan, 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. NewDelhi.

21SAC101 / 21AGR03 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.

21HOR111 / 21AGR01 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. Greneve.

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.

21AEX101 / 21AGR08 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.

21BIC101 / 21AGR02 FUNDAMENTALS OF PLANT BIOCHEMISTRY (2+1)

Course Objectives:

- The students will know, why the broad spectrum of biochemistry is important in medicine, agriculture, pharmaceuticals, and ethics;
- To educate on the importance of Biomolecules with structure classification and function.
- To understand about the generation and storage of metabolic energy

Course Outcome:

- Knowledge about developments in biochemistry Cell structure, water and major molecules of life.
- Understand overall aspects of the integration of metabolic processes;
- Basics of carbohydrates proteins enzymes vitamins nucleic acids minerals and lipids will be understood

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.

Glycoconjugates - Glycoproteins and Lectin - structure and significance.

UNIT II

Lipids

Lipids - occurrence and classification. Storage lipids - fatty acids, triacyl glycerol, essential fatty acids, waxes. **Structural lipids - role of lipids in biological membrane - glycolipids** and phospholipids - types and importance; Sterols - basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

UNIT III

Proteins and Enzymes

Amino acids - classification and structure. Essential amino acids. Properties of amino acids - amphoteric nature and isomerism. Classification of proteins based on functions and solubility. Structure of proteins: primary structure, secondary structure, tertiary structure and quaternary structure - **protein folding and denaturation**. Properties and reactions of proteins. Enzymes - Properties, classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme activity. Enzyme inhibition - Competitive, Non-competitive and Uncompetitive inhibition; Allosteric enzymes. Coenzymes, cofactors and isoenzyme.

UNIT IV

Metabolism

Carbohydrate metabolism - breakdown of starch by amylases, glycolysis, TCA cycle and pentose phosphate pathway. Respiration - electron transport chain and oxidative phosphorylation. Bioenergetics of glucose. Lipid metabolism - lipases and phospholipases. Beta-oxidation of fatty acids and bioenergetics. Biosynthesis of fatty acids and triacyl glycerol. General catabolic pathway for amino acids - transamination, deamination and decarboxylation. Ammonia assimilating enzymes. Metabolic inter-relationship.

UNIT V

Secondary metabolites

Secondary metabolites - occurrence, classification and functions of phenolics, terpenes and alkaloids.

Text books

1. Thayumanavan. B, Krishnaveni S, Parvathi K. Biochemistry for Agricultural Sciences, Galgotia Publications, New Delhi.
2. Jain, J. L.2001.Fundamentals of Biochemistry, 5th Edition,. S.Chand & company, New Delhi.

References

1. Lehninger, A.1984. Principles of Biochemistry, Published by CBS publishers and Distributors, New Delhi.
2. Verma, S.K .2000 A Text Book of Plant Physiology and Biochemistry, S .Chand & company, NewDelhi-110055.

21FOR111 / 21AGR04 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

21LAN101 / 21AGR05 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.

21PBG101/ 21AGR07 INTRODUCTION TO AGRICULTURAL BOTANY (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.

21AGR101 / NSS/NCC (non gradial) (0+1)**
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 10 th day of special camp | : 5 marks |

Total : 40 marks

NATIONAL CADET CROPS NCC1 (0+1) (Non gradial)

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

21PED101 PHYSICAL EDUCATION (0+1) (Non gradial)**

Credits: 0:0:1

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, 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 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.

21PED102 YOGA PRACTICES (0+1) (Non gradial)**

UNIT - 1:

PHYSICAL HEALTH AND REJUVENATION OF LIFE-FORCE

Significance of Value Education - Types of Education – Yoga for Human Excellence Principles and Purpose of living - Body structure – Body functions – Reasons for Diseases and Prevention - Concept of Health – Role of limit and method in five deeds for good health - Importance of Naturopathy - Objectives of physical exercises Benefits of physical exercises - Kayakalpa yoga philosophy - Youthfulness practices Enriching bio-magnetism.

UNIT - 2:

MENTAL PROSPERITY AND SOCIAL WELFARE

Mind functions – Mental frequency – Thought – Brain and Memory power – Problem solving and Decision making skills - Need and benefits for meditation - SKY Yoga types of meditation Part 1: Eye brow centre meditation - Genetic centre meditation - Spinal cord clearance - Crown centre meditation - Analysis of thoughts – Moralization of desires - Neutralization of Anger – Eradication of Worries – Benefits of blessings - Human culture and values – Five-fold culture - Time management – Personality Assessment - Environment awareness and protection - Family peace – World peace - Five duties - Harmonious friendship – Greatness of Womanhood.

UNIT - 3:

YOGA PRACTICES – I

PHASE I - Simplified Physical Exercises: Hand exercise - Leg exercise – Neuro muscular breathing exercise – Eye exercise – Kapalabathi - PHASE II – Makarasana Part 1 & 2 – Body massage - Acu-pressure – Relaxation exercise - Youthfulness practices (Kayakalpa) - SKY Yoga types of meditation Part 1: Eye Brow centre meditation - Genetic centre meditation - Spinal Clearance - Crown centre meditation.

2PED103 HUMAN VALUES & ETHICS (0+1) (Non gradial)**

Theory

Unit I

Basic principles of learning

Basic principles of learning - discussion - Bloom's classification of educational objectives – cognitive, affective, psychomotor domain(s) - teaching and learning.

Unit II

Career development

Career development – growth and development, education – for – life and life – long education, motivation and morale - occupation and profession, training and education, lateral thinking and convergent thinking.

Unit III Entrepreneurship

Entrepreneur- intrapreneur – managing an intrapreneur – motivation and entrepreneurship - development – planning, monitoring and evaluation.

Unit IV Communication skills

Interpersonal communication – transactional communication - role – play - brainstorming – demonstration -the conduct of symposium - conferencing – the concept and presentation of a paper - scientific article writing and editing - popular article writing, editing and blogging - project proposal - project report – writing.

Unit V

Simulation exercises

Simulation - educational simulation-Interactive teaching - business simulation – company's annual report for analysis.

2021 Batch

II Semester courses

S. no.	Course code	Course Title	Course Credit
1	21AGR102	Introductory Agro-meteorology & Climate Change	2+1
2	21AEC101	Fundamentals of Agricultural Economics	1+1
3	21SWE111	Soil and Water Conservation Engineering	2+1
4	21HOR112	Production Technology for Vegetables and Spices	2+1
5	21FSN111	Principles of food science and nutrition	2 + 1
6	21AEX102	Fundamentals of Agricultural Extension Education	2+1
7	21CRP101	Fundamentals of Crop Physiology	2+1
8	21AGM101	Fundamentals of Microbiology	2+1
9	21MAT111	Elementary Mathematics	1+1*
	21NSS/NCC101	NSS/NCC	0+1**
	21PED101	Physical Education	0+1**
	21PED102	Yoga Practices	0+1**
	Total	16+9=25	

*R: Remedial course; ** Non-gradual courses compulsory courses

II Semester

S. no.	Course code	New course code	Course Title	Course Credits
1	21AGR13	21SWE111	Soil and Water Conservation Engineering	2+1
2	21AGR14	21CRP101	Fundamentals of Crop Physiology	2+1
3	21AGR15	21AEC101	Fundamentals of Agricultural Economics	2+1
4	21AGR16	21AGM101	Fundamentals of Microbiology	2+1
5	21AGR17	21AEX102	Fundamentals of Agricultural Extension Education	2+1
6	21AGR18	21HOR112	Production Technology for Vegetables and Spices	2+1
7	21AGR19	21AGR 102	Introductory Agro-meteorology & Climate Change	2+1
8	21AGR20	21FSN 111	Principles of Food Science and Nutrition	2+1
9	21AGR21	21MAT111	Elementary Mathematics	1+1*
10	21AGR10	NSS/NCC	0+1**	
11	21AGR11	Physical Education	0+1**	
	Total	17+8=25		

*R: Remedial course; ** Non-gradual courses compulsory courses

21AGR102 / 21AGR19 INTRODUCTORY AGRO-METEOROLOGY & CLIMATE CHANGE (2+1)

Course Objectives:

- To understand the role of agricultural meteorology in crop production

- To learn climatic factors and their measurements
- To study the fundamentals of climate change
- To provide knowledge on the effect of climate change on crop production

Course Outcome:

- Agro-climatic factors understood
- Measurement and estimation techniques for climatic parameters learned
- Fundamentals of climate change studied
- Effect of climate change on crop production understood

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.

Text books:

1. Mavi, H.S., 1996. Introduction to Agrometeorology, oxford and IBH Publishing Co., New Delhi. Gopalaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur. Prasad, Reddy, S.R. and Reddy, D.S. 2014. Agro meteorology. Kalyani Publishers, NewDelhi
2. Reddy, S.R. 2014. Introduction to Agriculture and Agrometeorology. Kalyani Publishers,

New Delhi. Patra, A.K. 2016. Principles and applications of Agricultural Meteorology. New India Publishing Agency, New Delhi.

References

1. Smith, J.W. 2013. Agricultural meteorology. Axis Books (India), Jodhpur
2. Rao, P. 2008. Agricultural Meteorology. Prentice Hall of India Pvt. Ltd, New Delhi
3. Murthy, R.V. 2002. Basic Principles of Agricultural Meteorology. BS Publications, Hyderabad.
4. Singh, J. 2014. Textbook of Agricultural meteorology. Oxford Book Company, New Delhi.
5. Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University Press, Thrissur.

21AEC101 / 21AGR15 FUNDAMENTALS OF AGRICULTURAL ECONOMICS (1+1)

Theory

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.

References

1. Dewett, K. K. 2004. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
- Samuelson, P. 2004. Economics, (18/e), Tata Mc-graw-Hill, New Delhi
2. Seth, M. L. 2005. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi.

21SWE111 / 21AGR13 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 –

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.

21HOR112 / 21AGR18 PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES
(2+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 Herbal spices

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>
- <http://cpcri.nic.in/> <http://indiancoffee.org>

21FSN111/ 21AGR20 PRINCIPLES OF FOOD SCIENCE AND NUTRITION (2+1)

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.

Outcomes • 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, cyanocobalamin, 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.

Text books

1. Rao, D. G. Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.
2. Norman N. Potter and Joseph H. Hotchkiss. Food Science. Chapman and Hall Pub.
3. Acharya, K T Everyday Indian Processed foods. National Book Trust.

References:

1. Srilakhmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.
2. Srivastava, R.P., and Sanjeevkumar. S. 2013. Fruit and Vegetable preservation. International Book Distributing Co. Lucknow.

3. Srilakshmi .B. 2015. Nutrition Science. New Age International Pvt. Ltd. NewDelhi.
4. Mudambi Sumati R., Shalini M. Rao and M V Rajgopal. Food Science. NewAgeInternational Publishers.
5. Negi H.P.S., Savita Sharma, K. S. Sekhon. Hand book of Cereal technology. Kalyani Pub.

21AEX102 / 21AGR17 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.

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.

21CRP101 / 21AGR14 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, Münch 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.

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.

21AGM101 / 21AGR16 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. Prokaryotic 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.

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, 9 th 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, 7 th 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, 9 th 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.

21MAT111/ 21AGR21 ELEMENTARY MATHEMATICS(1+1)

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

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: 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.

Text books

1. Mehta, B. C. and G. M. K. Madnani, 2014, Mathematics for Economists, Sultan Chand & Sons, New Delhi.
2. Kailasam.C, Pangayar Selvi. R and Vasanthi. R, 2010, Applied Mathematics, Agrobios (India), Jodhpur

References:

1. James Stewart and Barhara Frank, Calculus, 2008, International Thomson Publishers, Singapore

2. Duraipandian, 2007, Calculus and Analytical Geometry, Emerald Publishers, Chennai.
3. Ranganathan.C.R. 2006, A First Course in Mathematical Models of Population Growth (with MATLAB programs), Associated publishing company, New Delhi
4. Manickavasagam Pillai, T. K and Natarajan, T. 2004. Calculus, Viswanathan Publications, Madras.

**2021 Batch
Semester III**

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21AGR201	Crop Production Technology I (Kharif Crops)	1+1	2
2.	21AGR202	Principles of Weed Management	1+1	2
3.	21PBG201	Fundamentals of Genetics	2+1	3
4.	21AEN201	Fundamentals of Entomology	2+1	3
5.	21AEC201	Farm Management, Production and Resource Economics	1+1	2
6.	21FMP211	Farm Machinery and Power	1+1	2
7.	21HOR211	Production Technology for Fruit and Plantation Crops	1+1	2
8.	21PAT201	Fundamentals of Plant Pathology	2+1	3
9.	21STA211	Statistical Methods	1+1	2
10.	21AMP201	Livestock and Poultry Management	2+1	3
11.	21AGR203	Study Tour*	0+1*	1*
Total			14+11	25
12.	21 NSS/ NCC 101	NSS or NCC	0+1#*	1#*
13.	21 PED 101	Physical Education and Yoga Practices	0+1#*	1#*

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

21AGR201 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

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>

21AGR202 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.

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>

21PBG201 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.

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

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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>

21AEN201 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, Tettigoniidae, 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).

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>

21AEC201 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.

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.

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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

21FMP211 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.

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>

21HOR211 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 –fertigation - 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

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/>

21PAT201 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*, *Ustilagoidea*. *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.

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.

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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>

21STA211 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.

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

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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

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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

21AMP 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.

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

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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/>

AGR203 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.

2021 Batch Semester IV

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21AGR 204	Crop Production Technology II (Rabi Crops)	1+1	2
2.	21AGR 205	Rainfed Agriculture and Watershed Management	1+1	2
3.	21COM 211	Agri-Informatics	1+1	2
4.	21PBG 202	Fundamentals of Plant Breeding	2+1	3
5.	21SAC 201	Problematic soils and their management	2+0	2
6.	21AEN 202	Management of Beneficial and Harmful Insects	2+1	3
7.	21ERG 211	Renewable Energy and Green Technology	1+1	2
8.	21PAT 202	Principles of Plant Disease Management	1+1	2
9.	21 HOR 212	Production Technology for Ornamental Crops, MAP and Landscaping	1+1	2
10.	21AEX 201	Communication Skills and Personality Development	1+1	2
11	21 ELC ***	Elective Course I	2+1	3
Total			15+10	25
12.	21 NSS/ NCC 101	NSS or NCC	0+1#	1#
13.	21 PED 101	Physical Education and Yoga Practices	0+1#	1#

21PBG 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 crosses 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 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. 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 Rice/horticultural crops. Study of Genic male sterility system in Redgram. 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.

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 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.
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. QTL mapping and Marker assisted selection in plant breeding.
32. Participatory plant breeding- Intellectual Property Rights- Patenting- 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. Final Practical examination**

References:

- Singh, B. D. 2005. Plant breeding - Principles and Methods. Kalyani Publishers, New Delhi.
- Phundhan Singh. 2001. Essentials of Plant Breeding, Kalyani publishers, New Delhi.
- Allard, R. 1989. Principles of Plant Breeding. John Wiley and Sons, New Delhi.
- D. N. Bharadwaj. 2012. Breeding Field Crops. Agrobios (India), Jodhpur
- Chahal, G. S. and S. S. Gosal. 2002. Principles and Procedures of Plant
- Breeding: Biotechnological and Conventional Approaches. Narosa Publishing House (India)
- Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot. Chennai – 15.
- Chopra, V. L. , 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
- Sharma, J. R. 1994. Principles and practice of plant breeding. Tata McGraw-Hill publishing Co.,
- Chaudhary, H. K. 1980. Elementary Principles of plant breeding. Oxford and IBH publication Co. ,
- R. K. Singh and B. D. Choudhary. Biometrical methods in quantitative Genetics. Kalyani Publishers,

E- References

- <http://www.edugreen.teri.res.in/explore/bio/breed.htm>
- <http://cuke.hort.ncsu.edu/gpb/>
- <http://www.stumbleupon.Com/tag/plant-breeding>
- <http://www.iaea.org>

21AGR 204 CROP PRODUCTION TECHNOLOGY- II (*RABI* CROPS) (1+1)

Course objective:

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

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

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

THEORY

UNIT I- Cereals

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield of wheat, barley and Oats.

UNIT II- Pulses

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield of chickpea, lentil and peas

UNIT III- Oilseeds

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield of rapeseed, mustard, Niger, Safflower and sunflower.

UNIT IV-Sugar crops

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield of Sugarcane.

UNIT V- Forage crops

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices of Berseem, Lucerne, Fodder maize.

PRACTICAL

Identification of rabi crops and recording their importance in the crop cafeteria. Acquiring skill in field preparation, sowing and manuring of rabi crops under pure and intercropping situations. Acquiring skill in seed treatment techniques and foliar nutrition of rabi crops. Estimation of plant population per unit area for rabi crops. Nursery preparation for Sugarcane. Acquiring skill practices detashing and propping in sugarcane. Study on growth parameters of sugarcane. Study on yield parameters and estimation of yield in sugarcane. Study on yield parameters and estimation of yield in rabi crops. Estimating Cost and returns of important rabi crops. Visit to Sugarcane Breeding Institute/ Research Station to study cultivation of sugarcane and its byproducts. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products. Silage making. Practicing field preparation and sowing Lucerne. Practicing field preparation and sowing for fodder maize. Visit to Wheat research station, Wellington to study rabi crops.

Lecture schedule:

1. Wheat- Origin, geographic distribution, economic importance, soil and climatic requirement.
2. Wheat - varieties, cultural practices and yield.

3. Barley and oats - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
4. Chickpea- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
5. Lentil and Peas - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
6. Rapeseed and Mustard - Origin, geographic distribution, economic importance, Classification, soil and climatic requirement, varieties.
7. Safflower and Niger- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
8. Rapeseed and mustard - cultural practices, yield.
9. **Mid-Semester Examination**
10. Sunflower- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
11. Sugarcane - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties,
12. Sugarcane - cultural practices and yield.
13. Sugarcane- package of practices for SSI
14. Sugarcane - Crop logging, maturity and ripening
15. Sugarcane - Gur manufacture, Value addition and byproduct utilization.
16. Berseem and Lucerne - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
17. Fodder maize - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Practical schedules

1. Identification of rabi crops and recording their importance in the crop cafeteria.
2. Acquiring skill in field preparation, sowing and manuring of rabi crops under pure and intercropping situations.
3. Acquiring skill in seed treatment techniques and foliar nutrition of rabi crops.
4. Estimation of plant population per unit area for rabi crops.
5. Nursery preparation for Sugarcane.
6. Acquiring skill practices detashing and propping in sugarcane
7. Study on growth parameters of sugarcane.
8. Study on yield parameters and estimation of yield in sugarcane.
9. Study on yield parameters and estimation of yield in rabi crops.
10. Estimating Cost and returns of important rabi crops.
11. Visit to Sugarcane Breeding Institute/ Research Station to study cultivation of sugarcane and its byproducts.
12. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products.
13. Silage making.

14. Practicing field preparation and sowing Lucerne.
15. Practicing field preparation and sowing for fodder maize.
16. Visit to Wheat research station, Wellington to study rabi crops
17. **Final Practical Examination.**

Text books:

1. Chidida 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. <http://sugarcane.tn.nic.in>
2. <http://fibre.tn.nic.in>,
3. www.tnau.ac.in/agriportal
4. www.crida.org www.cgiar.org www.tnau.ac.in/agriportal www.rkmp.irri.org.
5. <https://www.agrimoon.com/wp-content/uploads/Introduction-to-major-field-crops.pdf>

21AGR 205 RAINFED AGRICULTURE AND WATERSHED MANAGEMENT (1+1)

Course objective:

- Explaining the problems faced in rainfed agricultural systems
- Imparting knowledge on drought management strategies
- Describing watershed management techniques

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

- Build knowledge on solving problems related to rainfed agriculture

- Identify several drought management strategies
- Plan crop and water management approaches to mitigate drought
- Perceive the necessity and difficulties of watershed management
- Recommend practices to be followed in rainfed farming systems

THEORY

UNIT I- Rainfed agriculture

Rainfed agriculture - introduction and definition -Dry farming and rainfed farming: Characteristics. Significance and scope of dry farming in India -History of rainfed agriculture and Watersheds in India. Problems and prospects of rainfed agriculture in India - Soil and climatic conditions prevalent in rainfed areas.

UNIT II- Drought

Drought - types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Management strategies for drought.

UNIT III- Soil and water conservation

Soil erosion - definition - losses due to erosion - types of water and wind erosion - factors affecting erosion - Agronomic measures, mechanical measures and *In-situ* moisture conservation measures of soil and water conservation

UNIT IV- Water harvesting

Water harvesting - importance and its techniques - Water harvesting structures – Storage and recycling - Efficient utilization of water through soil and crop management practices - Management of crops in rainfed areas - Contingent crop planning for aberrant weather conditions - mid season correction.

UNIT V- Water shed management

Watershed - concept - objectives - principles and components of watershed development programme - factors affecting watershed management. Alternate land use system- Non-monetary inputs and low-cost technologies for crop production.

PRACTICAL

Zonation of Dry farming regions of Tamil Nadu, India and World - Characteristics of ACZs of Tamil Nadu and cropping pattern - Study of tools, implements and machineries for tillage, sowing and after cultivation - Rainfall analysis - working out economics - Sustainability Indices - working out LGP - Preparation of contingency crop plan for aberrant rainfall situations - Visit to watershed.

Lecture schedule:

1. Rainfed agriculture - introduction and definition -Dry farming and rainfed farming: Characteristics. Significance and scope of dry farming in India
2. History of rainfed agriculture and watersheds in India.
3. Problems and prospects of rainfed agriculture in India - climate - rainfall pattern -distribution - variabilities of rainfall
4. Soil and climatic conditions prevalent in rainfed areas.
5. Drought – definition - types of drought - effect of water deficits on physio-morphological characteristics of the plants- mechanism of crop adaptation under drought
6. Management strategies for drought - measures to reduce evapotranspiration – weeding, use of mulches, anti transpirants, windbreaks and shelterbelts

7. Soil erosion - definition - losses due to erosion - types of water and wind erosion – nature and extent of wind and water erosion - factors affecting erosion – universal soil loss equation
8. Agronomic measures of soil and water conservation - choice of crop - crop geometry

9. Mid Semester Examination

10. Tillage - contour cultivation - strip cropping - cover cropping - mulching – cropping systems and weed control
11. Mechanical measures of soil and water conservation - gully control - bench terraces – contour bunds - graded bunds
12. In-situ moisture conservation measures - bund forming - bunding, ridge and furrow system - conservation furrows - inter plot water harvesting, mulching - Broad Bed and Furrow (BBF) and leveling.
13. Water harvesting - importance and its techniques - Water harvesting structures – Storage and recycling
14. Efficient utilization of water through soil and crop management practices – Management of crops in rainfed areas
15. Contingent crop planning for aberrant weather conditions - mid season correction.
16. Watershed: concept - objectives - principles and components of watershed development programme - factors affecting watershed management.
17. Alternate land use system: Definition- Principles- Various models and benefits. Non-monetary inputs and low-cost technologies for crop production.

Practical schedule:

1. Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
2. Agroclimatic, Agro ecological zones and characteristics.
3. Zonation of dry farming regions of Tamil Nadu, India and World.
4. Characteristics of ACZs of Tamil Nadu and cropping pattern.
5. Cropping and farming systems in dryland.
6. Skill development in Seed hardening technique.
7. Input management and efficiency in dryland.
8. Soil erosion and soil conservation practices.
9. Water harvesting structures and their use.
10. Study of methods to reduce evaporation and transpiration.
11. Study of tools, implements, and machineries for tillage, sowing and after cultivation and assessing their efficiencies.
12. Indices in dry farming - working out LGP and planning for cropping system.
13. Drought management technologies in dryland agriculture.
14. Preparation of contingency crop plan for aberrant rainfall situations.
15. Alternate land use system and their merits.
16. Visit to watershed area to study the impact of various soil and moisture conservation methods.
17. **Final Practical Examination.**

Text books:

1. Reddy S.R and Prabhakara Reddy G.2018. Rainfed Agriculture and Watershed management. Kalyani Publications, New Delhi.
2. Oswal. M.C. 2017. Watershed Management (for Dryland Agriculture). Associated Publishing Company. India.
3. Rayees Ahamad Shah. 2017. Rainfed Agriculture and Watershed management. Kushal publications, Varanasi.
4. Subbareddy, G., Reddy, Y.V.R, Vittal, K.P.R, Thyagaraj, C.R., Ramakrishna, Y.S. and Somani, L.L. 2016. Dryland Agriculture. 2nd Edition, Agrotech., Publishing Academy, India.
5. Nagar, S. 2015. Integrated Watershed Management in Rainfed Agriculture. Scitus Academic publishing, USA.
6. Govindan K. and V. Thirumurugan. 2003. Principles and practice of Dryland Agriculture, Kalyani Publishers, Chennai.

Reference books:

1. Pradeep, S. 2014. Dryland Agriculture. Discovery Publishing House Pvt. Ltd, New Delhi.
2. Jat., Bharkar., Sharma and Kothari. 2013. Dryland Technology. Scientific Publishers, Jodhpur.
3. Widtsoe, J. A. 2012. Dry Farming for Sustainable Agriculture. Agrobios (India), Jodhpur.
4. Reddy, G. S., Reddy, Y. V. R. , Vittal, K. P. R. , Thyagaraj, C. R. , Ramakrishna, Y. S. and L. L Somani. 2008. Dryland Agriculture. Agrotech Publishing Academy, Udaipur.
5. Rengasamy P. 1990. Dry farming Technology in India. Agri publishing Academy, New Delhi.
6. Robert J. Naiman. 1992. Watershed management, Balancing sustainability and environmental change, Springer publications.

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2. [www. crida. org](http://www.crida.org)
3. [www. icrisat. Org](http://www.icrisat.Org)
4. www.iwmi.cgiar.org
5. <https://www.icarda.org/>

21COM 211 Agri- Informatics (1+1) (Updated by Dr.Pradeep on 11.08.2023)

Theory

Unit I: Information and Communication Technology (ICT)

ICT and its importance – Computer Fundamentals - Basic anatomy of the computer system: Input devices, CPU, Output devices, Memory: Primary and secondary - Software – Types: System software, Application software and Utility software –Software terminologies: Firmware, Liveware, Freeware, Shareware, Commercial software, Proprietary software, Semi-free software - Internet - World Wide Web – URL – Domain names - Protocols: HTTP, HTTPS - Internet Applications: Email, File sharing web apps, Social Networks, Online shopping, Video Conferencing – HTML: Introduction, Editor, HTML Documents – Tags: <head>, <body>, <title>, <heading>, <paragraph>,
, <table>, , , <href>, , <hr> and <marquee>.

Unit II: Spreadsheet and Database

Electronic spreadsheet– MicrosoftExcel- Worksheetmanipulation:insert, delete, move, copy and hide worksheet–Cellmanipulation:copy,editandformatcelldata–Charts –CreateBarandPiecharts - PIVOT table - DBMS: Database terms: Data, Database, DBMS, RDBMS, Row, Column, Table – Database Architecture –Datatypes:char,varchar(),int,float()–Useofdatabases inagriculture.

Unit III: C Programming

Introduction to Computer Programming – Programming languages - Translators: Compilers and Interpreters - Algorithm – Flowchart - Introduction to C – Structure of C program - Data types, Variables,Constants, Operators: Arithmetic, Relational, Logical, Assignment - Input/Output: scanf(), print f() - Control statements: if, if else – Loop: while, do while, for.

Unit IV: Agriinformatics

Agriinformatics – Needs and objectives - e-Agriculture : Concept, Meaning, Terminologies and Importance - eAgriculture – National and International scenario - ICT for Data collection, formation of development programmes, monitoring and evaluation of programmes - Decision support systems: Taxonomy, Components, Framework, Classification and applications in Agriculture -Expert systems - Concepts and Importance – Components –UserInterface– KnowledgeBase–InferenceMechanism–InferenceRule–DesigninganExpert Systems - Advantages and disadvantages of Expert Systems - Information systems for supporting farm decisions.

Unit V: Models and Computer Controlled Devices

Introduction to computer based agricultural models: Model, Simulation, Systems analysis models, Subsystems, Types: Mechanistic process models, Operational models, Statistical models and dynamic simulation models - List of agricultural models -Computer controlled devices – Sensor–Drones – Robots –Internet of Things (IoT) and Cloud Computing for Agriculture.

Practical

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 –Internet Applications: Email, File sharing web apps: Dropbox, Google drive – Social Networks, Online shopping, Video Conferencing – Creating a web page: HTML editor– Tags: <head>, <body>, <title>, <heading>, <paragraph>,
, <table>,,,<href>,,<hr>and<marquee>.Developalgorithmsandrepresentthesameint heflowchartforthefollowing problems -To calculate Leaf Area Index (LAI) -To calculate the Crop Growth Rate (CGR) - To find the greatest average seed sales of two districts during samba season - Familiarizing with the Integrated Development Environment of C Editor for coding, saving, compiling, debugging and executing – C Programs: Display TNAU motto "Till, Toil, Triumph" – Calculate Leaf Area Index (LAI) – Calculate the Crop Growth Rate (CGR) - Find the greatest average seed sales of two districts during samba season - e-Agriculture – Leveraging social media in agriculture (Social networks) - ICT in agriculture – Paperless data collection using google survey tools - Online photo and video editing tools - Simulating crop yield: Info

Crop - Base file creation for rice and maize (Weather, Varietal characters, Agronomy practices, Soil data) – Interpretation – Info Crop – Climate change impact studies on rice and maize - Smartphone mobile apps in Agriculture for farm advices, crop protection, market price, postharvest management - Decision support systems - Expert systems - Information systems for supporting farm decisions -Crop calendar–Crop planning tool for farmers.

Lecture Schedule

1. Introduction to Computers – Basic anatomy of the computer system: Input devices, CPU, Output devices, Memory: Primary and secondary.
2. Software – Types: System software, Application software and Utility software – Software Terminologies: Firmware, Liveware, Freeware, Shareware, Commercial software, Proprietary software, Semi-free software.
3. Internet - World Wide Web – URL – Domain names - Protocols: HTTP, HTTPS - Internet Applications: Email, File sharing web apps, Social Networks, Online shopping, Video Conferencing – HTML: Introduction, Editor, HTML Documents – Tags: <head>, <body>, <title>, <heading>, <paragraph>,
, <table>, , , <href>, , <hr> and <marquee>.
4. Electronics spreadsheet–Microsoft Excel–Worksheet manipulation: insert, delete, move, copy and hide worksheet– Cell manipulation: copy, edit and format cell data – Charts - Create Bar and Pie charts - PIVOT table.
5. DBMS: Database terms: Data, Database, DBMS, RDBMS, Row, Column, Table – Database Architecture – Data types: char, varchar (), int, float () – Use of databases in agriculture.
6. Introduction to Computer Programming – Programming languages - Translators: Compilers and Interpreters - Algorithm – Flowchart.
7. Introduction to C – Structure of C program - Data types, Variables, Constants, Operators: Arithmetic, Relational, Logical, Assignment - Input/Output: scanf(), printf().
8. Control statements: if, if else–Loop: while, do while, for.
9. **Mid-Semester Examination**
10. Agri informatics –Needs and objectives - e-Agriculture: Concept, Meaning, Terminologies and Importance
11. e-Agriculture – National and International scenario
12. ICT for Data collection, formation of development programmes, monitoring and evaluation of programmes.
13. Decision support systems: Taxonomy, Components, Framework, Classification and applications in Agriculture.
14. Expert systems - Concepts and Importance – Components – User Interface – Knowledge Base –Inference Mechanism – Inference Rule - Designing an Expert Systems - Advantages and disadvantages of Expert Systems -Information systems for supporting farm decisions.
15. Introduction to computer based agricultural models: Model, Simulation, Systems analysis models, Subsystems, Types: Mechanistic process models, Operational models, Statistical models and dynamics simulation models - List of agricultural models.
16. Computer controlled devices – Sensor – Drones – Robots.
17. Internet of Things (IoT) and Cloud Computing for Agriculture.

Practical Schedule

1. Innards of computer – Boot and shutdown – Windows apps: Sticky Notes, Steps Recorder, Snipping Tool– Pin and unpin the programs – System tray customization – Shortcut keys.

2. Software practices–Installation/Uninstallation–Practice ofDOScommands: dir,cd,mkdir,rmdir, del, cls, attrib,ren, copy, move, ipconfig, ping.
3. Microsoft Excel- Entering a formula in a cell, Built-in functions: SUM, AVERAGE, MIN, MAX, COUNT, COUNTIF, IF–Importandexportdata -Charts –CreateBarandPiecharts – PIVOTtable.
4. MS-ACCESS:Creatingagriculturedatabase–Entering,editingdeleting data–CreatingForms –
5. Query wizard: select, update, delete – Reports.
6. InternetApplications:Email,Filesharing webapps: Dropbox, Google drive SocialNetworks,Online
7. Shopping,VideoConferencing –Creatinga web page:HTML editor–Tags: <head>, <body>, <title>, <heading>, <paragraph>, </br>, <table>, , , <href>, , <hr> and <marquee>.
8. Develop algorithms and represent the same in the flowchart for the following problems -To calculate LeafAreaIndex (LAI)-To calculatetheCropGrowthRate(CGR)-To findthegreatestaverage seed sales oftwo districts during samba season.
9. Familiarizing with the Integrated Development Environment of C Editorfor coding, saving, compiling, debugging and executing – C Programs: Display TNAU motto "Till, Toil, Triumph" – Calculate Leaf Area Index (LAI) –Calculate the Crop Growth Rate (CGR) - Find the greatest average seed sales of two districts during samba season.
10. Looping statements: Calculate the average yield oflast10 years Rice yield of our District-Write a C program to find total, maximum, minimum and average rain fall of lastfive years in our District.
11. e-Agriculture – Leveraging social media in agriculture (Social networks).
12. ICT in agriculture – Paperless data collection using google survey tools - Online photo and video editing tools.
13. Simulatingcropyield:InfoCrop-Basefilecreationforriceandmaize (Weather, Varietal characters, Agronomy practices, Soil data) – Interpretation.
14. InfoCrop – Climate change impact studies on rice and maize.
15. Smartphonemobileapps inAgricultureforfarmadvices, cropprotection,marketprice, postharvest management.
16. Decision support systems
17. Expert systems -Information systems for supporting farm decisions.
18. Crop calendar – Crop planning tool forfarmers.
19. Final Practical Examination

Reference:

1. Introduction to Information Technology, 2012, Second Edition, ITL Education Solutions Limited, PEARSON Education.
2. Firuza Aibara, HTML 5 for Beginners, 2012, Shroff Publications.
3. John Walkenbach, Excel 2010 Bible, Wiley publishing, Inc
4. Balagurusamy, E., Programming inANSIC, 2017, Seventh Edition, McGraw Hill Education.
5. Saravanan,R.,Kathiresan,CandIndraDevi,T.,2011.Information&communicationtechnologyfor agriculture and rural development. New India Publ. Agency.
6. Aggarwal, P.K., NaveenKalra and SubhashChander, Info crop: A generic simulationmodel for annual crops intropicalenvironments,IndianAgriculturalResearchInstitute,NewDelhi.
7. Malcolm J.Blackie,Information Systems forAgriculture, 2012, SpringerNetherlands.

8. Smart Sensing Technology for Agriculture and Environmental Monitoring, 2012,
9. Editors: Mukhopadhyay and Subhas Chandra (Ed.), Springer
10. John Billingsley, Arto Visala and Mark Dunn, 2008, Robotics in Agriculture and Forestry – 46th
11. Chapter from book Springer Handbook of Robotics.
12. Introduction to Expert Systems, 3rd Edition by Peter Jackson

21SAC 201 PROBLEMATIC SOILS AND THEIR MANAGEMENT (2+0)

Course objective

- To study the basics of Soil quality and health, Distribution of Waste land and problem soils in India and Tamil Nadu
- To expose the students to reclamation and management of soil physical and chemical constraints - Eroded and Compacted soils, Flooded soils, Saline and sodic soils, Acid soils, Acid Sulphate soils, degraded alkali soils and Polluted soils.
- To impart knowledge on Effect of salts on soil and plants.

Course outcome

- Basics of Remote sensing and GIS in assessment and management of problem soils.
- Irrigation water – quality and standards.
- Utilization of saline water in agriculture.

THEORY

Unit I- Soil quality and health

Soil quality and health, Distribution of Waste land and problem soils in India and Tamil Nadu. Categorization of waste lands based on properties.

Unit II- Soil physical and chemical constraints

Characteristics, reclamation and management of soil physical and chemical constraints - Eroded and Compacted soils, Flooded soils, Saline and sodic soils, Acid soils, Acid Sulphate soils, degraded alkali soils and Polluted soils. Effect of salts on soil and plants.

Unit III- Remote sensing and GIS

Remote sensing and GIS in assessment and management of problem soils. Irrigation water – quality and standards. Utilization of saline water in agriculture.

Unit IV- Bio remediation and land classification

Multipurpose tree species, bio remediation of soils through MPTs, land capability classification, land suitability classification.

Unit V – Problem Soils

Problematic soils under different Agro ecosystems - Soil fertility improvement through carbon build up.

Lecture schedule:

1. Soil health - Definition - Soil Quality Indices – Physical indicators
2. Soil Quality Indices - Chemical and biological indicators

3. Distribution of waste lands and problem soils in India and Tamil Nadu
4. Categorization of waste lands based on properties
5. Soil physical constraints – slow permeable, excessively permeable soils and fluffy paddy
6. soils - Characteristics and management
7. Soil crusting, soil compaction, sub soil hard pan, sand dunes and shallow soils – characteristics and management
8. Eroded soil – Genesis, types and characteristics: water- sheet, rill, gully, ravines, wind – Aeolian, loess, saltation, suspension , soil creep
9. Universal soil loss equation and erosion control measures
10. Flooded soils – Formation, characteristics and management
11. Acid soil and acid sulphate soil – Genesis and characteristics.
12. Lime requirement of acid soil, liming materials, reclamation and management of acid soil
13. Formation and classification of Saline, Sodic and saline sodic soils. Effects of salts on soils-Physical: Clay swelling and Dispersion, permeability, Infiltration, Crust, Water transmission. Chemical: pH and EC. Biological : Microbial activity.
14. Effects of Salts on plants – Plants response to saline and sodic conditions, Factors affecting salt tolerance, crop response to salinity, ratings of crop salt tolerance.
15. Salts and plant mineral nutrition- Salinity and nutritional effects: Salinity and N, P, K, Ca, Mg, S, and Micronutrients. Alkalinity and nutritional effects.
16. Saline, Sodic, saline sodic, and degraded alkali soils- characteristics and their management
17. **Mid Semester Examination**
18. Saline soil-reclamation – Leaching requirement. Sodic soil – reclamation -gypsum requirement– calculations.
19. Polluted soils- industrial effluent s- Characteristics, reclamation and management
20. Polluted soils- mine spoils- Characteristics, reclamation and management
21. Irrigation water – quality and standards - EC, SAR, RSC, RSBC SSP, PSI and PS
22. Irrigation water – quality and standards -USDA system and specific ion toxicity-USSL system
23. Factors affecting suitability of irrigation water
24. Management of poor quality water in agriculture
25. Remote sensing and GIS in assessment of wastelands and problem soils
26. Remote sensing and GIS in monitoring
27. Management of wastelands and problem soils
28. Multipurpose tree species for waste lands and problem soils
29. Bio remediation through MPTs of soils MPTs - Nutrient cycling under waste lands and problem soils
30. Land capability and classification. Land suitability classification
31. Problematic soils under different Agro ecosystems- coastal salinity, inland salinity
32. Problematic soils under different Agro ecosystems- marshy, swampy soils, red sand dunes (Their soils) Tsunami affected soils.

33. Agricultural Ecosystem services- Soil fertility improvement in problem soils
34. Potential of agro forestry systems in management of problem soils. Carbon sequestration and its role in problem soil management

Textbooks

1. Das D.K. 2015. Introductory Soil Science (4th ed.). Ludhiana: Kalyani Publishers.
2. Gupta, I.C and Gupta, S.K. 2019. Crop production in salt affected soils. Scientific Publishers.
3. Mahendran, P.P. 2008. Soil Resource Inventory and Management of Problematic Soils. Agrotech Publishing Academy. pp.1- 184.
4. Ramesh, C and Singh, S.K. 2009. Fundamental and Management of soil quality. New Delhi: Westville Publishing House. pp.1- 380.
5. Somani, L.L. 2019. Textbook of problematic soils and their management. South Indian book traders.

References books

1. Brady, N.C. and Weil, R. C. 2013. The Nature and Properties of Soils (15th ed.). Pearson Education. pp.1 - 1035.
2. Indian Society of Soil Science. 2012. Fundamentals of Soil Science (2nd ed.). New Delhi: ISSS, IARI.
3. Istvan, S. (1988). Salt-affected soils, CRC press. pp.1 - 274.
4. Madhavi, L.G and Raghuveer, R. P. 2020. Problematic soils and Geo environmental concerns. Springer. pp.1 - 804.
5. Sanjay, A., Singh, A.K and Singh, Y.P. 2018. Bioremediation of salt affected soils: An Indian perspective. Springer. pp.1 - 313.

Web references

1. <http://www.fao.org/soils-portal/soil-management/management-of-some-problem-soils/salt-affectedsoils/en/#:~:text=When%20salts%20more%20soluble%20than,them%20are%20classified%20as%20Solonchakz.>
2. <https://www.tandfonline.com/doi/abs/10.1080/15324980590887344?journalCode=uasr20>
3. <https://www.noble.org/news/publications/ag-news-and-views/2008/february/management-of-salt-affected-soils/>
4. <https://youtu.be/yJ4pnyWdXoU>
5. <http://www.soilhealth.com/soil-health/management/>

Course objectives:

- To outline insect ecology
- To summarize Integrated pest management
- To discuss honey bee diversity, biology and beekeeping
- To demonstrate sericulture and lac culture
- To analyse beneficial insects and entomopathogens

Course outcomes: Through this course students should be able to

- define the concept of insect ecology
- understand and design IPM
- implement apiculture
- execute sericulture and lac culture
- differentiate parasitoids, predators and entomopathogens used in biological control of crop pest

THEORY**Unit I- Insect ecology**

Definition, Concept of Balance of life in nature, biotic potential and environmental resistance, Population dynamics - role of abiotic factors -temperature, moisture, humidity, rainfall light, atmospheric pressure and air currents. Effect of biotic factors – Competition- parasitoids and predators. Life table- Interspecific and intraspecific relationship Causes for outbreak of pests in agro-ecosystem. Pest monitoring- pest surveillance and forecasting – objectives, survey, sampling techniques and decision making. Categories of pests. Concept of damage Levels- Economic threshold levels (ETL), Economic injury levels (EIL)

Unit II- Integrated pest management (IPM)

Concept, principles and tools of IPM: Cultural, Mechanical, Physical, Legislative, Host plant resistance, Biological (parasitoids, predators & entomopathogens) and biotechnological methods of pest control. Chemical control – Pesticides – history, classification – mode of action of insecticides. Pesticides compatibility, safety and hazards in the use of pesticides – pesticide poisoning - impact of pesticides in agro-ecosystem. Insecticide act. Insecticides residues and resistance. Semiochemicals – allomones – kairomones – pheromones- semiochemicals in pest management. Sterile male technique – chemosterilants, insect growth regulators – moult inhibitors – Juvenile Hormone mimics – antifeedants and repellents. Botanicals.

Unit III- Honey bees and beekeeping

Honey bee diversity, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit IV- Sericulture and Lac culture

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, and mulberry cultivation and their management, rearing

appliances of mulberry silkworm and methods of disinfection. Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.

Unit 5- Beneficial insects and entomopathogens

Parasites and predators used in pest control and their mass multiplication techniques. Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques. Insect pollinators, weed killers and scavengers - their importance.

PRACTICAL

Types of damage caused by insect to plants. Methods of insect pests measurement and Assessment of crop yield losses. Pest survey, surveillance and forecasting. Different methods of insect sampling for insect population assessment. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others. Pesticide formulation and application equipments. Pesticide application techniques. Honey bee species and castes of bees. Beekeeping appliances and seasonal management. Bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry nursery bed preparation – methods of planting - Pruning methods – leaf / shoot harvest– preservation of leaves. Identification of damage symptoms of insects, diseases and nematodes of mulberry. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products. Identification and techniques for mass multiplication of predators, parasitoids and entomopathogens.

Lecture schedule

1. Insect ecology – definition – balance of life in nature – reproductive potential and environmental resistance
2. Population dynamics – role of biotic factors – competition – parasitoids and predators. Life table – Interspecific and intraspecific relationship. Abiotic factors – physical, nutritional and host plant associated factors on insect population
3. Pests – definition, categories and causes for outbreak of pests. Losses caused by pests
4. Pest monitoring – pest surveillance and forecasting – objectives, survey, sampling techniques and decision making. Economic Threshold Level and Economic Injury Level.
5. Integrated Pest Management – history, principles and strategies – requirements for successful pest management programme. Components of pest management
6. Cultural methods – definition – characteristics, requisites – farm level practices and community level practices, advantages and disadvantages- Ecological Engineering in pest management
7. Physical methods – definition – use of heat, moisture, light, electromagnetic energy and sound energy – Mechanical methods – definition – mechanical destruction and exclusion – merits and demerits.
8. Host plant resistance – types and mechanisms of resistance and role of host plant resistance in pest management Legal methods – definition – pest introductions – quarantine – phytosanitary certificate – pest legislation
9. Biological control – definition, parasitoids and predators and their role in pest management - Microbial control – viruses, bacteria, fungi, protozoa and nematodes and their role in pest management

10. Chemical control – definition – history of insecticide development – toxicity parameters – ideal qualities of an insecticide.
11. Classification of insecticides based on mode of entry, mode of action and chemical nature
12. Mode of action of organophosphates, carbamates, synthetic pyrethroids, neonicotinoids, diamides and avermectins
13. Pesticide compatibility, safety and hazards – pesticide poisoning - antidotes – safe handling. Insecticides Act 1968 – insecticide residues and waiting periods, role of pesticides in pest management, insecticide resistance management
14. Semiochemicals – definition – intraspecific semiochemicals – allomone, kairomone, synomone and apneumone - Interspecific semiochemicals – pheromone, sex pheromone, alarm and trail marking pheromone. Pheromones in Integrated Pest Management
15. Sterility methods – definition – principles – methods – requirements and limitations. Insect growth regulators – moult inhibitors – Juvenile Hormone mimics – mode of action and uses. Insect antifeedants and repellents – mode of action, groups and uses
16. Botanicals and Biotechnological approaches in pest management – bio safety of transgenic plants
17. **Mid Semester Examination**
18. Bee species – comparison – castes of bees – bee behaviour and bee dance
19. Apiary management practices – bee pasturage – foraging – seasonal variations.
20. Pests and diseases of honeybees and effect of agricultural inputs on bee activity – pesticide poisoning
21. Bee products – their properties and uses
22. Ecological requirements for mulberry cultivation – soil type – mulberry varieties
23. Methods of propagation – merits and demerits – selection of semi hard wood cuttings
24. Pests and diseases of mulberry
25. Sericulture- scope - Types of silkworm
26. Mulberry silkworm – origin – classification based on voltinism, moultnism, geographical distribution and genetic nature - Characters of multivoltine races, bivoltine races, cross breeds and bivoltine hybrids – double hybrids– suitability for rearing in different seasons.
27. Morphology and biology of silkworm – sexual dimorphism in immature and adult stages – silkworm genetics – chromosome number – sex limited characters in egg, larva and cocoon for grainage use
28. Pests and diseases of silkworm
29. Lac insect- biology-strains
30. Natural enemies of lac insect and lac products
31. Identification and techniques for mass multiplication of parasitoids
32. Identification and techniques for mass multiplication of predators
33. Identification and techniques for mass multiplication of entomopathogens
34. Weed killers, pollinators, scavengers and soil builders

Practical schedule

1. Symptoms and types of damage caused by insect pests to plants and methods of assessment of insect pest population and their damage
2. Pest survey, surveillance, forecasting and methods of insect sampling for insect population assessment
3. Behavioral approaches in pest management –Pheromone traps, light traps, sticky traps and others
4. Pesticide formulation, and toxicity parameters
5. Plant protection appliances
6. Pesticide application techniques, preparation of spray fluids and botanicals for field application
7. Identification, morphology and structural adaptations in honeybees and bee enemies and diseases
8. Bee keeping appliances, seasonal management, Bee pasturage, foraging and communication
9. Types of silkworm, voltinism and biology of silkworm, Chawki rearing and shoot rearing
10. Mulberry nursery bed preparation – methods of planting - Pruning – leaf / shoot, Harvest and preservation of leaves.
11. Identification of damage symptoms of insects, diseases and nematodes of mulberry
12. Lac insect-life history, hosts and culturing of lac, natural enemies of lac and lac products
13. Identification and mass culturing of different types of parasitoids
14. Identification and mass culturing of different types of predators
15. Identification and mass production of entomopathogens
16. Study of useful insects: pollinators, weed killers, scavengers, and soil builders
17. **Final Practical Examination**

Text books

1. Dhaliwal, G.S. and R.Arora. 2001. *Integrated Pest Management – Concepts and approaches*. Kalyani publishers, New Delhi. 427p. {ISBN: 81-7663-904-4}
2. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}

Reference books

1. Pedigo, L.P. and M.E.Rice.1996. *Entomology and Pest Management*. Prentice-Hall of India Pvt Ltd, New Delhi. 812p. {ISBN-978-8120338869}
2. Dandin, S.B., J.Jayaswal and K. Giridhar.2003. *Hand book of Sericulture Technologies*. Central Silk Board, Bangalore, 287 p.

Web references

- https://agritech.tnau.ac.in/farm_enterprises/fe_apiculture_home.html
- <http://ecoursesonline.iasri.res.in/course/view.php?id=166>
- <https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf>
- https://agritech.tnau.ac.in/crop_protection/crop_prot_ipm_introduction.html

- <https://www.gov.nl.ca/ecc/files/env-protection-pesticides-business-manuals-applic-chapter7.pdf>

21ERG 211 RENEWABLE ENERGY AND GREEN TECHNOLOGY (1+1)

Course objective

This course aims at understanding basic characteristics of renewable sources of energy and technologies for their utilization for the thermal and electrical energy needs and also the environmental aspects of these resources.

Course outcome

- Understand the role of renewable energy in product and service sectors, as well as its importance in the energy chain: processing, transportation, distribution and end use.
- To understand role significance of solar energy, wind energy, biomass and other renewable energy sources and technologies for their utilization.
- To get the utilization of Biogas plants and understand the concept of energy Conservation

THEORY

Unit I- Introduction to renewable energy sources

Energy crisis – classification of energy sources – renewable energy –significance – potential achievements in India. Biomass – methods of energy conversion.

Unit-II Biochemical energy conversion

Biofuels – importance – biodiesel and bioethanol production method – flowchart – byproducts utilization. Biogas technology – classification - types - factors affecting biogas plants- alternate feedstocks – applications - biodigested slurry and enrichment.

Unit III – Thermochemical energy conversion

Briquetting –methods- advantages and disadvantages -combustion –definition-Improved chulhas – types – construction features - applications. Pyrolysis – methods for charcoal /biochar production- comparison of slow and fast pyrolysis. Gasification –chemistry –types –updraft gasifierdowndraft gasifier – working principles – operation and applications.

Unit IV – Solar energy conversion

Solar Energy – characteristics - types of radiation – solar constant-solar thermal devices – solar water heater – solar cooker – solar pond – solar distillation – working principles and applications. Solar PV systems – principle – solar lantern - water pumping. Solar driers – natural and forced convection types – solar tunnel drier – working principles and operation.

Unit V- Wind and other renewable energy sources

Wind –formations - Wind mills –types – horizontal and vertical axis – components – working principles –applications. Geothermal energy –wave energy –tidal energy –ocean energy principle and operation -types – advantages and disadvantages

PRACTICAL

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

Lecture schedule

1. Energy crisis – renewable energy sources – significance – potential and achievements in India – energy requirements of agricultural and horticultural crops.

2. Biomass –methods of energy conversion– biochemical conversion methods – thermochemical conversion methods.
3. Biofuels – importance – biodiesel and bioethanol production method – flowchart – by products utilization
4. Biogas technology – classification - types of biogas plants – KVIC and Deenabandhu model biogas plants – factors affecting biogas plants.
5. Alternate feedstocks for biogas production – applications of biogas cooking, lighting and engine operations – bio digested slurry and enrichment.
6. Briquetting – MED – VED – methods – need for briquetting - benefits of biomass briquettes.
7. Combustion–improved chulha –singlepot– doublepot – conventional chulha - –biomassgas stove–constructional features –principles and applications.
8. Pyrolysis – methods for charcoal production –biochar production– comparison between slow and fast pyrolysis.
- 9. Mid Semester Examination**
10. Gasification – chemistry – types – updraft gasifier – working principles operations – application
11. Downdraft gasifier – working principles – operation and applications.
12. Solar energy – characteristics of solar radiation - types of radiation – solar constant
13. Solar thermal devices – solar water heater– solar cooker– solar pond – solar distillation – working principles and applications.
14. Solar PV systems –principle – solar lantern-water pumping applications.
15. Solar driers – natural and forced convection types – solar tunnel drier – working principles and operation.
16. Wind mills – types – horizontal and vertical axis – components – working principles – applications.
17. Energy from ocean, waves, tides. Geothermal energy sources – principles and operation.

Practical schedule

1. Basic principles of working of renewable energy gadgets
2. Experiments on biodiesel production
3. Experiments on bioethanol production process
4. Construction and working principle of KVIC biogas plant
5. Construction and working principle of deenbandhu biogas plant
6. Experiments on biogas applications
7. Experiments on briquetting technology
8. Performance evaluation of improved chulha
9. Evaluation of biochar production systems
10. Experiments on bio oil production method
11. Performance evaluation of producer gas production system
12. Performance evaluation of solar dryers

13. Experiments on solar cookers and distillation systems
14. Performance evaluation of solar water heaters
15. Experiments on solar water pumping system
16. Performance assessment of solar street light and fencing

17. Final Practical Examination

Text books

1. Renewable Energy: Power for a Sustainable Future, Godfrey Boyle.
2. Jagadishwar Sahay, 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi. ISBN: 978-8180140440

References

1. S. Pugalendhi, R. Shalini, J. Gitanjali and P. Subramanian. 2017. Introduction to Renewable Sources of Energy. TNAU, Coimbatore
2. G.D. Rai. 2012. Nonconventional Energy Sources. Khanna Publishers, New Delhi.
3. C.S. Solanki, 2009. Renewable Energy Technologies : A Practical Guide for Beginners. PHI Learning Pvt. Ltd., New Delhi.
4. S. Rao and B.B. Parulekar. 2007. Energy Technology: Non-Conventional, Renewable and Conventional. Khanna Publishers, Naisarak, Delhi.
5. G.D. Rai. 1993. Solar Energy Utilisation. Khanna Publishers, New Delhi.
6. J. F. Manwell, J. G. McGowan and A. L. Rogers. 2009. Wind Energy Explained: Theory, Design and Application. Wiley & Sons Ltd.,
7. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
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2. https://www.researchgate.net/publication/46279878_Handbook_of_renewable_energy_technology
3. <https://www.agrimoon.com/renewable-energy-pdf-book/>
4. <http://ecoursesonline.iasri.res.in/course/view.php?id=524>
5. http://cohvka.kau.in/sites/default/files/documents/renewable_energy.pdf
6. <https://nptel.ac.in/courses/108105058>

21PAT 202 PRINCIPLES OF PLANT DISEASE MANAGEMENT (2+1)

Course objective:

Detailed study of disease triangle, epidemiology of diseases, fungicidal classification, biocontrol agent and its mass multiplication.

Course outcome:

- To study about disease triangle – factors influencing disease- epidemiology in detail.
- To study different classes of fungicides and its mode of action.
- To study the role of biocontrol agent and its mass production
- To study the integrated disease management

THEORY

Unit I - Epidemiology and diagnosis of plant diseases

Classification of plant diseases - Disease triangle- Epidemiology of plant diseases- role of weather factors in disease development and spread- survival and dispersal of plant pathogens- Disease surveillance, assessment and forecasting– Diagnosis of plant diseases- Seed health tests- chemodiagnosis, serodiagnosis and Molecular diagnosis.

Unit II – Exclusion and avoidance

Different principles of Plant Diseases Management- Exclusion- Plant quarantine – domestic, International and Embargo - Phytosanitary certificate- Quarantine in India. Exotic diseases introduced into India- Role of cultural practices in plant disease management.

Unit III - Eradication

Eradication from seed and Planting materials – Eradication of diseased plants- Surgery and Rouging – Eradication of Alternate and Collateral host- different methods of eradication- Mechanical, physical , chemical and Biological methods.

Unit IV - Protection

Protection of crops from air borne, seed borne, soil borne and vector borne plant diseases-Physical methods- soil solarization, Hot water treatment, Incineration. Chemical control of plant diseases- fungicides- Different group of fungicides and antibiotics in plant disease management- Biological control of plant diseases - Plant products and Antiviral principles- method of application- plant protection appliances,

Unit V - Immunization and biotechnological approaches

Immunization - cross protection and host plant resistance – Types of resistance - vertical and horizontal resistance – Resistant varieties. Mechanism of resistance- structural and bio chemical resistance in plants -Biotechnological approaches for crop disease management..

PRACTICAL

Survey and Assessment of important plant diseases. Diagnosis of Plant diseases: Tetrazolium test, Iodine test and ELISA test. Seed health tests for diagnosis of seed borne pathogens - dry seed examination, seed washing, Blotter test and ELISA. Classification and grouping of fungicides. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshnut compound. Calculation of fungicides quantity and methods of application of fungicides – Seed (wet and dry) soil, foliar and post harvest dipping. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application. Special methods of application: Corm injection, Paring and prolinage, , root feeding and trunk injection. Mass multiplication of *Trichoderma viride* and method of application. Mass multiplication of *Pseudomons fluorescens* and method of application. Mass multiplication of *Bacillus subtilis* and method of application. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.

Cross protection: production of pre immunized citrus seedlings against tristeza virus. Tissue culture – Production of virus free plants through meristem tip culture technique. Visit to seed testing Laboratory. Field visit.

Lecture schedule

1. Plant diseases –Classification based on mode of infection, inoculums built up, spread, symptoms, severity and occurrence- Disease triangle- Role of weather factors in plant disease development.
2. Survival and dispersal of Plant Pathogens
3. Disease surveillance –Different methods- surveillance report-Disease surveillance programme in Tamil Nadu. Assessment of Plant Diseases- different methods- Measurement of disease growth rate by Area under disease Progressive curve (AUDPC)
4. Diagnosis of plant diseases-Seed health tests, Chemodiagnosis, serodiagnosis and Molecular diagnosis
5. Exclusion- Plant quarantine – domestic, International and Embargo -phytosanitary certificate- Quarantine in India. Exotic diseases introduced into India.
6. Role of cultural practices in plant disease management. Different methods of Eradication of Plant Diseases
7. Protection –Physical methods of protection- Chemical fungicides – Definition – classification- Sulphur and Copper fungicides, mode of action and uses
8. Mercury fungicides, Heterocyclic Nitrogen compounds , Organo tin, Quinone, Benzene and Miscellaneous compounds , Mode of action and Uses
9. **Mid Semester Examination**
10. Systemic fungicides including antibiotics – classification – mode of action - uses. New generation fungicides
11. Methods of application of fungicides: seed treatment, foliar spray, soil drenching and special methods of application
12. Biological control – Definition - mechanism of action – Mass production of *Trichoderma viride* , *Pseudomonas fluorescens* & *Bacillus subtilis* - methods of application - Plant products – antiviral principles – preparation – methods of application
13. Plant Protection appliances – Duster, Sprayers, Soil injector/Soil gun, Granular applicator and slurry seed treater
14. Disease Resistance- Types- Resistant varieties. Methods of developing resistant varieties
15. Mechanisms of resistance- structural and bio chemical resistance in plants
16. Immunization technique- Cross protection against viral and bacterial diseases.
17. Biotechnological approaches in plant diseases management: Tissue culture techniques- meristem tip culture, somoclonal variation and transgenic plant production by genetic engineering.

Practical schedule

1. Survey and Assessment of important plant diseases
2. Diagnosis of Plant diseases: Tetrazolium test, Iodine test and ELISA test
3. Seed health tests for diagnosis of seed borne pathogens - dry seed examination, seed washing, Blotter test and ELISA.
4. Classification and grouping of fungicides.
5. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshnut compound.
6. Calculation of fungicides quantity and methods of application of fungicides – Seed (wet and dry) soil, foliar and post harvest dipping.
7. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application
8. Special methods of application: Corm injection, Paring and prolinage, , root feeding and trunk injection.
9. Mass multiplication of *Trichoderma viride* and method of application
10. Mass multiplication of *Pseudomons fluorescens* and method of application
11. Mass multiplication of *Bacillus subtilis* and method of application
12. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
13. Cross protection: production of pre immunized citrus seedlings against tristeza virus.
14. Tissue culture – Production of virus free plants through meristem tip culture technique.
15. Visit to seed testing Laboratory
16. Field visit
17. **Final Practical Examination**

References

1. Agrios, G. N. 2008. Plant Pathology, 5 th edition, Academic Press, New York.
2. Nene,Y.L. and Thapliyal, P.N. 1998. Fungicides in plant disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
3. Chattopadhyay,S.G. 1998. Principles and procedure of plant protection, Oxford and IBH publishing Co. Ltd., New Delhi.
4. Narayanasamy,P. 1997. Plant pathogens detections and disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
5. Narayanasamy,P. 2011. Microbial plant pathogens detections and disease diagnosis Vol. I. Springer publication.
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9. Cooke, B.M, Jones, D.G and Kaye, B. 2006. The Epidemiology of plant Diseases. Published by Springer, The Netherlands

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1. Agrios, G.N. 2005. Plant Pathology – (5th Edition). Academic Press, New York
2. Pal, K. K. and B. McSpadden Gardener, 2006. Biological Control of Plant Pathogens. *The Plant Health Instructor* DOI: 10.1094/PHI-A-2006-1117-02.APS Net
3. J.M. Waller, J.M. Lenné and S.J. Waller 2002. Plant Pathologist's Pocketbook 3rd Edition, CABI Publishing UK
4. Cooke, B.M, Jones, D.G and Kaye, B. 2006. The Epidemiology of plant Diseases. Published by Springer, The Netherlands

Web-references

1. www.plantdisease.com
2. www.cropprotection.html

21HOR 212 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAP AND LANDSCAPING (1+1)

Course objective:

- Explaining the principles and components of landscape gardening.
- Impart knowledge about the production technology of ornamentals and MAP.
- Demonstrate the applications of landscaping.

Course outcomes:

- Appreciate the importance and significance of medicinal and aromatic plants.
- Understand the requirements for landscaping.
- Plan for the cultivation of flower crops.
- Summarize the values of medicinal and aromatics.
- Designing landscape and practice cultivation of flowers, medicinal and aromatic plants.

THEORY

Unit I- An introduction to ornamental, medicinal, aromatic plants and landscaping

Scope and importance of ornamental, medicinal, aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.

Unit II- Production technology of cut and loose flowers

Soil and climate - species and varieties - propagation- planting systems and methods - training and pruning practices - nutrient and water management - role of growth regulators - inter cultivation - harvesting and yield of Cut rose, Gerbera, Carnation, Lilium and Orchids under protected conditions and Gladiolus, Tuberose, Chrysanthemum under open conditions. Jasmine, Marigold, Crossandra, Gomphrena under open field conditions.

Unit III- Production technology of medicinal plants

Uses - current status of area and production - soil and climate - varieties and species - propagation and planting – weed, water and nutrient management- harvesting - postharvest handling of Ashwagandha, Asparagus, Aloe, Costus, Senna, Coleus, Periwinkle, and Isabgol.

Unit IV- Production technology of aromatic crops

Introduction - uses - current status of area and production - soil and climate - varieties and species - propagation and planting - weed and water management - nutrient management – harvesting and postharvest handling of Mint, Lemongrass, Citronella, Palmarosa, Ocimum, Geranium, Vetiver.

Unit V- Postharvest technology of ornamental crops, medicinal and aromatic plants

Processing and value addition in ornamental crops, medicinal and aromatic plants produce.

PRACTICAL

Identification of ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of medicinal and aromatic plants. Protected structures. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of medicinal and aromatic plants. Visit to commercial flower/MAP unit.

Lecture schedule:

1. Importance and scope of ornamental crops and landscaping - landscape uses of trees, shrubs and climbers.
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 - contract - harmony - vista - style.
3. Production technology of cut flowers under protected conditions - rose – introduction- origin and distribution - classification- species and varieties – climate and soil requirements - propagation – rootstocks - stock scion compatibility - land preparation – planting - manures and fertilizers - cultural operations (pruning pinching and mulching) harvesting - post harvest management - yield and rose biproducts.
4. Gerbera – introduction - origin and distribution – classification - species and varieties - climate and soil requirements – propagation - land preparation –planting - manures and fertilizers - cultural operations – defoliation - soil loosening- shading use of growth regulators - physiological disorders – harvesting - post harvest management and yield.
5. Carnation – introduction - origin and distribution- classification - species and varieties - climate and soil requirements - propagation - land preparation- planting - manures and fertilizers - Cultural operations- (Pinching and disbudding) use of growth regulators - physiological disorders - harvesting - post harvest management and yield.
6. Lilium and Orchids - introduction- origin and distribution- classification- species and varieties- climate and soil requirements- propagation- land preparation-planting manures and fertilizers- cultural operations - use of growth regulators physiological disorders- harvesting- post harvest management and yield.
7. Production technology of cut flowers under open conditions - gladiolus and tuberose- introduction - origin and distribution - classification of varieties - species and varieties -

climate and soil requirements - propagation - land preparation – planting - manures and fertilizers - cultural operations - use of growth regulators physiological disorders – harvesting - post harvest management and yield.

8. Chrysanthemum – introduction - origin and distribution – classification - species and varieties - climate and soil requirements – propagation - land preparation - planting, manures and fertilizers - cultural operations - pinching and disbudding - use of growth regulators- harvesting - post harvest management and yield.

9. Mid Semester Examination

10. Loose flowers - marigold and jasmine under open conditions – introduction – origin and distribution - species and varieties - F1 hybrids - climate and soil requirements - propagation-land preparation – planting - manures and fertilizers - cultural operations- pinching and disbudding - use of growth regulators – harvesting - postharvest management and yield.
11. Medicinal plants – scope and importance – production technology of asparagus, aloe, costus - botanical name – family - origin - economic part - introduction – climate – soil - varieties – propagation – planting - manuring - irrigation -intercultural operations - harvesting - Yield.
12. Periwinkle, Isabgol -botanical name – family - origin - economic part -introduction – climate – soil – varieties – propagation – planting - manuring – irrigation – intercultural operations - harvesting - yield.
13. Aromatic plants – importance – essential oil industry in India – properties of essential oils – production technology of mint and ocimum - Botanical name –family - origin - economic part - introduction – climate – soil - varieties –propagation – planting - manuring - irrigation - intercultural operations -harvesting - yield.
14. Lemongrass, Citronella, Palmarosa - botanical name – family - origin – economic part - introduction – climate – soil - varieties – propagation – planting – manuring- irrigation - intercultural operations - harvesting - yield.
15. Geranium and Vettiver - botanical name – family - origin - economic part - introduction – climate – soil - varieties – propagation – planting - manuring -irrigation - intercultural operations - harvesting - yield.
16. Processing and value addition in ornamental crops and medicinal and aromatic plants – produce – dry flower making - extraction methods of essential oils.

Practical schedule

1. Identification of ornamental plants.
2. Identification of Medicinal and Aromatic Plants.
3. Nursery bed preparation and flower seed sowing.
4. Training and pruning of roses.
5. Planning and layout of ornamental garden.
6. Bed preparation and planting of Medicinal and Aromatic Plants.
7. Protected structures – Care and maintenance.
8. Intercultural operations in flowers crops.
9. Intercultural operations in Medicinal and Aromatic plants.
10. Harvesting and post harvest handling of cut and loose flowers.
11. Floral preservatives to prolong vase-life of cut flowers.
12. Drying / dehydration techniques for flower drying.
13. Processing of Medicinal and Aromatic Plants.
14. Extraction of essential oils.

15. Visit to commercial floriculture unit.
16. Visit to commercial medicinal and aromatic plants unit.

17. Final practical examination

Text books

1. Anil Kumar Verma, Anil Gupta, Dharminder Kumar and Mast Ram Dhiman. 2012. Post Harvest technologies for Commercial floriculture, New India Publishing Agency 2nd edition pp:1-230
2. Ankan Das, Amit Baran Sharangi .2018. Indian spices: The legacy, production and processing of India Treasured Export 1st ed pp:1- 203
3. Gupta R.K .2010. Medicinal and aromatic plants, CBS publication 2nd edition pp1-201
4. Kumar.N .2017. Introduction to spices, plantation crops, medicinal and Aromatic plants 2nd Edition Oxford and IBH publishing pp1-250
5. Singh Anil. Et All .2017. text book of floriculture and landscaping 2nd edition pp1-124
6. Singh.A.K .2006. Flower crops cultivation and management, New India publishing 1st edition pp1-245
7. Serdar Oztekin, Milan Martinov. 2008. Medicinal and Aromatic crops: Harvesting, Drying and Processing 1st Ed pp:1-186 CRC Press

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2. Bhattacharjee, S.K 2004. Landscape Gardening and Design with plants. Aavishkar Publishers and Distributors, Jaipur Vol2 1st edition pp1-310
3. Bhattacharjee, S.K and De L.C .2003. Advanced Commercial Floriculture Vol. (1) Aavishkar publishers, Distributors, Jaipur. 1st edition pp1-127
4. Bose, T.K., Yadav, L.P., Pal. P., Das. P. and Parthasarathy, V.A., 2002. Commercial Flowers. Vol.1, Naya Prakash, Calcutta. 1st edition pp1-200
5. Farooqi, M., M. M. Khan and M. Vasundhara. 2004. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore – 561229. pp1-175
6. Kumar, N. Introduction to Spices, Plantation, Medicinal and Aromatic crops. 1995. Oxford and IBH Publications, New Delhi. 1st edition pp:315

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3. <http://www.webct.uark.edu>
4. <http://www.pubmed.com>
5. <http://www.bestgarden.net/>
6. <http://www.indiaagronet.com/>
7. <http://www.intuxford.tripod.com/>

8. <http://www.lawngrasses.com/>
9. <http://www.frlht.org>
10. www.herbs.org
11. <https://youtu.be/thaeC99H8FE>
12. <https://youtu.be/V5KODz92wLc>

**21AEX201 Communication Skills and Personality Development (1+1) (Updated by
Dr.Dineshkumar on 11.08.2023)**

THEORY

Communication Skills: meaning and process of communication, verbal and nonverbal communication; 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, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Unit I

Communication Skills: meaning and process of communication, verbal and nonverbal communication

Unit II

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

Unit III

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting

Unit IV

Individual and group presentations, impromptu presentation, public speaking

Unit V

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 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. Lab record : Definition –Importance of keeping a lab record - Features of a lab record - Contents of lab record – Guidelines for keeping a lab record

10. Mid semester examination

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

18.Final Theory Examination

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. Final Practical Examination

Reference

1. G.L. Ray and Sagar Mondal. 2010. Journalism – Farm journalism and communication skills. Kalyani publishers.
2. Sagar Mondal. 2016. Agricultural extension, Kalyani publishers
3. G. L. Ray 2007 Extension Communication and Management, Kalyani publishers
4. Communication and Instructional Technology, By: Indu Grover, Shusma Kaushik, Lali Yadav, Deepak Grover & Shashikanta Verma
5. Indu Grover, Lali Yadav & Deepak Grover Extension Management, Agrotech
6. Everett Rogers, and Floyd Shoemaker, Communication of Innovation – a Cross Cultural Approach, New York Free Press.
7. Kathleen M. German, Bruce E Gronbeck Principles of Public Speaking

e- Reference

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2. www.ajms.co.in
3. www.mindtools.com

21ELC 301 AGRICULTURAL JOURNALISM (2+1)

Course objective:

- Explain agricultural journalism and its role in agricultural development
- Recognize the skills in script writing for different media
- Summarize the knowledge on newspapers and magazines
- To know more about agricultural story and its types and structure
- Summarize the editorial mechanics for agricultural journalism

Course outcome:

- Compare the difference between agricultural journalism and other types of journalism
- Summarize on photojournalism
- Discuss the writing skills for news and agricultural stories to magazines
- Outline the various types of agricultural stories
- Recall script writing, proof reading, Editing and lay outting

THEORY

Unit I- Agricultural journalism

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.

Unit II- Newspapers and magazines

Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.

Unit III- Agricultural story and information

The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

Unit IV- Readability measures

Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions.

Unit V- Editorial mechanics

Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

PRACTICAL

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

Theory schedule:

1. Journalism: Meaning, definition and importance.
2. Agricultural Journalism: Meaning, definition.
3. Prospectus of agricultural journalism
4. Agricultural Journalism: The nature and scope of agricultural journalism
5. Characteristics and training of the agricultural journalist.
6. How agricultural journalism is similar to and different from other types of journalism.
7. Agricultural Journalism in rural areas, problems and prospectus of agricultural journalism.
8. Newspapers and magazines as communication media: Characteristics and kinds.
9. Functions of newspapers and magazines
10. Characteristics of newspaper and magazine readers.
11. Form and content of newspapers and magazines.
12. Style and language of newspapers and magazines.
13. Parts of newspapers and magazines.
14. The agricultural story: Types of agricultural stories.
15. Subject matter of the agricultural story
16. Structure of the agricultural story.

17. Mid Semester Examination

18. Gathering agricultural information: Sources of agricultural information,
19. Gathering agricultural information: interviews, coverage of events.
20. Gathering agricultural information: abstracting from research and scientific materials.
21. Gathering agricultural information: wire services.
22. Gathering agricultural information: other agricultural news sources.
23. Writing the story: Organizing the material.
24. Writing the story: Treatment of the story
25. Writing the story: writing the news lead and the body
26. Writing the story: readability measures.

27. Illustrating agricultural stories: Use of photographs.
28. Illustrating agricultural stories: use of artwork (graphs, charts, maps, etc.).
29. Illustrating agricultural stories: writing the captions.
30. Editorial mechanics: Copy reading.
31. Editorial mechanics: Headline
32. Editorial mechanics: title writing.
33. Editorial mechanics: proofreading
34. Editorial mechanics: lay outing.

Practical schedule:

1. Practice in interviewing
2. Covering agricultural events
3. Abstracting stories from research and scientific materials and from wire services
4. Writing news story
5. Writing magazine story
6. Writing success story
7. Preparation of leaflet
8. Preparation of folder
9. Script writing for radio and television
10. Selecting pictures and artwork for the agricultural story
11. Practice in editing, copy reading, headline and title writing
12. Use of proofreading symbols
13. Preparing layout of farm publication
14. Preparing cover design of farm publication
15. Testing copy with a readability formula
16. Visit to press to understand the process of publication of newspaper
17. **Final Practical Examination**

Text books

1. Ahuja, B.N. 1997. Theory and Practice of Journalism. New Delhi:Surjeet Publications .pp:1-150.
2. Bhaskaran C. 2008. Farm Journalism and Media Management. Jaipur: Agrotech Publishing Academy.pp:1-150.
3. Jana B.L. 2014. Agricultural Journalism. Jaipur: Agro Tech Publishing Agency.pp:1-234.

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1. Singh, A.K. 2014. Agricultural Extension and Farm Journalism. India: Agrobios Publishing Academy.pp.150-240.
2. Trullinger, RW. 2018. Needed, a Profession of Agricultural Journalism 1. United kingdom:Forgotten Books publisher.pp.1-34.

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2. The Indian Express <https://indianexpress.com/>

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4. Thinamani (Tamil) - <https://www.dinamani.com/>
5. <https://www.youtube.com/user/PTTVOnlineNews>
6. <https://www.youtube.com/c/News18Tamilnadu/featured>
7. <https://www.youtube.com/c/indiatoday/featured>

21ELC 202 FOOD SAFETY AND STANDARDS (2+1)

Course objective:

This course aims to provide the students with an understanding of food contaminants and how to control the factors influencing the safety of agricultural products and to familiarize with food quality standards and laws

Course outcome:

- Identify the hazard of the food chain to ensure food safety
- Examine the chemical and microbiological quality of food samples
- Detect the adulteration in food samples
- Understand and apply properly the national and international legislation/ regulation

THEORY

Unit I – Introduction to food quality and safety

Food quality and safety – importance and general principles. Factors affecting food safety. Hazards and risks, types of hazards – biological, chemical, physical hazards. Management of hazards – need, control of parameters, temperature control. Salient features of Food Safety and Standards Act, 2006, Structure of FSSAI, Food safety officer

Unit II – Food quality

Evaluation of food quality – subjective and objective methods of evaluation. Quality criteria of foods – food grains, fruits, vegetables and animal foods. Quality criteria of processed foods. Food storage system. Food Audit, Food alert and food recall, Food inspection and quality control of food processing, Food categorization, licensing and registration

Unit III– Hygiene, sanitation and food borne infection

General principles of hygiene – its relation to food preparation – personal hygiene and food handling habits. Food poisoning – causes and types – control measures food borne intoxication and infection – source – effects and prevention. Water supply sources- impurities and purification of water. Waste disposal ,Water borne disease and air borne disease

Unit IV – Contaminants and adulterants in foods

Physical, chemical and microbial contamination of foods and control - Food adulteration - common adulterants – health hazards. Tests to detect adulterants in food. Food additives- Destruction of microbes – disinfection, physical, mechanical and chemical methods. Proximate analysis of food products

Unit V – Food safety measure and packaging

Packaging- Packaging materials - Product labeling and nutritional labeling. Health programmes in India. Food safety management tools – GHPs, GMPs, SSOPs, HACCP, ISO series. TQM – concept and need for quality, components of TQM, Risk analysis. International Food Standards – Concept of Codex Alimentarius Commission, Food and Drug Administration (FDA). The Kosher and Halal Food Laws.

PRACTICAL

Preparation of media for microbial analysis. Biochemical test for identification of bacteria. Estimation of quality parameters of cereals and cereal products. Estimation of quality parameters of pulses and pulses products. Estimation of quality parameters of fruits and fruit products. Estimation of quality parameters of vegetables and vegetables products. Estimation of quality parameters of milk and milk product. Estimation of quality parameters of meat and meat product. Estimation of quality parameters of fish and fish product. Estimation of quality parameters of water quality. Market survey and quality analysis of processed foods. Detection of food adulterants in food. Visit to food corporation of India. Visit to quality control laboratory. Visit to food processing unit to study the role of Halal food laws in food safety. Visit to food processing industry to study the Hazard Analysis Critical Control Point (HACCP) concept.

Theory schedule

1. Food quality and safety- importance and general principles
2. Factors affecting food safety, hazards
3. Types of hazards
4. Management of hazards - need, control of parameters, temperature control
5. Salient features of Food Safety and Standards Act
6. Structure of FSSAI, Food safety officer
7. Evaluation of food quality - subjective and objective methods of evaluation
8. Quality criteria of foods - food grains, fruits, vegetables, animal foods
9. Quality criteria of foods - processed foods
10. Food storage system and types of food storage
11. Food Audit and inspection –objectives-Criteria for recognition of auditing agencies, duties of auditors, Audit process
12. Food Recall- Food traceability System
13. Food categorization,
14. Licensing and registration
15. Principles of hygiene -its relation to food preparation and food handling practices
16. Food poisoning - causes and types and control measures
17. **Mid- Semester Examination**
18. Food borne intoxication and infection - source, effects and prevention
19. Water borne diseases- prevention and control
20. Air borne diseases- prevention and control
21. Physical, chemical and microbiological contamination of foods
22. Food adulteration - common adulterants and their detection method
23. Food additives, types and control
24. Destruction of microbes - disinfection, physical, mechanical and chemical methods
25. Food Packaging and packaging materials
26. Product labeling and nutritional labeling

27. Health programmes in India
28. Good manufacturing practices (GMP) and standard sanitation and operating procedures (SSOP)
29. Good Hygiene practice in food industry
30. HACCP- Concepts, principles and applications
31. Food safety standards
32. Total quality management system
33. Concept of Codex Alimentarius Commission, Food and Drug Administration (FDA).
34. The Kosher and Halal food laws

Practical schedule

1. Preparation of media for microbial analysis
2. Biochemical test for identification of bacteria
3. Estimation of quality parameters of cereals and cereal products
4. Estimation of quality parameters of pulses and pulses products
5. Estimation of quality parameters of fruits and fruit products
6. Estimation of quality parameters of vegetables and vegetables products
7. Estimation of quality parameters of milk and milk product
8. Estimation of quality parameters of meat and meat product
9. Estimation of quality parameters of fish and fish product
10. Estimation of quality parameters of water quality
11. Market survey and quality analysis of processed foods
12. Detection of food adulterants in food
13. Visit to food corporation of India
14. Visit to quality control laboratory
15. Visit to food processing unit to study the role of Halal food laws in food safety
16. Visit to food processing industry to study the Hazard Analysis Critical Control Point (HACCP) concept

17. Final Practical Examination

Text books

1. Early, R, 2010. Guide to quality Management System for Food Industries , Blackie Academic Publication
2. Patricia and Curing A. 2005. An operational Text book, guide to Food Laws and Regulations. Wiley-Blackwell publisher.
3. Radonit Lassztity. 2008. Food Quality and Standards. Encyclopedia of Life effort systems. USA.
4. The Food Safety and Standards Act (2006), alone with Rules and Regulations. Commercial Law Publisher (India) Pvt. Ltd.

Reference books

1. Srilakshmi. 2018. Food Science. 7th Edition, New age international publisher, New Delhi
2. William, C., Frazierad Dennie. C Westheff and N M Vanitha. (2013). Food Microbiology 4th Editions, Tata McGraw hill Company Limited

Web-references

1. www.fda.gov
2. www.food.gov.uk/safeeating
3. www.foodstandards.gov.uk

21HOR 352 HI-TECH HORTICULTURE (2+1)

Course objective:

- Explain scope, importance of Hi tech horticulture
- Describe the modern technology on mechanization in horticulture
- Explain hi tech nursery management techniques
- Outline the micro irrigation and fertigation system in a greenhouse
- Discuss the canopy management techniques and high density planting
- Describe precision farming technologies in horticulture crops

Course outcome:

- Recall modern mechanization technologies in horticulture
- Identify canopy management technology on fruit crops
- Summarize precision farming technology in horticultural crops.
- Outline the maintenance of a commercial hi tech nursery
- Summarize the establishment and management of high density fruit orchards
- Describe and manage the protected structures

THEORY

UNIT I- Horticultural nursery techniques

Introduction & importance; Management and mechanization in horticultural nursery; Micro propagation of horticultural crops

UNIT II- Protected cultivation

Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques

UNIT III- Micro irrigation

Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding

UNIT IV- Components of precision farming

Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA)

UNIT V- Application of precision farming

Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

PRACTICAL

Types of Polyhouses and shade net houses, intercultural operations, tools and equipments identification and application, micro propagation, nursery-portrays, microirrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Theory Schedule:

1. Hi-tech horticulture – Introduction - Scope and importance – Perspectives of Hi-tech horticulture in India.
2. Nursery management – Quality control of planting material- Plastics in nursery management Advantages of plant propagation under green houses (Hi-tech nursery).

3. Mechanization – Importance of mechanisation in Hi-tech horticulture – Mechanisation of nursery, sowing and transplanting, plastic mulching, irrigation, fertigation, pest and disease Control, weed control, harvesting etc.
4. Micro propagation of horticultural crops – Meristem culture - Various approaches of shoot multiplication –
5. Applications of micro propagation – Problems in micro propagation - Advantages and limitations – Micro-grafting.
6. Modern field preparation methods – Raised bed preparation – Plastic mulching.
7. Modern planting methods – Container planting - Soil less culture – Hydroponics, aeroponics.
8. Protected cultivation- Advantages- Types of protected structures - Glass house, poly house, rain shelters, poly tunnels, hotbeds and cold frames, shade nets etc.
9. Greenhouse – Advantages- Controlled conditions – Light, Humidity, Temperature, CO₂ - Ventilation and cooling in a green house –
10. Naturally ventilated, fan and pad cooling, forced air cooling etc. – Relative humidity, carbon-di-oxide level.
11. Micro irrigation systems and its components – Methods of micro irrigation (Surface drip, sub-surface drip irrigation, Bubblers, micro sprinkler etc.) –
12. Maintenance of micro irrigation system.
13. Fertigation Advantages –Limitations - Method of fertilizer injection (Fertilizer injection system, Pressure differential injection system, Venturi injection system) – Selection of fertilizers – Solid fertilizers & liquid fertilizers.
14. EC, pH based fertilizer scheduling – Site specific nutrient management – Advantages and disadvantages.
15. Canopy management – Importance of canopy management- principles of canopy management –
16. Tools of canopy management (Rootstocks, plant density, training and pruning, nutrient management, growth retardants etc.).
17. **Mid Semester Examination**
18. High Density orcharding – Concept – HDP systems – Components of HDP (use of genetically dwarf scion cultivars, dwarf rootstocks, pruning and training, use of growth retardants, induction of viral infection, use of incompatible rootstocks etc.) – Impact of HDP- Advantages Constraints in HDP.
19. Precision farming – Definition – Scope and status of precision farming in India- Perspectives and potentials of precision farming in India - Components of precision farming.
20. Remote sensing – Role of remote sensing in precision farming –
21. Application of remote sensing in the field of horticulture.
22. Geographical Information System (GIS) – Role of GIS in precision farming.
23. Differential Global Positioning System (DGPS) – GPS introduction –
24. Types of GPS – DGPS uses in Agriculture - Yield monitoring, field mapping, precision crop input application (fertilizers, pesticides, weedicides etc.).
25. Variable Rate applicator (VRA) – Introduction – Variable rate application methods – map based VRA and Sensor based VRA –

26. VRA management zones – Seeding VRA, Weed control VRA, Lime VRA, Fertilizer VRA.
27. Precision farming – Applications of precision farming in horticultural crops (fruits, vegetables and ornamental crops) –
28. Strategic approaches of precision technology for improvement of fruit production.
29. Mechanized harvesting of produce – Advantages and disadvantages of mechanical harvesting
30. Mechanical harvesters developed for different horticultural crops – Robots in harvesting.
31. Green food production – Approaches – Biodynamic farming – Biodynamic preparations
32. Cosmic integration – Biodynamic calendar – Strategies for green food production.

Practical Schedule

1. Study of types of polyhouses.
2. Study of shade net houses.
3. Intercultural operations in Hi – tech horticulture.
4. Identification and application of tools and equipments.
5. Micro propagation.
6. Nursery raising in portrays.
7. Study of Micro-irrigation system and its components.
8. Problems of micro irrigation system.
9. Estimation of EC of soil and water.
10. Estimation of pH in soil and water.
11. Fertilizer scheduling.
12. Canopy management in Mango.
13. Canopy management in Guava.
14. Canopy management in Grapes.
15. Visit to Hi-Tech orchard.
16. Visit to Hi-Tech nursery.

17. Final Practical Examination

Text books

1. Dashora, L.K., Jitendar Singh and S.K. Jain. 2013. Precision Farming in Horticulture. New India Publishing Agency. pp 1-382
2. Kumar, N. 2020. Introduction to Horticulture. Oxford & I.B.H. Publishing, New Delhi. pp 1-452
3. Prasad, S. And Kumar, U. 2012. Greenhouse Management of Horticultural Crops. 2nd edition, Agribios publishers, New Delhi. pp 1-520
4. Srivasthava, K.K. 2007. Canopy Management of Fruit Crops. International book distributing co., Lucknow. pp 1-95

Reference books

1. Chadha, K.L. 2019. Handbook of Horticulture. Vol. II (2nd revised edition) ICAR, New Delhi. pp 1-299
2. Dhillon W.S. 2013. Fruit production in India. Narendra Publishing House, Delhi. pp 1-678

Web-references

1. <http://ecourses.iasri.res.in>
2. http://agritech.tnau.ac.in/horticulture/horti_fruits.html
3. <http://www.ishs.org>

2021 batch – Vth Semester

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 SST 301	Principles of Seed Technology	2+1	3
1.	21 AGR 301	Practical Crop Production I (Kharif Crops)	0+1	1
2.	21 AGR 302	Farming System and Sustainable Agriculture	1+0	1
3.	21 SAC 301	Manures, Fertilizers and Soil Fertility Management	2+1	3
4.	21 AEN 301	Pests of Crops and Stored Grain and their Management	2+1	3
5.	21 AEC 301	Agricultural Marketing Trade and Prices	2+1	3
6.	21 APE 311	Protected Cultivation and Secondary Agriculture	1+1	2
7.	21 PAT 301	Diseases of Field and Horticultural Crops and their Management I	2+1	3
8.	21 HOR 311	Post Harvest Management and Value Addition of Fruits and Vegetables	1+1	2
9.	21 ARM 301	Entrepreneurship Development and Business Communication	1+1	2
10.	21 ELC ***	Elective Course II	2+1	3
		Total	16+10	26

SEMESTER V
21SST 301 PRINCIPLES OF SEED TECHNOLOGY (2+1)

Course Objective:

- To study the importance of seed and its quality characters
- To impart knowledge on classes of seed and seed production of important crops
- To educate the importance of seed quality control and testing
- To have a general understanding on post harvest handling of seeds and marketing

Course Outcome:

- Importance of seed and quality characters studied
- Knowledge gained about classes of seed and seed production
- Importance of seed quality control and testing learnt
- Post harvest handling of seeds and marketing understood

THEORY

Unit I – Seed- Importance and quality

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

Unit II - Seed Production

Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Cereals: Rice, Maize, Sorghum, Bajra and Ragi. Pulses: Blackgram, Greengram, Redgram. Oilseeds: Sunflower, Groundnut, Castor and Sesame. Cotton. Fodder crops: Cenchrus sp and Lucerne. Vegetable crops: Tomato, Brinjal, Chillies, Bhendi, Onion and Cucurbits: Bittergourd, Ashgourd, Snakegourd, Ribbedgourd, Bottlegourd and Pumpkin.

Unit III - Seed Quality Control and Seed Testing

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

Unit IV - Post harvest handling of seeds

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

Unit V - Seed marketing

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

PRACTICAL

Seed production in major cereals: Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Blackgram, Greengram, Redgram. Seed production in major oilseeds: Sunflower, Groundnut, Castor and Sesame. Cotton. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Lecture Schedule:

1. Seed and seed technology: introduction, definition and importance.
2. Deterioration causes of crop varieties and their control; maintenance of genetic purity during seed production.
3. Seed quality; definition, characters of good quality seed, different classes of seed.
4. Foundation and certified seed production of rice varieties and hybrids.
5. Foundation and certified seed production of maize varieties and hybrids.
6. Foundation and certified seed production of sorghum varieties and hybrids.
7. Foundation and certified seed production of bajra varieties and hybrids.
8. Foundation and certified seed production of ragi varieties and hybrids.
9. Foundation and certified seed production of blackgram varieties.
10. Foundation and certified seed production of greengram varieties.
11. Foundation and certified seed production of redgram varieties and hybrids.
12. Foundation and certified seed production of sunflower varieties and hybrids.
13. Foundation and certified seed production of groundnut varieties.
14. Foundation and certified seed production of castor varieties and hybrids.
15. Foundation and certified seed production of sesame varieties.
16. Foundation and certified seed production of cotton varieties and hybrids.
17. **Mid Semester Examination**
18. Foundation and certified seed production of cenchrus species and lucerne.
19. Foundation and certified seed production of tomato, brinjal and chillies varieties and hybrids.
20. Foundation and certified seed production of bhendi varieties and hybrids.
21. Foundation and certified seed production of onion varieties.
22. Foundation and certified seed production of cucurbits; bitter gourd, ash gourd and snake gourd.
23. Foundation and certified seed production of ridge gourd, bottle gourd and pumpkin varieties and hybrids.
24. Seed certification, phases of certification, procedure for seed certification, field inspection.
25. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983.
26. Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test.
27. Detection of genetically modified crops, Transgene contamination in non-GM crops.
28. Principles of GM crops and organic seed production.
29. Post harvest handling of seeds; Seed drying, processing and their steps.
30. Seed testing for quality assessment.
31. Seed treatment, its importance, method of application and seed packing.
32. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.
33. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing.
34. Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

Practical schedule:

1. Seed production in major cereals: Rice and Maize.

2. Seed production in major cereals: Sorghum, Bajra and Ragi.
3. Seed production in major pulses: Blackgram, Greengram and Redgram.
4. Seed production in major oilseeds: Sunflower and Groundnut.
5. Seed production in major oilseeds: Castor and Sesame.
6. Seed production in Cotton.
7. Seed production in important vegetable crops.
8. Seed sampling: mixing and dividing, equipments.
9. Seed testing: Estimation of seed moisture content and physical purity.
10. Seed germination testing.
11. Tetrazolium test for viability - evaluation.
12. Seed and seedling vigour test - brick gravel test, paper piercing test - cool and cold test - accelerated ageing test.
13. Genetic purity test: Grow out test and electrophoresis.
14. Seed certification: Procedure, Field inspection, Preparation of field inspection report.
15. Visit to seed production farms.
16. Visit to seed testing laboratories and seed processing plant.
17. **Final practical examination**

Text Books:

1. Agrawal, R.L. 2008. *Seed Technology*. New Delhi : Oxford & IBH Publishing Co. pp. 1- 821.
2. Dharmendra Jat, Sai Prasad, S. V. & Sheela Verma. 2014. *Seed Science and Technology* (2nd ed.) New Delhi: New Vishal Publications. pp. 1- 304.
3. Khare, D. 2014. *Seed Technology* (2nd ed.). Jodhpur: Scientific Publishers India. pp. 1- 944.
4. Padmavathi, S. 2012. *A Text Book of Seed Science and Technology*. New Delhi: New India Publishing Agency. pp. 1- 282.

Reference Books

1. Basra, A. S. 2006. *Handbook of Seed Science and Technology*. New York: Food Products Press. pp. 1- 749.
2. Lawrence O. Copeland & Miller McDonald. 2001. *Principles of Seed Science and Technology*. USA: Springer Science. pp. 1- 390.
3. Sreenivas, Y.S. 2009. *Seed Production of Commercial Vegetables*. Oxford: Oxford Book Company. pp. 1- 325.
4. Subir Sen & Nabinananda Ghosh. 2012. *Seed Science and Technology*. New Delhi: Kalyani Publishers. pp. 1- 277.
5. Vanangamudi, K., Prabhu, M. & Bhaskaran. 2010. *Vegetable Hybrid Seed Production and Management*. In India: Agrobios. pp. 1- 339.

Web-References

1. <https://agro.au.dk/en/research/research-areas/seed-science-and-technology/>
2. www.seednet.gov.in
3. <https://www.fabinet.up.ac.za/index.php/research-groups/seed-science>
4. <https://www.youtube.com/watch?v=j6MwsmmYql8&list=PLMwQyDnbQLRWkULTTg3wMpi8YK04PnzzP>

21AGR 301 PRACTICAL CROP PRODUCTION-I (*Kharif* crops) (0+1)

Course objective:

- Planning and practicing *kharif* crop cultivation
- Expounding information about balanced nutritional pest and disease control
- Sharing information about marketing of produce and estimating cost benefit ratio.

Course outcome:

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

PRACTICAL

Example Rice (*Transplanted rice or Direct sown rice*):

- Each student will be allotted a minimum land area of 100/200 m² and he / she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pest diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.
- Any *Kharif* crop (Rice /Maize / Sorghum / Cumbu / Ragi / Cotton / Groundnut/ / Sesame/ Green gram / Black gram etc.).

Transplanted rice:

Rice ecosystems - Climate and weather - Seasons and varieties of Tamil Nadu. Preparation of nursery - Application of manures to nursery - seed treatment - Forming nursery beds and sowing seeds - Weed management and plant protection to nursery. Preparation of main field - Application of organic manures - Green manuring - Bio-fertilizers - Pulling out seedlings and transplanting - SRI - Application of herbicides - Water management - Nutrient management - Plant protection measures - Mechanization in rice cultivation - Recording growth, yield attributes and yield. Harvesting, threshing, drying and cleaning the produce - Working out cost of cultivation and economics.

Practical schedule:

1. Study of rice ecosystems, climate, weather, seasons and varieties of Tamil Nadu.
2. Selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery.
3. Acquiring skill in seed treatment, seed soaking and incubation, nursery sowing and management.
4. Study and Practice of main field preparation and puddling operations.
5. Practicing of field preparatory operations - sectioning of field bunds and plastering, leveling and basal application of fertilizers.
6. Practicing transplanting techniques in lowland rice.
7. Estimation of plant population and acquiring skill in gap filling and thinning.
8. Study of weeds and weed management in rice.
9. **Mid-Semester Examination**
10. Acquiring skill in nutrient management and practicing top dressing techniques.
11. Study of water management practices for lowland rice.
12. Observation of insect pests and diseases and their management.
13. Recording growth and other related characters of rice.

14. Estimation of yield and yield parameters in rice.
15. Harvesting, threshing and cleaning, drying and calculating the yield of produce
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. irri. org](http://www.irri.org).
2. www.tawn.tnau.ac.in
3. [www. crrl. nic. in](http://www.crrl.nic.in).
4. [www. drrindia. org](http://www.drrindia.org).

21AGR 302 FARMING SYSTEM AND SUSTAINABLE AGRICULTURE (1+0)

Course objective:

- Imparting knowledge on the types of farming systems
- Describing cropping systems and state the importance of sustainable agriculture
- Explaining integrated farming

Course outcome:

- Interpret farming systems and its significance
- Design an efficient cropping system
- Demonstrate sustainability in agriculture
- Propose integrated farming systems
- Determine the efficiency of farming systems

THEORY

UNIT I - CROPPING SYSTEM

Cropping systems - Definition - Principles - Concepts - Classification - mono cropping-intensive cropping - cropping systems of India and Tamil Nadu - Interaction between different cropping systems-Cropping system management - Resource management - land, nutrient, water and weed.

UNIT II - CROPPING SCHEME AND EVALUATION OF CROPPING SYSTEM

Cropping scheme-factors influencing cropping scheme- principles, advantage-steps in preparing cropping scheme - Index for evaluation of cropping systems - Land use - yield advantages - Economic evaluation - sustainability.

UNIT III - FARMING SYSTEM

Farming systems - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises with cropping - scope and advantages of Integrated Farming system - Integrated farming system models for different agro eco-systems - interaction between enterprises.

UNIT IV - EVALUATION OF FARMING SYSTEM

Resource recycling in IFS - Evaluation indicators of integrated farming system - LEISA & HEIA - concepts and principles - Conservation agriculture - principles, concept and scope.

UNIT V - RESOURCE AND LABOUR MANAGEMENT IN FARMING SYSTEM

Resource management under constraint situation - Cost reduction strategies in crop production - Non-monetary inputs and low-cost technologies - Labour management - farming system and environment.

Lecture schedule:

1. Cropping system: Definition, Principles and basic concepts.
2. Classification of cropping system - Mono cropping, intensive cropping, multiple cropping, mixed cropping.
3. Major cropping systems prevailing in India and Tamil Nadu for different agro eco systems.
4. Complementary and competitive interaction in different cropping system - light, nutrient, water and weed.
5. Cropping system management: agronomic requirement for crops and cropping system selection of crops and varieties, tillage and land shaping, plant population and crop geometry.
6. Cropping system management: agronomic requirement for crops and cropping system - water management, soil fertility management and plant protection.
7. Cropping scheme-factors influencing cropping scheme- principles, advantage-steps in preparing cropping scheme.
8. Indices for evaluation of cropping system - land use, yield advantage and economics.
9. **Mid-Semester Examination.**
10. Farming system: definition, principles and concepts and factors influencing choice and size of enterprises
11. Scope and advantages of integrated farming system.
12. Allied enterprises for wetland, irrigated upland and dryland - selection and management and their interaction.
13. Resource recycling in integrated farming system and Integrated Farming System evaluation indicators.

14. Integrated farming system - models for wetland, irrigated upland and dryland eco system.
15. LEISA and HEIA - principles and concepts and Labour management in integrated farming system.
16. Conservation agriculture and environmental impact of integrated farming system.
17. Cost reduction technologies and non-monetary inputs in integrated farming system.

Text books

1. Shagufta. 2015. Cropping and Farming Systems. APH Publishing Corporation.
2. Jana, B.L. 2014. Farming Systems. Agrotech Publishing Academy, Udaipur.
3. Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House, Delhi.
4. S.C. Panda. 2003. Cropping and Farming Systems. Agrobios Publishers. Jodhpur.
5. Rangasamy, A., Annadurai, K., Subbian, P. and Jayanthi, C. 2002. Farming System in the Tropics. Kalyani Publishers, Ludhiana.
6. Palaniappan, SP and K. Sivaraman. 1996. Cropping systems in the tropics Principles and management. New Age International (P) Ltd., New Delhi.

Reference books

1. Zaman, A. 2019. Integrated Farming System and Agricultural Sustainability. New India Publishing Agency, New Delhi.
2. Oborn I., Vanlauwe M.P., Thomas R., Brooijmans W. and Atta-Krah Kwesi. (Eds.) 2017. Sustainable Intensification in Smallholder Agriculture. An integrated systems research approach. Routledge Taylor & Francis Group, London.
3. Sankarsana Nanda. 2016. Integrated farming system practices: challenges and opportunities. New India Publishing Agency, New Delhi.
4. Farming System and Poverty - Improving Farmers livelihoods in a changing World. 2001. (Ed.) Malcolm Hall et al., FAO and World Bank Publication.
5. Lal, R. et al. (ed.). 2015. Sustainable intensification to advance food security and enhance climate resilience in Africa. Springer International Publishing.
6. Sunilkumar Brendra Prasad. 2013. Modern Technology for Sustainable Agriculture, NIPA, New Delhi.

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2. www.fao.org
3. www.agritech.tnau.ac.in
4. http://agritech.tnau.ac.in/agriculture/agri_majorareas_ifs.html
5. <https://leisaindia.org/integrated-farming-an-approach-to-boost-up-family-farming/>
6. www.fao.org/ag/ca
7. www.pdfsr.ernet.in

21SAC 301- Manures, Fertilizers and Soil Fertility Management (2+1)

Course Objective

- To understand the properties and composition of organic manures and chemical fertilizers
- To learn about the mechanism of nutrient transport in plant and soil, plant nutrient deficiency and
- toxicity symptoms.
- To study about soil chemistry, soil fertility testing and plant nutrient analysis

Course Outcome

- At the end of this course, the students will be able to Remember the properties of manures, fertilizers and soil amendments
- Understand the concept of soil fertility and plant nutrition, chemistry of nutrients in soil, manuring,
- Integrated Nutrient Management and fertilizer recommendation practices
- Evaluate the fertility of soil and plant nutrient content

THEORY

Unit I – Soil Fertility and Productivity

Soil fertility and productivity; History of soil fertility and plant nutrition; Criteria of essentiality; Essential nutrients: role, deficiency and toxicity symptoms; Mechanism of nutrient transport to plant, factors affecting nutrient availability to plants.

Unit II - Nutrient Dynamics

Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Nutrient transformations in waterlogged soils; Nutrient interactions; Critical levels of different nutrients in soil.

Unit III – Fertilizers

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary and micronutrient fertilizers, complex fertilizers, Nano-fertilizers; Bio-fertilizers; Manufacturing processes; Soil amendments; Fertilizer storage; Fertilizer control order.

Unit IV – Organic Manures

Organic manures: Introduction, classification, importance of organic manures, properties, and methods of preparation of bulky and concentrated manures. Green manuring and green leaf manuring; Compost and composting.

Unit V - Nutrient Management

Soil fertility evaluation; DRIS approach; Soil testing, rapid plant tissue test, indicator plants; Nutrient use efficiency and nutrient budgeting; Nutrient management concepts: INM, STCR, IPNS, SSNM and RTNM; Permanent Manurial Experiments, Long Term Fertilizer Experiments; Fertilizer recommendation approaches; Methods of fertilizer recommendation to crops: Fertilizer recommendation models and crop growth models; Method of fertilizer application in rainfed and irrigated conditions

PRACTICAL

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

Lecture Schedule

1. Soil fertility and productivity; History of soil fertility and plant nutrition; Criteria of essentiality.
2. Essential nutrients: role, deficiency and toxicity symptoms.
3. Mechanism of nutrient transport to plants and factors affecting.
4. Sources, forms, mobility, transformation, fixation, losses and availability of soil N.
5. Sources, forms, mobility, transformation, fixation, losses and availability of soil P.

6. Sources, forms, mobility, transformation, fixation, losses and availability of soil K.
7. Sources, forms, mobility, transformation, fixation, losses and availability of soil Ca, Mg, S.
8. Sources, forms, mobility, transformation, fixation, losses and availability of soil Micronutrients.
9. Nutrient transformations in waterlogged soils.
10. Nutrient interactions; Critical level of different nutrients in soil.
11. Chemical fertilizers: classification and composition.
12. Properties and manufacturing process of nitrogen fertilizers (Urea, ammonium sulphate, ammonium nitrate and CAN); its reaction in soil.
13. Properties and manufacturing processes of phosphatic fertilizers (Rock phosphate, SSP, DAP, TAP, basic slag); its reaction in soil.
14. Properties and manufacturing processes of potassic fertilizers (MOP, SOP); its reaction in soil.
15. Secondary and micronutrient fertilizers: properties and manufacturing process.
16. Complex and Nano fertilizers: definition, properties and manufacturing processes.
17. **Mid semester Examination**
18. Bio-fertilizers: definition, classification and importance.
19. Soil amendments; Fertilizer storage; Fertilizer control order.
20. Organic manures: Introduction, classification, properties and importance.
21. Methods of preparation of bulky and concentrated manures.
22. Green manuring and green leaf manuring; Compost and composting.
23. Soil fertility evaluation: Liebig's law, Mitscherlich's law, Brays nutrient mobility concept.
24. Soil fertility evaluation: DRIS approach
25. Soil testing, rapid plant tissue test, indicator plants: importance.
26. Nutrient use efficiency and nutrient budgeting.
27. Nutrient management concepts: INM
28. Nutrient management concepts: STCR
29. Nutrient management concepts: IPNS
30. Nutrient management concepts: SSNM
31. Nutrient management concepts: RTNM
32. PME and LTFE
33. Fertilizer recommendation approaches; Fertilizer recommendation models and crop growth models
34. Method of fertilizer applications in rainfed and irrigated conditions

Practical Schedule

1. Preparation of analytical reagents and standardization.
2. Estimation of soil organic carbon
3. Estimation of alkaline KMnO₄ N in soil (available N).
4. Estimation of Olsen P and Bray P in soil (available P).
5. Estimation of Neutral Normal NH₄ OAc K in soil (available K).
6. Estimation of available Ca and Mg in soil.
7. Estimation of available S in soil.
8. Estimation of micronutrients in soil (DTPA extractable) and plants.
9. Estimation of N content in plant sample.
10. Estimation of P and K content in plant sample.

11. Estimation of N in urea and FYM / Compost.
12. Estimation of ammoniacal and nitrate N in ammonium nitrate.
13. Estimation of water-soluble P in SSP/FYM/compost.
14. Estimation of K in KCl and K₂SO₄/FYM/Compost.
15. Soil test-based fertilizer prescriptions.
16. Visit to soil, plant, water and fertilizer testing laboratory.
17. **Final practical examination.**

Text books

1. Biswas, T.D. and Mukherjee S.K. 2017. Textbook of Soil Science (2nd ed.). New Delhi: Tata McGraw Hill Publishing Co. Ltd. pp. 1 - 433.
2. Chopra, S.C and Kanwar J.S. 2014. Analytical Agricultural Chemistry. Ludhiana, Kalyani publishers.
3. Das, D.K.2015. Introductory Soil Science (4th ed.). Ludhiana: Kalyani Publisher.
4. Indian Society of Soil Science. 2012. Fundamentals of Soil Science (2nd ed.). New Delhi: ISSS, IARI.
5. Brady, N.C. and Raymond, C. W.2013.The Nature and Properties of Soils (15th ed.). Pearson Education. pp. 1 - 1035.

Reference books

1. Epstein, E. and Bloom, A.J.2005. Mineral Nutrition of Plants: Principles and perspectives (2nd edition). Sinauer Associates, Sunderland, MA. pp. 1 - 380.
2. Jackson, M.L. 2012. Soil chemical analysis: Advanced course, Scientific Publisher.
3. John, L. H., Beaton J.D, Tisdale S.L and Nelson W.L. 2016. Soil Fertility and Fertilizers - An Introduction to Nutrient Management. (2nd edition). New Delhi, PHL Learning Pvt. Ltd. pp. 1 - 433.
4. Tan K.H. 2018. Principles of Soil Chemistry, Special Indian edition (4th ed.). Taylor& Francis.
5. Mengel, K and Kirkby, E.A. 2001. Principles of Plant Nutrition (5th ed.). Springer. pp. 1 - 849.

21AEN 301 Pests of Crops and Stored Grain and their Management (2+1)

Course objectives:

- To list major arthropod pests of crops and stored grains and their nature and symptom of damage on crop plants
- To describe bionomics, nature and symptoms of damage of pest of field crops.
- To explain bionomics, nature and symptoms of damage of pest of horticulture crops.
- To illustrate bionomics, nature and symptoms of damage of pest of stored grain.
- To recommend control measures for management of crop and stored grain pests.

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

- Recall the major arthropod pests of crops and stored grains and their nature and symptom of damage on crop plants
- Summarize the bionomics, nature and symptoms of damage of pest of field crops.
- Explain the bionomics, nature and symptoms of damage of pest of horticulture crops.
- Outline the bionomics, nature and symptoms of damage of pest of stored grain.
- Design strategies for management of pests of crops and stored grains.

THEORY

Unit I – Arthropod pests of field crops and their management

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cereals (rice, wheat, maize, barely) pulses (redgram, Bengal gram, black gram, green gram), cotton, sugarcane and oilseeds (groundnut, gingelly, mustard).

Unit II – Arthropod pests of vegetable crops and their management

Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of solanaceous, malvaceous, cucurbitaceous and cruciferous vegetables

Unit III – Arthropod pests of fruit crops and their management

Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of mango, citrus, banana, guava, pomegranate, grapevine, apple, pear and plum

Unit IV – Arthropod pests of ornamental crops, spices, condiments, plantation crops, and their management

Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of rose, jasmine, carnation, onion, garlic, turmeric, ginger, cardamom, pepper, tea, coffee, coconut, areca nut, cashew, cocoa and betel vine.

Unit V- Pests of Stored grains and their management

Factors affecting losses of stored grain and role of physical, biological, mechanical, and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

PRACTICAL

Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Identification of insect and non-insect pests of stored grain and their management. Determination of moisture content of grain. Methods of grain sampling under storage condition.

Visit to nearest FCI godowns.

Lecture schedule:

1. General account on nature and type of damage by different arthropods pests.
2. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cereals (rice)
3. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cereals (wheat)
4. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cereals (maize, barely)
5. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of pulses (redgram and bengalgram)
6. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of pulses (blackgram and greengram)
7. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cotton
8. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of sugarcane
9. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of oilseeds (groundnut and gingelly).
10. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of oilseeds (mustard)
11. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of solanaceous vegetables (tomato and chilli)
12. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of solanaceous vegetables (brinjal and potato)
13. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of malvaceous vegetables.
14. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cucurbitaceous vegetables
15. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cruciferous vegetables
16. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of mango
17. **Mid Semester Examination**
18. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of citrus
19. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of banana
20. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of guava and pomegranate
21. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of grapevine

22. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of apple, pear and plum
23. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of rose, jasmine and carnation.
24. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of onion and garlic
25. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of turmeric and ginger
26. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cardamom and pepper.
27. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of tea and coffee.
28. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of coconut and areca nut.
29. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cashew.
30. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major arthropod pests of cocoa and betel vine.
31. Factors affecting losses of stored grain and role of physical, biological, mechanical, and chemical factors in deterioration of grain.
32. Storage structure and methods of grain storage and fundamental principles of grain store management.
33. Insect pests associated with stored grain and their management.
34. Non - Insect pests (mites, rodents, birds and microorganisms) associated with stored grain and their management.

Practical schedule:

1. Identification and study of life cycle and seasonal history of major insect pests of rice and sorghum
2. Identification and study of life cycle and seasonal history of major insect pests of wheat and maize
3. Identification and study of life cycle and seasonal history of major insect pests of sugarcane
4. Identification and study of life cycle and seasonal history of major insect pests of cotton
5. Identification and study of life cycle and seasonal history of major insect pests of pulses
6. Identification and study of life cycle and seasonal history of major insect pests of oil seed crops
7. Identification and study of life cycle and seasonal history of major insect pests of solanaceous and malvaceous vegetables
8. Identification and study of life cycle and seasonal history of major insect pests of cruciferous and cucurbitaceous vegetables
9. Identification and study of life cycle and seasonal history of major insect pests of mango and citrus
10. Identification and study of life cycle and seasonal history of major insect pests of banana and grapevine
11. Identification and study of life cycle and seasonal history of major insect pests of apple, pear and plum

12. Identification and study of life cycle and seasonal history of major insect pests of flower crops and plantation crops
13. Identification and study of life cycle and seasonal history of major insect pests of narcotics, spices and condiments
14. Identification of insect pests of stored grains and determination of moisture content in grains.
15. Identification of non insect pests of stored grains.
16. Visit to the nearest FCI godown / Farmer's field
17. **Final Practical Examination**

Text Books

1. Srivastava, K.P. and Dhaliwal G.S. 2013. A Text Book of Applied Entomology Vol 1 & 2. Kalyani Publishers.
2. Sehgal P.K. and Mir M.A. 2014. A Text Book of Agricultural Entomology. Kalyani Publishers.

Reference books

1. Vasantharaj David B. and Ramamurthy V.V. 2016. Elements of Economic Entomology. Brillion Publishing.
2. Dhaliwal G.S. and Ramesh A. 2014. Integrated Pest Management. Kalyani Publishers
3. Awasthi V.B. 2017. Agricultural Insect Pests and Their Control. 2nd Ed. Scientific Publishers.

Web references

1. https://agritech.tnau.ac.in/crop_protection/crop_prot_crop_insect_pest.html
2. <https://agritech.tnau.ac.in/pdf/6.pdf>
3. <https://agritech.tnau.ac.in/pdf/7.pdf>
4. <https://www.agric.wa.gov.au/pest-insects/insect-pests-stored-grain>

21AEC 301 AGRICULTURAL MARKETING, TRADE AND PRICES (2+1)

Course Objective: The Purpose of learning of this subject is

- Explain agricultural marketing,
- Discuss the market function and force
- Describe the functions of Agricultural Market institutions
- Discuss the efficiency of Agricultural marketing
- Explain Agriculture Trade and trade policies and WTO regulations

Course Outcome:

- Describe the process of marketing Agriculture produces
- Recognize the Institutional approach to regulate prices and market structure
- Recall the Market process, conduct and facilitations
- Outline the Market price and exchange prices and market data analysis
- Identify the Market promotional activities and integrations
- Summarize the Institutional regulations for quality control

THEORY

Unit I – Agricultural Marketing – Nature and Scope

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and

characteristics of agricultural markets; nature and determinants of demand and supply of farm products. Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.

Unit II – Marketing Functions, Pricing and Promotion Strategies

Marketing process and functions: Marketing process - concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK); Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking - Market Structure, Conduct and Performance paradigm (SCP) – Market Structure: Meaning, Components, Dynamics of Conduct and Performance – Market structure and Price determination under perfect and imperfect competition. Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits.

Unit III – Marketing Efficiency and Marketing Institutions

Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration over space, time and form: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Modern marketing systems versus traditional agricultural marketing systems; Role of Government in agricultural marketing - Public sector institutions - CWC, SWC, FCI and DMI – their objectives and functions; cooperative marketing in India; Market Intelligence -Legal measures for improving agricultural marketing: APMC Act. New EXIM policy of India – Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.

Unit IV – Agricultural Prices and Risk Analysis

Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP – Concept of MSP, FRP (SMP) and SAP – Price Parity - Procurement of food grains and buffer stock - Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging and Forward and Futures trading; an overview of futures trading; – Role of Contract Farming in risk mitigation.

Unit V –Trade in Agricultural Products

International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs - Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments – Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements – AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

PRACTICAL

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

Lecture Schedule:

1. Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing.
2. Market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets.
3. Demand and supply of agri-commodities: meaning, nature and determinants of demand and supply of farm products.
4. Approaches to the study of marketing: Market functionaries and Market forces.
5. Marketing of agricultural versus manufactured goods. Producer surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.
6. Marketing process and functions: Marketing process - concentration, dispersion and equalization.
7. Exchange functions – buying and selling; physical functions – storage, transport and processing.
8. Facilitating functions – packaging, branding, grading, quality control and labelling (AGMARK).
9. Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking.
10. Market Structure, Conduct and Performance paradigm (SCP) – Market Structure: Meaning, Components, Dynamics of Conduct and Performance.
11. Market structure and Price determination under perfect and imperfect competition.
12. Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC.
13. Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing.
14. Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits.
15. Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products.
16. Integration over space, time and form: Meaning, definition and types of market integration.
- 17. Mid-Semester Examination**
18. Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing reasons for higher marketing costs of farm commodities; ways of reducing marketing costs.

19. Role of Government in agricultural marketing - Modern marketing systems versus traditional agricultural marketing systems.
20. Public sector institutions- CWC, SWC, FCI, and DMI – their objectives and functions.
21. Co-operative marketing in India.
22. Market Intelligence - Legal measures for improving agricultural marketing: APMC Act. New EXIM policy of India.
23. Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.
24. Agricultural Prices: Meaning and functions of price; administered prices; need for agricultural price policy;
25. Objectives of Price Policy and Price Stabilization – Role of CACP – Concept of MSP, FRP (SMP) and SAP.
26. Price Parity - Procurement of food grains and buffer stock.
27. Risk in marketing: Meaning and Importance - Types of risk in marketing.
28. Speculation and Hedging and Forward and Futures trading: an overview of futures trading. Role of Contract Farming in risk mitigation.
29. International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs.
30. Theories of Trade: Absolute and comparative advantage.
31. Present status and prospects of Agricultural exports / imports from India and their share.
32. Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments.
33. Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements.
34. AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

Practical Schedule:

1. Preparation of farm survey schedule
2. Visit to a farm to collect information on marketing practices of agricultural commodities and marketing problems.
3. Computation of marketable and marketed surplus of important commodities.
4. Visit to a local market / weekly *shandy* / farmers' market to study various marketing functions performed by different agencies.
5. Study of relationship between market arrivals and prices of some selected commodities.
6. Identification of marketing channels for selected commodity.
7. Collection of data regarding marketing costs, margins; price spread estimation for major agricultural and allied agricultural products to assess their marketing efficiency; and presentation of report in the class.
8. Visit to market committee and regulated market to study their organization and functioning.
9. Visit to co-operative marketing society to study its organization and functioning.
10. Visit to market institutions – SWC / CWC to study their organization and functioning.
11. Visit to AGMARK Laboratory / Grading institutions.
12. Farm input marketing: Visit to Farm input dealer to study marketing of farm inputs.
13. Visit to Commodity Boards / AEZ / Export oriented units.
14. Time Series Analysis of prices–TCSI Study of price behaviour over time for some selected commodities.
15. Construction of Index Numbers and their uses.

16. Application of principles of comparative advantage of international trade.

17. Final Practical Examination

Text Books

1. Acharya, S. S., & Agarwal, N. L., 2019. Agricultural Marketing in India (6ED), New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd. pp1-401
2. Kym Anderson, 2016. Agricultural Trade, Policy Reforms, and Global Food Security. USA: Palgrave Macmillan Publishing Company, pp1-398
3. SakOnkvisit.JohnJ.Shaw.1999.InternationalMarketingAnalysisandStrategy.Prentice-Hallof India. New Delhi

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1. Kahlon A. S. and S. D. Tyagi, 2000. Agricultural Price Policy in India - Allied Publishers Pvt. Ltd. Bomba.
2. SivaramaPrasadA.1999.AgriculturalMarketing in India. Mittal Publications, New Delhi.
3. Kohls, R. L., & Uhl Joseph, N.,1980. Marketing of Agricultural Products, New York: Collier Macmillan. pp 560-790.

Web-References

1. www.nimsme.org
2. www.nsic.co.in
3. www.nabard.org
4. www.archive.mu.ac.in/myweb_test/M.A.%20PART%20-%20I%20Agriculture%20Economics%20-%20Eng.pdf
5. www.rvskvv.net/images/Principles-of-Agricultural-Economics_17.04.2020.pdf
6. www.rvskvv.net/images/II-Year-II-Sem_Agri-Marketing_ANGRAU_20.04.2020.pdf
7. www.rvskvv.net/images/II-Year-II-Sem_Agri-Marketing_TNAU_20.04.2020.pdf

21APE 311 PROTECTED CULTIVATION AND SECONDARY AGRICULTURE (1+1)

Course objective:

- Impart knowledge on importance of protected cultivation
- Gain exposure to NFT, hydro phonics and aero phonics
- Develop knowledge on environmental control inside the greenhouse
- Learn post-harvesting techniques for different crops

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

- Exhibit skills of managing protected structures
- Manage irrigation and fertigation systems
- Plan and design the greenhouse construction
- Apply the concept of greenhouse in crop production and post-harvest operations

THEORY

Unit I – Introduction to Protected Cultivation

Introduction, Scope, importance, constraints and future strategies of protected cultivation in India; hydroponics, NFT, aeroponics and vertical farming

Unit II – Classification and Construction of Greenhouse

Greenhouse technology, types of protected structures, Plant response to Greenhouse environment, classification of greenhouses, designing and erection of protected structures,

cladding/glazing/covering materials

Unit III - Environmental Control

Typical applications - passive solar greenhouse, ventilation, heating and cooling systems - Fan and pad systems, CO₂ enrichment, light regulation, containers and growing media, soil/media decontamination, Irrigation and fertigation systems, mulch films

Unit IV – Post Harvest Technology

Important Engineering properties; Physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed; Applications in post-harvest technology equipment design and operation.

Unit V – Drying Methods and Different Types of Dryer

Drying and dehydration: moisture measurement, EMC, drying theory, various drying method; commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer); Material handling equipment; conveyer and elevators, their principle, working and selection.

Lecture Schedule

1. Introduction, Scope, importance, constraints and future strategies of protected cultivation in India
2. Hydroponics, NFT, aeroponics and vertical farming
3. Greenhouse technology, Plant response to Greenhouse environment
4. Types of protected structures,
5. Classification of greenhouses
6. Designing and erection of protected structures, cladding/glazing/covering materials
7. Typical applications - passive solar greenhouse ventilation, heating and cooling systems - Fan and pad systems,
8. CO₂ enrichment, light regulation,

9. Mid Semester Examination

10. Containers and growing media, soil/media decontamination
11. Irrigation and fertigation systems, mulch films
12. Importance of engineering properties of grain crops.
13. Physical, thermal, aero and hydrodynamic properties of cereals, pulses and oilseeds.
14. Applications in Post-harvest technology equipment design and operation.
15. Drying and dehydration: moisture measurement, EMC, drying theory.
16. Commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer)
17. Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical Schedule

1. Study of different types and classification of greenhouses
2. Study of greenhouse equipments
3. Construction of greenhouse
4. Testing of Soil And Water
5. Determine the rate of air exchange in an active summer winter cooling system.
6. Regulation of irrigation and fertilizers through drip, fogging and misting
7. Determination of drying rate of agricultural products inside green house.
8. Determination of moisture content of various grains by oven drying moisture method.
9. Determination of moisture content of various grains by infrared moisture method.

10. Determination of engineering properties viz., shape, size, bulk density and porosity of biomaterials.
11. Determination of moisture content of various grains by moisture meter
12. Visit to commercial protected cultivation units
13. Visit to hydroponic unit
14. Visit to various Post Harvest Laboratories.
15. Field visit to a seed processing plant.
16. Project preparation for protected cultivation of important horticultural crops.
17. **Final Practical Examination**

Text Books

5. Brahma Singh, Balraj Singh, NavedSabir and MurtazaHasan, 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi. pp 1-248
6. Donell Hunt, 2013. Farm Power and Machinery Management. 10th edition. MedTec Publishers, New Delhi. pp 1-368
7. Jana, B. L., 2008. Precision Farming. AgroTech Publishing Academy. pp 1-1040

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1. Kali CharanSahu, 2008. Text Book of Remote Sensing and Geographical Information Systems. Atlantic Publishers and Distributors Pvt Ltd. pp 1-512
2. K. RadhaManohar and C. Ignathinathane. 2015. Greenhouse Technology and Management. 2nd edition. B. S. Publications. pp 1-234

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2. <http://agrimoon.com/protected-cultivation-post-harvest-technology-pdf-book-pdf-book/>
3. www.jains.com
4. www.gisdevelopment.net
5. www.lasercladding.com

21PAT 301 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT -I (2+1)

Course objective:

- To know the symptoms of diseases in field and horticultural crops
- To study the host pathogen interaction
- Understand the disease development cycle in correlation with environmental factors
- Providing knowledge on integrated disease management.

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

- Diagnosis of disease by visualizing symptoms
- Identify the causal organism of disease
- Identify the host parasite relationship for different crops
- Plan for sustainable crop production of oilseeds
- Prediction of appropriate management practices

THEORY

Unit I- Diseases of Cereals and Millets Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of Cereals: Rice - Blast, brown spot, sheath rot, sheath blight, foot rot, stem rot, false smut, stack burn, grain discoloration, leaf blight, leaf streak, Tungro, grassy stunt, Hoja Blanca. Maize – smut, rust, downy mildew, stalk rot, leaf spot. Millets: Sorghum, pearl millet, finger millet and small

millets - Smut, rust, downy mildew and other minor diseases.

Unit II- Diseases of Pulses and Oilseed Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of Pulses: Pigeon pea, black gram, mung bean, cowpea, soybean – wilt, powdery mildew, sterility mosaic, powdery mildew, root rot, leaf spot, anthracnose, rust, bacterial leaf spot and blight, mosaic, leaf crinkle. Oilseeds: Groundnut- leaf spot, rust, collar rot, wilt, root rot, rosette, mosaic, peanut bud necrosis, Castor and sesame – leaf spot, rust, root rot, stem rot, powdery mildew, downy mildew, white rust, mosaic, phytoplasma. Diseases of stored grains

Unit III- Diseases of Cash Crops and Fruit Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of Cash crops: Tobacco, - damping off, black shank, frog eye leaf spot, powdery mildew, mosaic, leaf curl. Jute - root rot, powdery mildew, anthracnose, Mulberry - wilt, root rot, powdery mildew, rust. Fruit crops: Banana - Panama wilt nematode complex, 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. Guava - wilt, root rot, gray blight, leaf spot, algal leaf spot, sooty mold, Sapota- gray blight, leaf spot, sooty mold, flat stem, Papaya- foot rot, fruit rot, papaya ring spot, papaya mosaic, Pomegranate - bacterial leaf spot, fungal blight, anthracnose, Pineapple - butt rot, heart rot, wilt, Jack fruit- fruit rot, Aonla- powdery mildew, leaf spot, fruit rot and Ber-powdery mildew, fruit rot.

Unit IV- Diseases of Vegetables Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of Vegetable crops: Crucifers- damping off, black rot, club root, leaf spot, white blister, head rot, leaf blight, white blister, downy mildew, Tomato - early blight, late blight, damping off, root rot, wilt, bacterial wilt and nematode complex, canker, spotted wilt, big bud, Brinjal- damping off, leaf spot, rust, fruit rot, wilt, root rot, little leaf, Okra- powdery mildew, leaf spot, vein clearing, Sweet potato – violet root rot, Beans - anthracnose, root rot, rust, mosaic disease, bacterial blight, Peas- powdery mildew, fusarium wilt, rust, Carrot and beetroot - leaf spot, leaf blight, powdery mildew, bacterial soft rot, curly top.

Unit V- Diseases of Plantation and Medicinal Crops, Post Harvest Diseases

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of Plantation crops: 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, Oilpalm –bud rot, wilt, leaf spot, Vanilla- stem rot, fruit rot, bean shedding, blight, Tea- blister blight, algal leaf spot, gray blight, leaf spot, root rot, Coffee- anthracnose, rust, root rot, leaf spot, sooty mould, Rubber- stem rot, powdery mildew, leaf spot, root rot, Cocoa – black pod rot, charcoal pod rot, gray blight, wilt, root rot, and swollen shoot, Medicinal crops: Gloriosa, coleus, stevia and aloe. Post-harvest diseases of fruits and vegetables.

PRACTICAL

Identification of diseases based on symptoms, microscopic examination of causal organism and study of host parasite relationship and management of major diseases of rice, maize, sorghum, pearl millet, finger millet, small millets, pigeonpea, urdbean, mungbean, soybean, cowpea, groundnut, sesame, castor, tobacco, jute, mulberry, banana, guava, papaya, sapota, pomegranate, pineapple, jack fruit, ber, aonla, crucifers, tomato, brinjal, okra, sweet potato, beans, peas, carrot, beetroot, coconut, arecanut, oilpalm, vanilla, tea, coffee, rubber and cocoa gloriosa, coleus, stevia and aloe Vera.

Lecture schedule:

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of,

1. Diseases of rice I
2. Diseases of rice II
3. Diseases of maize
4. Diseases of sorghum
5. Diseases of pearl millet and finger millet
6. Diseases of small millets
7. Diseases of pigeonpea
8. Diseases of urdbean, mungbean and cowpea
9. Diseases of soybean
10. Diseases of groundnut
11. Diseases of sesame and castor
12. Diseases of stored grains and their management
13. Diseases of tobacco
14. Diseases of jute and mulberry
15. Diseases of banana
16. Diseases of guava, papaya and sapota
17. **Mid-semester examination**
18. Diseases of pomegranate and pineapple
19. Diseases of jack fruit, ber and aonla
20. Diseases of crucifers
21. Diseases of tomato
22. Diseases of brinjal
23. Diseases of okra
24. Diseases of sweet potato, beans and peas
25. Diseases of carrot and beetroot
26. Diseases of coconut
27. Diseases of arecanut and oilpalm
28. Diseases of vanilla
29. Diseases of tea
30. Diseases of coffee
31. Diseases of rubber
32. Diseases of cocoa
33. Diseases of gloriosa, coleus, stevia, aloe vera
34. post-harvest diseases of fruits and vegetables

Practical schedule:

Symptomatology, host parasite relationship and management of

1. Diseases of rice
2. Diseases of maize and sorghum
3. Diseases of pearl millet, finger millet and small millets
4. Diseases of pigeonpea, urdbean, mungbean, soybean and cowpea
5. Diseases of groundnut, sesame and castor
6. Diseases of tobacco, jute and mulberry
7. Diseases of banana, guava, papaya, sapota
8. Diseases of pomegranate, pineapple, jack fruit, ber and aonla

9. Diseases of crucifers
10. Diseases of tomato, brinjal and okra
11. Diseases of sweet potato, beans, peas, carrot and beetroot
12. Diseases of coconut, arecanut, oilpalm and vanilla
13. Diseases of tea and coffee
14. Diseases of rubber and cocoa
15. Diseases of gloriosa, coleus, stevia and aloe Vera
16. Post-harvest diseases of fruits and vegetables

17. Final Practical Examination.

Text Books

1. Agrios, G.N. 2005. *Plant Pathology* (5th Ed.). New York: Academic Press. pp. 1-922.
2. Chaube, H.S. and Pundhir, V.S. 2009. *Crop diseases and their management*. New Delhi: PHI Learning Private Limited. pp. 1-724.
3. Girish Chand and Santhosh Kumar. 2016. *Crop Diseases and Their Management*. Florida: CRC press. pp. 1-285.
4. Rangaswami, G & Mahadevan, A. 2004. *Diseases of Crop Plants in India*. New Delhi: Prentice Hall of India Pvt. Ltd. pp. 1-548.
5. Sanjeev Kumar. 2016. *Diseases of Field Crops and Their Integrated Management*. India: New India publishing agency. pp. 1-296.

Reference Books

1. Nene, Y.L. and Tapliyal, P.N. 1993. *Fungicides in Plant Disease Control*. New Delhi: MEDTECH, Oxford and IBH publishing company. pp. 1-691.
2. Roland N Perry, Maurice Moens. 2013. *Plant Nematology*. UK: CABI. pp. 1-568.
3. Sonia Ahuja. (2005). *Plant Diseases*. New Delhi: Vishvabharti. pp. 1-268.
4. Suresh, Borkar, G. and Rupert, A.Y. 2017. *Bacterial diseases of crop plants*. Boca Raton: CRC Press. pp. 1-594.

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3. www.apsnet.org/edcenter
4. www.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>

21HOR 311 POST HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES (1+1)

Course Objectives

1. Describing the role of post-harvest technology in extending shelf life of agricultural produces
2. Improving the knowledge and need on value addition in agro-processing
3. Developing hands on training on processing of different fruits and vegetable products

Course Outcome

1. Discuss on the importance of post-harvest management of crops
2. Analyze effective methods of storage of the harvested produce
3. Define processing and value addition of harvested crop produces
4. Formulate and describe packaging of value added products from fruits and vegetables
5. Develop entrepreneur skills and discover ideas to process fruits and vegetables

THEORY

UNIT I - Principles and importance of postharvest technology

Importance of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.

UNIT II - Post harvest handling and physiology of ripening

Respiration and factors affecting respiration rate; Role of ethylene; Post harvest disease and disorders; Heat, chilling and freezing injury; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric).

UNIT III - Value addition and preservation

Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and nonfermented beverages.

UNIT IV– Value added products and dehydration techniques

Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables Concept and methods, osmotic drying.

UNIT V – Canning technology

Canning – Concepts and Standards, Packaging of products.

PRACTICAL

Applications of different types of packaging containers for shelf life extension, Effect of temperature on shelf life and quality of produce, Demonstration of chilling and freezing injury in vegetables and fruits, Extraction and preservation of pulps and juices, Preparation of jam, Preparation of Jelly, Preparation of RTS, Preparation of Nectar, Preparation of Squash, Osmotically dried products, Fruit bar and Candy and Tomato products, Canned products, Qualityevaluation of products — physico-chemical and sensory, Visit to processing unit/ industry

Lecture schedule

1. Scope and Importance of post harvest technology of fruits and vegetables - Extent and possible causes of post harvest losses - Causes of post harvest losses.
2. Pre-harvest factors affecting postharvest quality, maturity, ripening and shelf life of fruits and vegetables – Environmental factors (Temperature, Light, Rainfall, Wind, Relative humidity) – Cultural factors – (Rootstock, Variety, Mineral nutrients, growth regulators, Irrigation, pruning, thinning, girdling) – Maturity – Pest and diseases.
3. Changes occurring during ripening – Ripening definition - Climacteric and non climacteric fruits – Metabolic changes - Maturation of seeds – Colour – Texture - Changes in carbohydrates- Changes in aromatic volatiles - Changes in organic acids – Fruit abscission – Changes in respiration rate – Development of surface waxes – Changes in tissue permeability.

4. Causes for deterioration of harvested fruits and Vegetables -Respiration and factors affecting respiration rate – Transpiration and factors affecting transpiration - Ethylene –Mechanical damage – Pest and Diseases.
5. Post harvest diseases and disorders - Heat, chilling and freezing injury.
6. Harvesting and field handling – Methods of harvesting – Post harvest handling – Pre-cooling - Sorting and grading – Disinfestation – Post harvest treatments (Waxing, Wrapping, de-greening, ripening).
7. Storage – Methods of storage – Traditional storages (In-situ, pit storage, high altitude, clamp storage, wind breaks, cellars, barns, Night ventilation, Evaporative cool storage ZECC) - Improved storage methods (Refrigerated storage, modified atmospheric storage, controlled atmospheric storage, hypobaric storage).
8. Packaging of products - Definition – Properties of good packaging material – Different packaging materials for fresh fruits and vegetables for export – Cushioning materials – Purpose – Characteristics of cushioning material.

9. Mid semester examination

10. Value addition – Concept – Scope and importance of fruit preservation in India – Status of fruit preservation in India.
11. Principles and methods of preservation – Principles of preservation – Preservation methods – High temperature, low temperature, drying, filtration, chemicals, food additives, fermentation, carbonation, antibiotics, irradiation etc.
12. Intermediate moisture foods - Jam, jelly, marmalade – Problems in Jam making important considerations and problems in Jelly making- Problems in marmalade making.
13. Preserve candy – Concepts and Standards – Flow chart for manufacturing of preserve and candy – Problems in preservation of preserve and candied fruits – Glazed fruits/vegetables.
14. Fruit beverages –Fermented (Juices, Ready to serve, Nectar, cordial, Squash, crush, Syrup, Fruit Juice concentrate, Fruit Juice, Powder, Carbonated beverages) and non-fermented beverages (Wine, Champagne, Port, Sherry, Tokay, Muscat, Perry, Nira, Feni, Cider) – Preparation and preservation of unfermented fruit beverages.
15. Tomato processing - Concepts and Standards – Tomato juice – Tomato puree and paste – Tomato sauce/ketchup- Tomato chutney/pickle –Tomato cocktail – Tomato soup – Canned tomatoes.
16. Drying/dehydration of fruits and vegetables – Factors affect the rate of drying – Advantages of dehydration over sun drying – Process of drying/dehydration of fruits and vegetables – Spoilage of dried fruits and vegetables - Freezing – Methods of freezing.
17. Canning of fruits and vegetables – Selection of fruits and vegetable - Causes of spoilage of canned foods – Testing for defects - Containers for packing of canned products – Tin containers, glass containers.

Practical Schedule

1. Applications of different types of packaging containers for shelf life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Demonstration of chilling and freezing injury in vegetables and fruits.
4. Extraction and preservation of pulps and juices.

5. Preparation of jam.
6. Preparation of jelly.
7. Preparation of RTS.
8. Preparation of nectar.
9. Preparation of squash.
10. Preparation of osmotically dried products.
11. Preparation of fruit bar and candy.
12. Preparation of tomato sauce.
13. Preparation of tomato ketchup.
14. Preparation of canned products.
15. Quality evaluation of products - (physic-chemical and sensory).
16. Visit to processing unit/ industry.

17. Final Practical Examination

References

1. Rathore, N.S., Mathur, G.K., Chasta, S.S. 2012. Post-harvest Management and Processing of Fruits and Vegetables. ICAR, New Delhi.
2. Chadha, K.L. 2009. Handbook of Horticulture. IARI Publications, New Delhi.
3. Giridharilal, G.S., Siddappa and Tondon, G.L. 2007. Preservation of Fruits and Vegetables. ICAR, New Delhi.
4. Mitra, S.K. 2005. Post Harvest Physiology and Storage of Tropical and Subtropical Fruits. CABI Publishers, Kolkatta.

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3. <https://www.researchgate.net/publication/315835335>
4. <http://www.indiaagronet.com/>
5. <http://www.intuxford.tripod.com/>

21ARM 301 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION (1+1)

Course Objective:

- Expose to functional areas of agribusiness management and its application
- Understand the concept of entrepreneurship, entrepreneurial competencies
- Learn about entrepreneurial opportunities
- Gain knowledge on various management issues in establishing a business and to inculcate success
- Understand the networking techniques
- Explore various types of business strategies and entrepreneurship concepts that should help define the learning methods and goals.

Course Outcome:

- Explain principles relevant for agribusiness and their applications for decision making
- Gain knowledge on Business environment
- Establish small and medium enterprises
- Explain the scope for agribusiness
- Identify consumer behavior

- Demonstrate the techniques in capital management and financial management of agribusiness.

THEORY

Unit I – Entrepreneur and Entrepreneurial Process

Concept and Types of Entrepreneurship - Characteristics of Entrepreneurs and Entrepreneurial Skills - Entrepreneurial process – Importance of Entrepreneurship. SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development.

Unit II – Entrepreneurship Opportunities

Innovation - principles of innovation - Sources of innovative opportunities - Business environment – Micro and Macro environment - MSME Classification and Opportunities for rural entrepreneurship - KVIC classification, Start up and Business incubators. Agribusiness – Importance, Opportunities and Challenges. Impact of economic reforms on Agribusiness/Agrienterprises

Unit III – Managerial Functions – Planning and Organizing

Entrepreneurial development process, business leadership skills – Developing organizational skill, controlling, supervising, problem solving, monitoring & evaluation - Management Functions – Planning – Types of Plans and Steps in Planning, Organizing – Principles and Departmentation.

Unit IV – Managerial Functions – Staffing, Directing and Control

Staffing – Job Analysis, Human Resource Planning Process, Recruitment and Selection, Directing-Principles, Techniques and Supervision, Controlling – Process and Types. Business leadership skills, communication, direction and motivation skills.

Unit V – Functional Areas of Management

Operations Management – Meaning and Scope, Supply Chain Management – Drivers and flows and Total Quality Management – Meaning and Principles, Marketing Management – Market Segmentation and Marketing Mix Financial Management – Meaning, Objectives and Scope.

PRACTICAL

Practical Assessment of entrepreneurial traits-Identification of new business opportunities-Exercise on SWOC Analysis of Agribusiness Sector in India -Market survey for understanding customer needs-Starting new business - Visit to firms / discussion with entrepreneurs-Documenting Procedure for Establishing Agribusiness Firms-Government programs and institutions for entrepreneurship development-Financing new agribusiness ventures – Visit to banks / discussion-Exercise on Demand Forecasting for Agricultural Inputs/Products-Preparation of Advertisement and Sales Promotion Measures for Agribusiness-Exercise on Inventory Management–ABC Analysis and EOQ Model-Exercise on discounted measures of Capital Budgeting- Calculation of Break Even Point and its Business Implication-Understanding balance sheet and income statement-Financial Performance Analysis - Ratio Analysis.

Lecture Schedule

1. Concept of Entrepreneurship and Types of Entrepreneurship
2. Characteristics of Entrepreneurs and Entrepreneurial Skills, Entrepreneurial process – Importance of Entrepreneurship

3. SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development.
4. Innovation - principles of innovation - Sources of innovative opportunities
5. Business environment – Micro and Macro environment, MSME Classification and Opportunities for rural entrepreneurship
6. KVIC classification, Startup and Business incubators
7. Agribusiness – Importance, Opportunities and Challenges. Impact of economic reforms on Agribusiness/Agrienterprises
8. Management Functions – Planning – Types of Plans and Steps in Planning
9. **Mid Semester Examination**
10. Organizing – Principles and Departmentation
11. Staffing – Job Analysis, Human Resource Planning Process, Recruitment and Selection
12. Directing – Principles, Techniques and Supervision
13. Controlling – Process and Types, . Business leadership skills, communication, direction and motivation skills.
14. Functional Areas of Management – Operations Management – Meaning and Scope
15. Supply Chain Management – Importance, Drivers and flows
16. Total Quality Management – Meaning and Principles
17. Marketing Management – Market Segmentation and Marketing Mix. Financial Management –Meaning, Objectives and Scope

Practical Schedule

1. Assessment of entrepreneurial traits
2. Identification of new business opportunities
3. Exercise on SWOT Analysis of Agribusiness sector in India
4. Market survey for understanding customer needs
5. Starting new business - Visit to firms / discussion with entrepreneurs
6. Documenting Procedure for Establishing Agribusiness Firms
7. Government programs and institutions for entrepreneurship development
8. Financing new agribusiness ventures - Visit to banks / discussion
9. Exercise on Demand Forecasting for Agricultural Inputs/Products
10. Preparation of Advertisement and Sales Promotion Measures for Agribusiness
11. Exercise on Inventory Management – EOQ Model and ABC Analysis
12. Exercise on discounted measures of capital budgeting
13. Calculation of Break Even Point and its Business Implication
14. Business Plan Preparation
15. Understanding balance sheet and income statement
16. Financial Performance Analysis - Ratio Analysis
17. **Final Practical Examination**

Text Books

1. Aswathappa, K., 2013. Human Resource and Personnel Management. New Delhi: Tata McGraw Hill Publishing Co. Ltd. pp: 1-686.
2. Mohanty, S, K., 2007. Fundamentals of Entrepreneurship. New Delhi: Prentice Hall India Ltd. pp. 1-203.

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1. Dollinger, M, J., 1999. Entrepreneurship Strategies and Resources. Upper Saddle River, New Jersey: Prentice-Hall. pp.1-259.

2. Koontz, H., & Weihrich, H., 2015. Essentials of Management. India: Tata McGraw Hill Education. pp. 1-265

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3. www.msme.gov.in
4. www.niesbudtraining.org
5. www.nimsme.org
6. www.nsic.co.in
7. www.nabard.org

21ELC301 BIOPESTICIDES AND BIOFERTILIZERS (2+1)

Course Objectives:

- To state the history, potential and scope of biopesticides and biofertilizers.
- To explain the mechanism of action of different biopesticides
- To demonstrate the mechanism of action of different biofertilizers
- To discuss the procedure of isolation, mass production, quality control parameters and method of application of biopesticides
- To elaborate the procedure of isolation, mass production, quality control parameters and method of application of bio fertilizers
-

Course Outcomes: Through this course the student will be able to

- Define the concepts and classify biopesticides and biofertilizers based on their traits
- Illustrate the procedure of isolation and mass production of biopesticides
- Demonstrate the procedure of isolation and mass production of biofertilizers
- Choose the method of application of biopesticides and biofertilizers
- Assess the quality of biopesticides and biofertilizers

THEORY

Unit I - Introduction to bio pesticides

History, importance, scope and potential of biopesticides, definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, biorationales, botanicals and their uses

Unit II - Characteristics of biopesticides, their mass production quality control and application Virulence, pathogenicity and symptoms of entomopathogenic microbes and nematodes, methods of isolation, purification and mass production, methods of application of biopesticides, methods and parameters for quality control of biopesticides, impediments and limitation in production and use of biopesticides. Structure and characteristic features of bacterial bioagents - *Bacillus* and *Pseudomonas*.

Unit III - Introduction to biofertilizers

Introduction, status, scope and classification of biofertilizers, structure and characteristic features of bacterial biofertilizers - *Azospirillum*, *Azotobacter*, *Rhizobium* and *Frankia*. Cyanobacteria, characteristic features of cynobacterial biofertilizers viz., *Anabaena*, *Nostoc*, *Hapalosiphon*, mechanism of nitrogen fixation by free living and symbiotic bacteria

Unit IV- P and K solubilizing microbes and mass production of biofertilizers: Mechanism of phosphate solubilization and phosphate mobilization, mechanism of k solubilisation, strain selection, sterilization, growth, fermentation and mass production of carrier based and liquid bio fertilizers. Characteristic features of fungal biofertilizers - AM mycorrhiza and ectomycorrhiza

Unit V- Quality control parameters, Storage and application technology of bio fertilizers: FCO specifications and quality control of biofertilizers, application technology for seeds, seedlings, tubers, sets etc, storage, shelf life and marketing of biofertilizers, factors influencing the efficacy of bio fertilizers

PRACTICAL

Basic instrumentation and safety in Biopesticide/biofertilizer Laboratory. Isolation, purification and mass production of *Pseudomonas*, *Bacillus*, *Trichoderma*, *Metarhizium*, *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizing bacteria and cyanobacteria. Isolation of AM fungi by wet sieving method and sucrose gradient method. Mass production technique of AM inoculants. Extraction of important botanicals. Field visit to explore naturally infected cadavers and identification of entomopathogenic entities in field condition. Visit to biopesticide laboratory in nearby area. Study of quality control parameters of biopesticides and biofertilizers.

Lecture Schedule

1. History, importance, scope and potential of bio pesticides
2. Definitions, concepts and classification of biopesticides viz. pathogen, biorationals, botanicals and their uses
3. Entomopathogenic microbes : classification, virulence and pathogenicity
4. Structure and characteristic features of Entomopathogenic microbes (bacteria and actinobacteria)
5. Structure and characteristic features of Entomopathogenic fungus and their production methods
6. Structure and characteristic features of Entomopathogenic virus and their production methods
7. Structure and characteristic features of Entomopathogenic nematodes and their production methods
8. Structure, characteristic features, methods of isolation, purification and mass production of *Trichoderma*
9. Structure, characteristic features, methods of isolation, purification and mass production of *Bacillus*
10. Structure, characteristic features, methods of isolation, purification and mass production of *Pseudomonas*.
11. Methods of application of biopesticides
12. Methods and parameters for quality control of biopesticides
13. Study of botanicals and their uses
14. Study of biorationals, their classification and uses
15. Impediments and limitation in production and use of biopesticides.
16. Biofertilizers - Introduction, status, scope and classification
17. **Mid semester examination**
18. Structure and characteristic features of *Azospirillum*
19. Structure and characteristic features of *Azotobacter*
20. Structure and characteristic features of *Rhizobium*

21. Structure and characteristic features of *Frankia*
22. Characteristic features of cyanobacterial biofertilizers-*Anabaena*
23. Characteristic features of cyanobacterial biofertilizer- *Nostoc*
24. Characteristic features of cyanobacterial biofertilizer-*Hapalosiphon*
25. Mechanism of nitrogen fixation by free living and symbiotic bacteria
26. Phosphate solubilizing microbes and Mechanism of phosphate solubilization and mobilization.
27. Potassium solubilizing microbes
28. Mechanism of potassium solubilization.
29. Biofertilizer Production technology: Strain selection, sterilization, growth and fermentation
30. Fungal bio fertilizers- AM mycorrhiza and ectomycorrhiza
31. FCO specifications and quality control of bio fertilizers
32. Biofertilizer application technology for seeds, seedlings, tubers, and sets
33. Storage, shelf life and marketing of biofertilizers
34. Factors influencing the efficacy of bio fertilizers

Practical Schedule:

1. Basic instrumentation and safety in Biopesticide/biofertilizer Laboratory
2. Isolation, purification and mass production of *Pseudomonas*
3. Isolation, purification and mass production of *Bacillus*
4. Isolation, purification and mass production of *Trichoderma*
5. Isolation,, purification and mass production of *Metarhizium*
6. Isolation, purification and mass production of *Azospirillum*
7. Isolation, purification and mass production of *Azotobacter*
8. Isolation, purification and mass production of *Rhizobium*
9. Isolation, purification and mass production of P-solubilizing bacteria
10. Isolation, purification and mass production of cyanobacteria
11. Isolation of AM fungi by wet sieving method and sucrose gradient method
12. Mass production technique of AM inoculants
13. Extraction of important botanicals
14. Field visit to explore naturally infected cadavers and identification of entomopathogenic entities in field condition.
15. Visit to biopesticide laboratory in nearby area.
16. Study of quality control parameters of biopesticides and biofertilizers.

17. Final Practical Examination

Text books

1. Suri Shalini. 2011. Biofertilizers and Biopesticides. APH Publishing Corporation
2. G.S. Dhaliwal and Opendar K. 2007. Biopesticides and pest management. Kalyani Publishers.

References books

1. Ghosh G.K. 2000. Bio-Pesticide and Integrated Pest Management. APH Publishing Corporation
2. Subba Rao N.S. 2009. Soil Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd.
3. Thamizh Vendan, Pandiyarajan and Thangaraju. 2008. Techniques in Agricultural Microbiology. Agribios (India).

21ELC 302 AGRIBUSINESS MANAGEMENT (2+1)

Course Objective: The Purpose of learning subject is

- Expose the students on functional areas of agribusiness management and its applications
- Understand the concept of entrepreneurship, entrepreneurial competencies
- Expose on the entrepreneurial opportunities
- Expose the students on various management issues in establishing a business and inculcating success
- Understand the Networking techniques
- Explore various types of business strategies and entrepreneurship concepts that should help define the learning methods and goals.

Course Outcome:

- Elaborate on economic principles relevant to agribusiness and their applications for decision making
- Appraise the Business environment
- Establish Small and Medium Enterprises
- Explain the scope of Agribusiness
- Validate consumer behaviour analysis
- Demonstrate the techniques in Capital Management and Financial Management of Agribusiness

THEORY

UNIT I- Agribusiness

Agribusiness: Definition – Nature and Scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Structure of Agribusiness (input, farm and product sectors) - Agribusiness Management - Distinctive features of Agribusiness - Importance of Agribusiness in Indian Economy and New Agricultural Policy – Agri-value chain: Understanding primary and support activities and their linkages. Business environment – PEST and SWOT analysis.

UNIT II- Management

Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management. Forms of Business Organisation – Sole Proprietorship – Partnership – Private and Public Limited – Cooperatives.

Unit III- Management Functions

Management functions: Roles and activities, organizational culture. Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning and implementation – Characteristics of Sound plan. Objectives – MBO. Organizing – Principles of Organizing – Concept of Departmentation-Delegation- Centralization – Decentralization. Staffing – Concept – Human Resource Planning – Process. Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management. Controlling – Concept - Steps – Types – Importance – Process.

Unit IV- Functional areas of management

Functional areas: Operations, Human Resources, Finance and Marketing – Meaning and scope. Operations management: meaning – physical facilities – implementing the plan. Inventory

control: meaning – inventory model – EOQ. Financial management of agribusiness: Financial statements and their importance – Balance sheet, Network analysis and Cash flow analysis. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies. Consumer behavior analysis Product Life Cycle (PLC). Sales and distribution management. Pricing policy, various pricing methods.

Unit V- Preparation of bankable project

Project management: Definition – classification of agricultural projects – Project cycle: Identification, Formulation, Appraisal, Implementation, Monitoring and Evaluation. Project appraisal and evaluation of bankable projects – Pay Back Period, BCR, NPW and IRR. Agro-based industries – importance and need – Types of agro-based industries – institutional arrangements. Procedure to set up agro-based industries, constraints in establishing agro-based industries- Laws and policies related to agri-business in India.

PRACTICAL

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

Lecture schedule

1. Agribusiness – Nature and scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems.
2. Agribusiness – definition - Structure of Agribusiness (input, farm and product sectors).
3. Agribusiness Management - Distinctive features of Agribusiness - Importance of Agribusiness in Indian Economy – New Agricultural Policy.
4. Agri-supply chain management and agri-value chain management – Forward and Backward linkages.
5. Business environment – analyzing the demographic, economic, socio-cultural, natural, technological and political-legal environment.
6. Business environment – PEST and SWOT analysis.
7. Management – Definition and Importance – Management functions. Management – Roles, Skills, Levels, Activities and organizational culture.
8. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited - Cooperatives.
9. Management functions: Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget).
10. Steps in planning – Characteristics of Sound plan. Objectives – MBO
11. Organizing – Principles of Organizing – Organisation structure – Formal and Informal Organisation.
12. Concept of Departmentation- Span of control – Authority and Responsibility – Concept and Meaning. Delegation- Centralization – Decentralization
13. Staffing – Concept – Human Resource Planning – Process.
14. Directing – Concept – Principles – Techniques -ordering, leading, supervision.
15. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques.

16. Communication – Definition and Process – Models – Types – Barriers.
17. **Mid-semester examination**
18. Leadership – Definition – Styles – Difference between leadership and management.
19. Controlling – Concept - Steps – Types – Importance – Process.
20. Functional areas of management: Operations management: meaning – operating system – physical facilities – implementing the plan.
21. Scheduling the work – controlling production in terms of quantity and quality – ISO standards – HACCP – TQM.
22. Inventory – meaning – types – inventory costs – inventory management – EOQ.
23. Financial management – financial statements – importance and need – Balance sheet, Net worth analysis and cash flow analysis.
24. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies.
25. Consumer buying behavior – factors influencing buying behavior – Buying decision process.
26. Sales and distribution management.
27. Pricing policy- pricing method – pricing at various stages of marketing.
28. Project – meaning, definition – classification of agricultural projects – project cycle – Identification, formulation, appraisal, implementation, monitoring and evaluation.
29. Project appraisal and evaluation techniques – undiscounted and discounted measures.
30. Agro-based industries – importance and need – types of agro-based industries – institutional arrangements for financing agro-based industries.
31. Procedure to set up agro-based industries – constraints in establishing agro-based industries.
32. Business plan – components of business plan.
33. Preparation of project reports for various activities in agriculture and allied sectors.
34. Laws and policies related to agri-business in India.

Practical schedule

1. Study of agro-input markets: Seeds, fertilizers and pesticides.
2. Visit to output markets – Regulated market/Uzhavarsandhai.
3. Visit to output markets – Shandies/flower market.
4. Visit to agro-processing unit to study retail trade, commodity trading and value addition.
5. Visit to Cooperatives to know their role in agriculture development.
6. Visit to Lead Bank/RRBs.
7. Visit to NABARD district office.
8. A case study of agro-based industries – preparation and presentation of project report.
9. Exercise on project evaluation techniques – Undiscounted measures.
10. Exercise on project evaluation techniques – Discounted measures.
11. Preparation of bankable project – I.
12. Preparation of bankable project – II.
13. Group presentation of projects – I.
14. Group presentation of projects – II.
15. Trend and growth rate in prices of agro-inputs.
16. Trend and growth rate in prices of agricultural commodities.
17. **Final Practical examination.**

Text Books

1. Aswathappa, K., 2013. Human Resource and Personnel Management. India, Tata McGraw Hill Publishing Co. Ltd, pp. 1-686.
2. Mohanty, S, K., 2007. Fundamentals of Entrepreneurship. New Delhi: Prentice Hall India Ltd., pp. 1-203.

Reference Books

1. Dollinger, M.J., 1999. Entrepreneurship Strategies and Resources. Upper Saddle River: New Jersey Prentice-Hall. pp. 1-259.
2. Koontz, H., & Weihrich, H., 2015. Essentials of Management. New Delhi: Tata McGraw Hill Education. pp: 1-265

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

21ELC 303 MICRO-PROPAGATION TECHNOLOGIES (2+1)

Course Objectives

1. Describing the importance of plant tissue culture
2. Imparting knowledge on the applications and commercial importance of in vitro propagation
3. Introducing the role of tissue culture in plant breeding

Course Outcome

1. Understand how in vitro culture originated and appreciate its applications
2. Comprehend the various types of plant tissue culture and its importance
3. Demonstrate mass multiplication of micropropagules
4. Apply tissue culture techniques in crop improvement
5. Examine the demands of the plant tissue culture industry
6. Practice plant tissue culture techniques and become an entrepreneur

THEORY

Unit I: Introduction

Meaning and concept of *in vitro* culture and micro-propagation. Different concepts employed in micropropagation. Historical mile stones, advancement and future prospects of micropropagation; totipotency, dedifferentiation. Applications, advantages and limitations of tissue culture techniques. Tissue culture methodology: Sterile techniques, synthetic and natural media components, growth regulators, environmental requirement, genetic control of regeneration. Techniques of sterilization/asepsis for glass and metal ware, liquids both thermo stable and thermolabile and disposal of remnants of culture. Laboratory organization, requirements, layout of small, medium and large scale Tissue culture laboratories.

Unit II: Organogenesis

Components of the tissue culture media – Inorganic nutrients, vitamins, amino acids and other organic supplements, carbon source, hormones/ plant growth regulators, pH of the media, gelling agents. Different types of media. Preparation of media – Stocks and working media, preparation and storage. Plant regeneration pathways-Organogenesis and Somatic embryogenesis. Organo genesis-

Purpose, methods and requirements for organogenesis, indirect and direct organogenesis. Somatic embryo genesis – Procedures and requirements for organogenesis, indirect and direct embryogenesis; Differences between somatic and gametic embryogenesis,

Unit III: Types of cultures and their importance

Haploid culture- Anther culture, pollen culture and Ovary culture- applications and limitations. Synthetic seed- Concepts, necessity, procedure and requirements for production of synthetic seeds. Artificial seed. Micro-propagation – Definition, methods, stages of micro-propagation and its significance. Axillary bud proliferation approach – Shoot tip and meristem culture. Factors affecting micropropagation-applications and limitations. Advancements and future prospects of *in vitro* culture – Techniques of single cell culture, suspension cultures. Applications of organ culture - Meristem tip culture (virus free plants) and anther culture (doubled haploids). Production of secondary metabolites through cell culture techniques.

Unit IV: Micropropagation

Micropropagation-Definition, stages of micropropagation-Factors affecting micropropagation – applications and limitations. Micropropagation techniques in Banana, Neem, Bamboo, Cassuarina, Sugarcane, *Eucalyptus*, *Aloe vera*, *Phyllanthus*, Gerbera, Coleus, Rose, Chrysanthemum and Orchids.

Unit V: Hardening of tissue culture plants

Primary hardening of tissue cultured plants –requirements and layout of polyhouse. Secondary hardening of Tissue cultured plants- Requirements and layout of shade net provision. National certification and Quality management of TC plants. Genetic fidelity test and virus indexing in TC plants. Production of secondary metabolites through cell culture techniques. Public and private organizations involved in Plant Tissue culture in India. Preparation of Project proposal forestablishing a commercial Tissue culture lab.

PRACTICAL

Laboratory organization, Laboratory organization small, medium and large scale laboratories. Sterilization techniques for explants, glassware, plasticwares, labwares and working platform. Preparation of stocks and working solution. Preparation and sterilization of growth regulators. Preparation of working medium and Experimentation on determining optimum concentration of growth regulators. Callus induction and regeneration of whole plants from different parts of plants. Direct regeneration into whole plants using bud, node and other tissues. Induction of somatic embryos. Experiments of synthetic seeds production and testing storability and germination efficiency.

Lecture Schedule

1. Meaning and concept of *in vitro* culture, micro propagation, totipotency, dedifferentiation. Different concepts employed in tissue culture.
2. Scope of Plant Tissue culture.
3. Historical mile stones, advancement and future prospects of micro propagation; totipotency, dedifferentiation.
4. Different tissue culture techniques- applications, advantages and limitations.
5. Layout of Tissue culture, requirements and types- small, medium and large scale laboratories. Environmental requirements of Tissue culture unit.
6. Techniques of sterilization/asepsis for glass and metal ware, liquids both thermo stable and thermo labile, disposal of remnants of culture.
7. Components of the tissue culture media – Inorganic nutrients, vitamins, amino acids and other organic supplements.
8. Components of the tissue culture media- carbon source, hormones/ plant growth regulators, pH of the media, gelling agents.
9. Preparation of media – Stocks and working media, preparation and storage.
10. Genetic control of regeneration. Pathways of regeneration of plants and Regeneration methods- morphogenesis, organogenesis and embryogenesis.

11. Organogenesis-Purpose, methods and requirements for organogenesis, indirect and direct organogenesis.
12. Somatic embryogenesis and factors affecting somatic embryogenesis - Differences between gametic and somatic embryos.
13. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture. Applications and limitations.
14. Auxillary bud proliferation, shoot tip and meristem culture- application and limitations.
15. Anther culture, pollen culture and ovary culture- applications and limitations
16. Production of virus free plants through Meristem tip culture.
17. **Mid Semester Examination**
18. Synthetic seeds and Artificial seed – Concept, necessity, procedure and requirements of synthetic seeds.
19. Micro propagation-Definition, stages of micro propagation- Factors affecting micro propagation –applications and limitations.
20. Micro propagation techniques in Banana and Neem
21. Micro propagation techniques Bamboo and Cassuarina
22. Micro propagation techniques in Sugarcane and *Eucalyptus*
23. Micro propagation techniques in *Aloe vera* and *Phyllanthus*
24. Micro propagation techniques in Gerbera and Coleus
25. Micro propagation techniques in Rose
26. Micro propagation techniques in Chrysanthemum
27. Micro propagation techniques in Orchids
28. Primary hardening of tissue cultured plants –requirements and layout of poly house.
29. Secondary hardening of Tissue cultured plants- requirements and layout of shade net provision.
30. National certification and Quality management of TC plants
31. Genetic fidelity test and virus indexing in TC plants.
32. Production of secondary metabolites through cell culture techniques.
33. Public and private organizations involved in Plant Tissue culture in India.
34. Preparation of Project proposal for establishing a commercial Tissue culture lab.

Practical schedule

1. Organization of tissue culture laboratory- small, medium and large scale laboratory layout.
2. Sterilization techniques used in tissue culture laboratory – Glass, plastic and metal ware.
3. Study and use of laminar flow unit for tissue culture.
4. Study and use of autoclaves for tissue culture.
5. Preparation of stock and working solutions of tissue culture media.
6. Sterilization techniques used in tissue culture laboratory media.
7. Filter Sterilization thermo labile compounds-Hormones and Vitamines and Aminoacids.
8. Preparation and inoculation of explants for direct organogenesis – Shoot tip, nodal explants.
9. Preparation and inoculation of explants for callus production – Leaf, stem and root explants.
10. Determination of optimum concentration of hormones/ growth regulators for direct organogenesis – Shoots.
11. Determination of optimum concentration of hormones/ growth regulators for direct

organogenesis – Roots.

12. Sub culturing for multiple shoots and calli produced in vitro.
13. Determination of optimum concentration of auxins to generate shoots from *in vitro* generated calli.
14. Preparation of synthetic seeds from somatic embryos and its storage.
15. Visit to commercial Tissue culture lab.
16. Visit to Accredited Tissue Culture lab/NRC Banana, Trichy

17. Final practical examination

References

1. Gamborg, O.L. and Phillips, G.C. 1995. Plant Cell Tissue Organ Culture : Fundamental Methods. Springer, Berlin.
2. Keshavachandran, R. and Peter, K.V. 2008. Plant Biotechnology: Methods in Tissue Culture and Gene Transfer. Universities Press, Hyderabad. 224
3. Smith, R.H., 2013. Plant Tissue Culture : Techniques and Experiments. 3rd ed. Academic Press, San Diego, CA, USA.
4. Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture, Theory and Practice. Elsevier, Netherlands.
5. Bhojwani, S.S. and Dantu, P.K. 2013. Plant Tissue Culture: An Introductory Text. Springer, India, New Delhi.

Web references

1. <https://en.wikipedia.org/wiki/Micropropagation>
2. <https://byjus.com/biology/micro-propagation>
3. www.hsi1942.org
4. <https://www.rhs.org.uk/propagation/micropropagation>

2021 batch Semester VI

S. No	Course Code	Course Title	Credit Hours	Total Credits
1.	21 AGR 303	Practical Crop Production II (Rabi Crops)	0+1	1
2.	21 AGR 304	Principles of Organic farming	1+1	2
3.	21 PBG 302	Crop Improvement	2+1	3
4.	21 AEC 302	Agricultural Finance and Co-operation	2+1	3
5.	21 PAT 302	Diseases of Field and Horticultural Crops and their Management II	2+1	3
6.	21 ABT 301	Plant Biotechnology	2+1	3
7.	21 RSG 301	Geo-informatics, Nanotechnology and Precision Farming	1+1	2
8.	21 AEC 303	Intellectual Property Rights	1+0	1
9.	21 ENS 301	Environmental Studies and Disaster Management	2+1	3
10.	21 ELC ***	Elective Course III	2+1	3
		Total	15+9	24

2021 batch - Semester VI
21AGR 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>

21AGR 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 (Sunnhemp / 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=JIWsxo5nNgg>
8. <http://www.soilassociation.org>

21PBG 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); Ideo type- 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).

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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/>

21AEC 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

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

21PAT 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 tuberose and carnation
29. Diseases of liliun 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.

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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>

21ABT 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>

21RSG 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 – meteorological, 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>

21AEC 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/

21ENS 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>

21ELC 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.

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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

21ELC 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 P₂O₅ and citrate soluble P₂O₅ in single super phosphate. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

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.

21ELC 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 – Bulbs – 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 – Clapsed 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*. AlliedPublishers 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
