

B. Sc. (Hons.) Agriculture

**Curriculum and Syllabus
2018**



**DEPARTMENT OF AGRICULTURE
KALASALINGAM SCHOOL OF AGRICULTURE AND HORTICULTURE
KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION
(To be a Kalasalingam University)
Krishnankoil - 626126, Virudhunagar District.**

SEMESTER – I

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R151	Fundamentals of Horticulture	1	1	2
2.	AGR18R152	Fundamentals of Plant Biochemistry and Biotechnology	2	1	3
3.	AGR18R153	Fundamentals of Soil Science	2	1	3
4.	AGR18R154	Introduction to Forestry	1	1	2
5.	HSS18R154	Comprehension and Communication Skills in English	1	1	2
6.	AGR18R155	Fundamentals of Agronomy	3	1	4
7.	MAT18R111	Elementary Mathematics	2	0	2
8.	AGR18R101	Agricultural Heritage	1	0	1
9.	AGR18R102	Rural Sociology and Educational Psychology	2	0	2
10.	TAM18R181/ HSS18R181	jkpH; ,yf]fpa']fspy; ntshz]ika}k; mwptpay; jkpH; gad:ghLk: /Developmental Education	0	1	1
11.	NG18R1001/02	NCC/ NSS	0	1*	1*
12.	NG18R1003	Physical Education	0	1*	1*
13.	NCA18R601	Human Value & Ethics	1*	0	1*
Total			15+1*	7+2*	22+3*

*Non Credit courses

SEMESTER-II

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R156	Fundamentals of Genetics	2	1	3
2.	AGR18R157	Agricultural Microbiology	1	1	2
3.	AGR18R158	Introductory Soil and Water Conservation Engineering	1	1	2
4.	AGR18R159	Fundamentals of Crop Physiology	1	1	2
5.	AGR18R103	Fundamentals of Agricultural Economics	2	0	2
6.	AGR18R160	Fundamentals of Plant Pathology	3	1	4
7.	AGR18R161	Fundamentals of Entomology	3	1	4
8.	AGR18R162	Fundamentals of Agricultural Extension Education	2	1	3
9.	HSS18R251	Communication Skills and Personality Development	1	1	2
Total			16	8	24

SEMESTER-III

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R251	Crop Production Technology – I (Food crops)	1	1	2
2.	AGR18R252	Fundamentals of Plant Breeding	2	1	3
3.	AGR18R253	Agricultural Finance and Cooperation	2	1	3
4.	AGR18R254	Agri-Informatics	1	1	2
5.	AGR18R255	Farm Machinery and Power	1	1	2
6.	AGR18R256	Production Technology for Vegetables and Spices	1	1	2
7.	AGR18R257	Environmental Studies and Disaster Management	2	1	3
8.	AGR18R258	Livestock and Poultry Management	3	1	4
9.	MAT18R211	Statistical Methods and Designs	1	1	2
Total			14	9	23

SEMESTER-IV

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R259	Crop Production Technology – II (Commercial crops)	1	1	2
2.	AGR18R260	Production Technology for Ornamental Crops, MAPs and Landscaping	1	1	2
3.	AGR18R261	Renewable Energy and Green Technology	1	1	2
4.	AGR18R201	Problematic Soils and their Management	2	0	2
5.	AGR18R262	Production Technology for Fruits and Plantation Crops	1	1	2
6.	AGR18R263	Principles of Seed Technology	1	2	3
7.	AGR18R202	Farming System and Sustainable Agriculture	1	0	1
8.	AGR18R264	Agricultural Marketing Trade and Prices	2	1	3
9.	AGR18R265	Introductory Agro-Meteorology and Climate Change	1	1	2
10.	AGR18R2**	Elective Course	2	1	3
Total			13	9	22

SEMESTER-V

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
11.	AGR18R351	Principles of Integrated Pest and Disease Management	2	1	3
2.	AGR18R352	Manures, Fertilizers and Soil Fertility Management	2	1	3
3.	AGR18R353	Pests of Crops and Stored Grain and their Management	2	1	3
4.	AGR18R354	Diseases of Field and Horticultural Crops and their Management-I	2	1	3
5.	AGR18R355	Crop Improvement-I (Food crops)	1	1	2
6.	AGR18R356	Entrepreneurship Development and Business Management	1	1	2
7.	AGR18R357	Geoinformatics and Nano-technology and Precision Farming	1	1	2
8.	AGR18R381	Practical Crop Production - I (Food crops)	0	2	2
9.	AGR18R301	Intellectual Property Rights	1	0	1
11.	AGR18R3**	Elective course	2	1	3
Total			14	10	24

SEMESTER-VI

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R358	Rainfed Agriculture and Watershed Management	1	1	2
2.	AGR18R359	Protected Cultivation and Secondary Agriculture	1	1	2
3.	AGR18R360	Diseases of Field and Horticultural Crops and their Management-II	2	1	3
4.	AGR18R361	Post-harvest Management and Value Addition of Fruits and Vegetables	1	1	2
5.	AGR18R362	Management of Beneficial Insects	1	1	2
6.	AGR18R363	Crop Improvement - II (Commercial crops)	1	1	2
7.	AGR18R382	Practical Crop Production - II (Commercial crops)	0	2	2
8.	AGR18R364	Principles of Organic Farming	1	1	2
9.	AGR18R365	Farm Management, Production and Resource Economics	1	1	2
10.	AGR18R302	Principles of Food Science and Nutrition	2	0	2
11.	AGR18R3**	Elective Course	2	1	3
Total			13	11	24

SEMESTER-VII

S.No.	SUB. CODE	SUBJECT NAME		L	P	C
1.	AGR18R481	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
		Activities	No. of weeks			
		General orientation & On campus training by different faculties	1	0	14	14
		Village attachment	8			
		Unit attachment in University / College / KVKs / Research Stations	5			
		Plant Clinic	2	0	02	02
		Agro-Industrial Attachment	3			
		Project Report Preparation, Presentation and Evaluation	1	0	04	04
		Total weeks for RAWE & AIA	20			
2	NG18R4001	Educational tour		0	2*	2*
		Total		0	20+2*	20+2*

*Non credit courses

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

RAWE Component-I Village Attachment Training Programme

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions – (Soil sampling and testing)	1 week
5	Fruit and Vegetable Production Interventions	1 week
6	Animal Production Interventions	1 week
7	Extension and Transfer of Technology Activities	1 week

RAWE Component –II Agro Industrial Attachment

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

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff.

- Study of structure, functioning, objective and mandates of the industry.
- Study of various processing units and hands-on trainings under supervision of industry staff.
- Ethics of industry.
- Employment generated by the industry.
- Contribution of the industry promoting environment.
- Learning business network including outlets of the industry.
- Skill development in all crucial tasks of the industry.
- Documentation of the activities and task performed by the students.
- Performance evaluation, appraisal and ranking of students.

Evaluation of RAWE Programme

Attendance: Minimum attendance – 85%.

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

Evaluation Procedure: Students shall be evaluated component-wise under village attachment and agro-industrial attachment. The respective component in-charge instructor(s), agro-industrial official and course coordinator will evaluate the students as under:

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

Assessment Parameters (RAWE & AIA):

	Parameters	Marks (%)
A	Village Attachment	
	Regularity	10
	Initiative and creativity	10
	General conduct and discipline	10
	Work performance	20
B.	Industrial Attachment	
	Initiative and compliance	10
	General conduct and discipline	10
	Project planning and implementation	10
	Work performance	20

SEMESTER VIII

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R482	Modules for Skill Development Entrepreneurship-I	0	10	10
2.	AGR18R483	Modules for Skill Development Entrepreneurship-II	0	10	10
Total			0	20	20

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

S. No.	Title of the module	L	P	C
1.	Production Technology for Bioagents and Biofertilizers	0	10	10
2.	Seed Production and Technology	0	10	10
3.	Mushroom Cultivation Technology	0	10	10
4.	Soil, Plant, Water and Seed Testing	0	10	10
5.	Poultry Production Technology	0	10	10
6.	Commercial Horticulture	0	10	10
7.	Floriculture and Landscaping	0	10	10
8.	Food Processing	0	10	10
9.	Agricultural Waste Management	0	10	10
10.	Organic Production Technology	0	10	10
11.	Commercial Sericulture	0	10	10
12.	Commercial Bee Keeping	0	10	10

Evaluation of Experiential Learning Programme/HOT

Sl. No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output Delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business Networking Skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
Total		100

ELECTIVE COURSES

S. No.	Course Code	Courses	L	P	C
1.	AGR18R266	Agri-Business Management	2	1	3
2.	AGR18R267	Landscaping	2	1	3
3.	AGR18R268	Agricultural Journalism	2	1	3
4.	AGR18R269	Agrochemicals	2	1	3
5.	AGR18R366	Commercial Plant Breeding	2	1	3
6.	AGR18R367	Protected Cultivation	2	1	3
7.	AGR18R368	Hi-tech Horticulture	2	1	3
8.	AGR18R369	Bio-pesticides and Bio-fertilizers	2	1	3
9.	AGR18R370	Micro Propagation Technologies	2	1	3
10.	AGR18R371	Weed Management	2	1	3
11.	AGR18R372	System Simulation and Agro-Advisory	2	1	3
12.	AGR18R373	Food Safety and Standards	2	1	3

S. No.	SEMESTER	L	P	C
1.	SEMESTER I	15+1*	7+2*	22+3*
2.	SEMESTER II	16	8	24
3.	SEMESTER III	14	9	23
4.	SEMESTER IV	13	9	22
5.	SEMESTER V	14	10	24
6.	SEMESTER VI	13	11	24
7.	SEMESTER VII	0	20+2*	20+2*
8.	SEMESTER VIII	0	20	20
	TOTAL	85+1*	94+4*	179+5*

Total credits with Non Credit courses (5 credits) as recommended by ICAR = 179+5* =184

SEMESTER – I

AGR18R151	FUNDAMENTALS OF HORTICULTURE	L	P	C
		1	1	2

THEORY

UNIT I

Horticulture – origin, definition, **branches**, scope and importance, nutritive value of horticultural crops – classification of horticultural crops – climatic zones of India and Tamil Nadu in relation to horticulture.

UNIT II

Factors limiting growth and development – climate and soil - light, temperature, wind, humidity, rainfall and frost – soil factors – kind of soil, chemical composition and reaction, soil depth, texture and soil fertility - physiology of flowering, pollination, fruit set, fruit ripening and senescence – Fruitfulness and causes of unfruitfulness – Growth regulators and growth hormones classification and applications.

UNIT III

Propagation – definition – methods - seed propagation – merits and demerits – propagation through seeds - dormancy and methods of overcoming dormancy – vegetative propagation – merits and demerits – cutting, layering, grafting and budding – rootstock influence – stock/scion relationship - Specialized plant parts – micro – propagation – **propagating structures**.

UNIT IV

Cropping systems - planting methods – Crop geometry - intercultural operations – weed, water and fertilizer management – bearing habits – crop regulatory practices for fruit crops and vegetables – training, pruning, and special practices - off season production – Basics of protected cultivation.

UNIT V

Pre-harvest operations – maturity indices – climacteric and non-climacteric fruits - harvesting methods – pre-cooling – sorting – grading – standards for domestic and export consumption – packing – storage – transport.

PRACTICAL SCHEDULE

1. Visit to Orchard and study of different features of an orchard.
2. Planning, layout and planting of horticultural crops.
3. Machineries, tools and implements used for various horticultural operations.
4. Preparation of potting mixture, potting and repotting of plants.
5. Plant propagation structures including mist chamber, shade net, glass houses and poly houses.
6. Preparation of growth regulators and method of application in horticultural crops.
7. **Preparation of seed bed/nursery bed**
8. Demonstration of propagation through **seeds**, layering and cutting.
9. Demonstration of propagation through budding, grafting and top working.

10. Propagation through specialized plant parts.
11. Visit to tissue culture laboratory and study of micro-propagation protocols and hardening.
12. Nutrient and irrigation management practices.
13. Bearing habits and training practices in horticultural crops.
14. Pruning practices in horticultural crops.
15. Maturity indices for various horticultural crops.
16. Post harvest handling practices viz., grading, sorting and packing techniques.
17. Visit to private orchards and nursery.

REFERENCE BOOKS

1. Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth – Heinemann, Oxford University Press.
2. Chadha, K.L. 2001. Handbook of Horticulture, ICAR, New Delhi.
3. Jitendra Singh. 2006. Basic Horticulture. Kalyani Publishers, New Delhi.
4. Rajan, S. and B.L. Markose. 2007. Propagation of horticultural crops. New India Publishing, New Delhi.
5. Singh, N.P. 2005. Basic concepts of fruit science. International Book Distributing Co., Lucknow.

TEXT BOOKS

1. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi.
2. George Acquaah. 2002. Horticulture-principles and practices. Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Hartman, H.T., D.E. Kester, Davies Jr. F.T. and Geneve, R.L. 2002. Plant propagation – Principles and Practices – Prentice Hall of India Ltd., New Delhi.
4. Kumar, N. 2010. Introduction to Horticulture, (7th Ed.) Oxford IBH Publication, New Delhi.

AGR18R152	FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY	L	P	C
		2	1	3

THEORY

UNIT I

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Poly saccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids.

UNIT II

Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.

UNIT III

Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

UNIT IV

Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation.

UNIT V

Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

PRACTICAL SCHEDULE

1. Preparation of solution, pH & buffers.
2. Qualitative tests of carbohydrates and amino acids.
3. Quantitative estimation of glucose.
4. Quantitative estimation of proteins.
5. Titration methods for estimation of aminoacids.
6. Titration methods for estimation of lipids.
7. Effect of pH, temperature and substrate concentration on enzyme action.
8. Paper chromatography/TLC demonstration for separation of amino acids/ Monosaccharides.
9. Sterilization techniques.

10. Composition of various tissue culture media.
11. Preparation of stock solutions for MS nutrient medium.
12. Callus induction from various explants.
13. Micro-propagation, hardening and acclimatization.
14. Demonstration on isolation of DNA.
15. Demonstration of gel electrophoresis techniques.
16. DNA finger printing.

REFERENCE BOOKS

1. Conn, E.E. and Stumpf, P.K. 1996. Outlines of Biochemistry – Wiley Eastern Ltd., Fifth Edition.
2. Stryer L, Berg T, Tymoczko, J. Biochemistry. 2009. 5th Ed. Wiley Eastern Ltd, New Delhi.
3. Chawla, H.S. 2005. Introduction to Plant Biotechnology, India.
4. Chesworth, J.M., Stuchbury, T. and Scaife, J.R. 1998. An Introduction to Agricultural Biochemistry. Chapman and Hall.
5. Goodwin, T.W. and Mercer, E.I. 1991. Introduction to Plant Biochemistry. Pergamon Press.
6. Brown, T.A. 2006. Gene cloning - An Introduction. V Ed. Chapman Hill, U.K.

TEXT BOOKS

1. Rastogi S.D. 2010. Biochemistry, 3rd edn, Tata McGraw-Hill, Delhi.
2. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. 2003. 26th edn, Tata McGraw-Hill, New Delhi.
3. Nelson DL, Cox MM. 2004. Lehninger Principles of Biochemistry Fourth (Indian edition) MacMillian, Worth Publishers.
4. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice. Elsevier Publication.
5. Gupta, P.K. 2005. Elements of Biotechnology. Rastogi Publication, India.

AGR18R153	FUNDAMENTALS OF SOIL SCIENCE	L	P	C
		2	1	3

THEORY

UNIT I

Soil - Pedological and edaphological concepts - Origin of the Earth - Composition of Earth's crust - Rocks and minerals - primary and secondary minerals.

UNIT II

Weathering of rocks and minerals - Physical, chemical and biological weathering - Soil formation – factors - active & passive - Soil forming processes - Simenson's and specific - Soil profile, **components of soil**.

UNIT III

Soil physical properties and their significance - Soil texture and textural classes - Soil structure and classification - Soil consistence **and plasticity**. Bulk density, particle density and porosity - Soil colour - significance - causes and measurement. Soil temperature - Soil air - Soil water- Measurement - Soil water potentials - Soil moisture constants - Movement of soil water - saturated and unsaturated flow - infiltration, hydraulic conductivity, percolation, permeability and drainage – **Elementary knowledge of soil taxonomy classification soils of India**.

UNIT IV

Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability. Soil colloids - Properties, types and significance - Layer silicate clays - their genesis and sources of charges - Ion exchange - CEC, AEC and Base saturation - Factors influencing Ion exchange - significance. Soil reaction, buffering capacity and EC.

UNIT V

Soil organic matter: Composition, **properties and its influence on soil properties**, decomposition and mineralization, C:N ratio, Carbon cycle - Fractions of soil organic matter - Humus formation. Soil organisms - Beneficial and harmful effects - Soil enzymes. **Soil pollution – behavior of pesticides and inorganic contaminant, prevention and mitigation of soil pollution**.

PRACTICAL SCHEDULE

1. Identification of common rocks and minerals.
2. Methods of soil sample collection.
3. Visit to soils of different terrains and study of soil profiles.
4. Determination of bulk density, particle density and porosity - cylinder, wax coating and core methods.
5. Soil textural analysis - feel method, International pipette method (Part 1).
6. International pipette method (Part 2).
7. International pipette method (Part 3).
8. Determination of soil colour and temperature.
9. Determination of soil moisture - Gravimetry and moisture probes.
10. Determination of available soil moisture - Pressure Plate Apparatus.
11. Determination of Infiltration rate - Double Ring Infiltrometer.
12. Determination of hydraulic conductivity - Constant head Hydraulic Conductivity unit.

13. Determination of soil pH and EC.
14. Estimation of soil organic carbon.
15. Colloquium 1. - Chemical constituents of soil - Total elemental composition - relevance in soil properties and behaviour.
16. Colloquium 2. - Preparation of interpretative reports of soil analysis and assignments.

REFERENCE BOOKS

1. Arun Kumar Saha and Anuradha Saha. 2012. Text book of Soil Physics. Kalyani Publishers. New Delhi.
2. Bear, Firman. E. 2012. Soil Science. Vol. 8. Scientific Publishers, Jodhpur, India.
3. Bear, Firman. E. 2014. Chemistry of the Soil. 2nd Edition. Scientific Publishers, Jodhpur, India.
4. Biswas T.D. and Mukherjee S.K. 1987. Text Book of Soil Science - Tata McGraw Hill Publishing Co. Ltd., New Delhi.

TEXT BOOKS

1. Brady, N.C. and Raymond, C. Weil. 2013. The Nature and Properties of Soils (14th Edition) Pearson Education, Inc. Publishing as Prentice Hall.
2. Sehgal, J. 2005. Pedology - Concepts And Applications. Kalyani Publishers, New Delhi.

AGR18R154	INTRODUCTION TO FORESTRY	L	P	C
		1	1	2

THEORY

UNIT I

Introduction, definition of basic term related to Forestry – Objective of silviculture - Role of forests – Classification of forests – Locality factors – Regeneration of forests – Natural and artificial regeneration – Indian forest – **Salient features of Indian Forest Policies.**

UNIT II

Site selection - Choice of species - Modern silvicultural techniques in site preparation – Planting and tending operations – Mechanization in silviculture - Silvicultural packages for Timber species (Teak, Sal, Sandal wood Rosewood and sandal), Pulpwood species (Eucalyptus, Casuarina, Bamboo), Fuel wood species (Acacia's, Prosopis), (Ailanthus, Melia) Tree borne oilseeds (Neem, Pungam, Bassia), Fodder trees (Subabul, White babul).

UNIT III

Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Forest utilization – wood and non-wood forest products – Solid Wood – Timber - Wood composites - plywood, fibre board and particle boards and Non wood forest products.

UNIT IV

Social Forestry concepts and applications – JFM concepts – Agroforestry - Agroforestry classification - Agroforestry systems for different agro climatic zones of Tamil Nadu and India – Distinction between social forestry and agroforestry.

UNIT V

Techniques and management of urbanforestry and recreation forestry – Ecotourism concepts and applications.

PRACTICAL SCHEDULE

1. Identification of different tree species
2. Nursery layout and other nursery techniques.
3. Nursery technology for Teak and Sandal.
4. Nursery technology for Rose wood.
5. Nursery technology for Eucalyptus.
6. Nursery technology for Casuarina.
7. Nursery technology for Bamboo and Acacia.
8. Nursery technology for TBO's.
9. Visit to a forest nursery to study the Nursery techniques.
10. Visit to an agro-forestry model unit.
11. Clonal propagation techniques for forest trees.
12. Practicing tree planting techniques.

13. Practicing tending and cultural operations in forest plantations.
14. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer.
15. Visit to Pulp and paper manufacturing industry.
16. Study of plywood production technology – visit to plywood industry.
17. Study of match manufacturing process – visit to matchwood industry.
18. Visit to a NWFP value addition unit.

REFERENCE BOOKS

1. Heygreen, G. and J.L. Bowyer. 1982. Forest Products And Wood Science. The Ohio State University Press, Ames.
2. Lal, J.B. 1992. India's Forest – Myth and Reality. Natraj Publishers, Dehra Dun.

TEXT BOOKS

1. Brown, H. 1989. Indian Wood Technology. IBD Publishers, Dehra Dun.
2. Dwivedi, A.P. 1992. Agroforestry – Principles and Practices. Oxford and IBH Publishing Co., New Delhi.
3. Khanna. L.S. 1999. Principles and Practice of Silviculture. IBD Publishers, Dehra Dun.
4. Negi. S.S. 2008. Hand Book of Forestry, IBD Publishers, Dehra Dun.

HSS18R154	COMPREHENSION & COMMUNICATION SKILLS IN ENGLISH	L	P	C
		1	1	2

THEORY

UNIT I

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science
Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw.
Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often
confused words. Introduction to listening - kinds of listening, process of listening - listening
mechanism listening TOEFL, IELTS, BEC.

UNIT II

Reading: skimming, scanning, SQ3R, intensive reading, extensive reading, critical
reading, Cloze texts for integrated grammar and vocabulary, including subtle differences
between synonyms, reading comprehension texts for civil service exams, Bank P.O. exams,
IELTS, TOEFL and GRE.

UNIT III

English phonemes – stress, intonation and rhythm - genres of speaking, techniques of
speaking – public speaking (welcome address, vote of thanks, extempore talk).

UNIT IV

Mechanics of writing, writing genres, five types of writing, précis paragraph writing,
essay writing – issue - based writing and argument based writing.

UNIT V

Note-taking, note - making, summarizing, brainstorming and simulation.

PRACTICAL SCHEDULE

1. Introduction to listening - kinds of listening and process of listening.
2. English phonemes.
3. Stress, intonation and rhythm.
4. Introduction to speaking skill - dialogue and monologue.
5. Reading strategies – skimming and scanning - Critical reading.
6. Introduction to writing – basic grammar in writing.
7. Genre - Mechanics of writing.
8. Welcome address, vote of thanks and extempore talk.
9. Listening comprehension.
10. Reading comprehension – (five levels of comprehension viz., factual , inferential,
referential , global and attitudinal).
11. Cloze texts - grammar and vocabulary in discourse.
12. Listening cloze & Reading cloze.
13. Brainstorming, simulation for integrated skills.
14. Paragraph writing and essay writing.
15. Précis writing and summarizing and Integrated skills: SQ3R, factual writing and
summarizing note taking, note making.
16. Orientation to TOEFL. IELTS and BEC.

REFERENCE BOOKS

1. Peter Roach (2009): English Phonetics and Phonology, A Practical Course: (Fourth edition).CUP. U.K.
2. Steven Brown & Dorokyn Smith (2006) - Active Listening: CUP U.K.
3. Christian Evans Carter (2010) Mindscapes: Critical Reading Skills: Wadsworth Publishing Company. Belmont, Calif. USA.
4. Kory Floid (2008) Interpersonal Communication: the Whole Story Tata McGraw Hill Publishers.

AGR18R155	FUNDAMENTALS OF AGRONOMY	L	P	C
		3	1	4

THEORY

UNIT I

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

UNIT II

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

UNIT III

Agronomy - Definition - Importance - Meaning 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 - 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 – **Importance of weeds, classification, crop weed competition and** control methods.

UNIT V

Manures and fertilizers (organic, in-organic, green manure) - time and method of application - Irrigation - Principles and concepts - Cropping patterns and cropping systems – **Cop management technologies in problematic areas, harvesting and treshing of crops** – Sustainable agriculture - integrated farming systems - Organic agriculture - Principles and concepts - Dry farming - Principles and concepts.

PRACTICAL SCHEDULE

1. Visit to college farm, study of farm features and measurements.
2. Identification of crops and seeds.
3. **Seed testing – germination and viability test.**
4. **Working out seed rate and study of seed treatment practices.**
5. **Different methods of sowing and effect of sowing depth on germination and seedling vigour.**
6. Study of tillage implements; practicing ploughing, puddling operations, practicing seeding different methods of sowing and planting.
7. Study and practicing inter-cultivation implements; Practicing fertilizer applications - Participation in ongoing field operations.

8. Identification of manures and fertilizers.
9. Fertilizer recommendation and calculations.
10. Methods of fertilizer applications- broadcasting, placement, foliar application and fertigation.
11. Computation of seed rate and plant population.
12. Measurement of field capacity, bulk density, infiltration rate and measurement of irrigation water
13. Yield contributing characters and yield estimation of crops.
14. Identification of weeds in crops: Techniques of weed collection and preservation.
15. Herbicide formulation and identification- Herbicide label information.

REFERENCE BOOKS

1. Yellamananda Reddy, T. and G.H. Sankara Reddi. 1997. Principles of Agronomy. Kalyani Publishers, New Delhi.
2. Sankaran, S. and V.T. Subbiah Mudaliar. 1997. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
3. ICAR. 2011. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

MAT18R111	ELEMENTARY MATHEMATICS	L	P	C
		2	0	2

THEORY

UNIT I

Permutation and combination - meaning of nPr and nCr and simple problems. Progressions - arithmetic, geometric and harmonic progressions. Matrices: types - algebra of matrices - Determinants – expansion– inverse of a matrix by adjoint method - solving system of equations by Cramer’s rule and matrix inverse method.

UNIT II

Review of various forms of equations of a straight line. Circles – standard and general forms of equation of a circle – Conic sections - parabola, ellipse and hyperbola in standard forms (without proof).

UNIT III

Definition – methods of differentiation. Geometrical and physical meaning of the derivative - higher order derivatives - applications of differentiation. Partial differentiation – Homogeneous functions and Euler’s Theorem (without proof). Increasing and decreasing function - maxima and minima of single and several variables without constraints - physical and economic optima - applications in agriculture.

UNIT IV

Definition of integration - indefinite and definite integrals – formulae - methods of integration - substitution, method of partial fractions - integration by parts - Simple applications in finding the area and volume by integration.

UNIT V

Mathematical models – system – types of models and their uses in agriculture – fitting of linear, quadratic, exponential and logistic models to data from agricultural field experiments.

REFERENCE BOOKS

1. Duraipandian. 2007. Calculus and Analytical Geometry, Emerald Publishers, Chennai.
2. Suyambulingom, C. and Kailasam, C. 1990. Mathematics for Plant Sciences, Sakthi Publications, Coimbatore.
3. Mehta, B. C. and G. M. K. Madnani. 2006. Mathematics for Economists, Latest edition, Sultan Chand & Sons, New Delhi.
4. Veerarajan, T. 2004. Engineering Mathematics, Tata McGraw - Hill Publishing Company Limited, New Delhi.
5. Ranganathan, C.R. 2006. A First Course in Mathematical Models of Population Growth (with MATLAB programs), Associated publishing company, New Delhi.

AGR18R101	AGRICULTURAL HERITAGE	L	P	C
		1	0	1

THEORY

UNIT I

Introduction of Indian agricultural heritage, status of farmers in society, advice by sages to kings on their duties towards farmers.

UNIT II

Soil management in ancient, medieval & pre-modern India and its relevance in modern day sustainable agriculture, heritage of crop & water management, plant growth and development, **plant production** & plant protection through vrikshayurveda and traditional knowledge.

UNIT III

Heritage of medicinal plants and their relevance today, seed health in ancient & medieval history and its relevance to present day agriculture.

UNIT IV

Description of Indian civilization and agriculture by travelers from China, Europe and United States, our journey in agriculture.

UNIT V

Agricultural resources available in India. Green revolution and its impact and concerns – **National agriculture setup in India – Current scenario of Indian agriculture – Indian agricultural concerns and future prospects.**

REFERENCE BOOKS

1. Choudary S.L, Sharma, G.S, and Nene, Y.L (eds). 2000. Ancient and Medieval History of Indian agriculture and its relevance to sustainable agriculture in the 21st century; Proceedings of the summer school held from 28th May to 17th June 1999. Rajasthan college of Agriculture, Udaipur.
2. Nene, Y.L (Ed). 2005. Agricultural Heritage of Asia proceedings of the international conference, 6-8 December 2004, Asian-Agri history Foundation, Secunderabad- 500 009, Andhra Pradesh, India.
3. Nene, Y.L 2007. Glimpses of Agricultural heritage of India. Asian- Agri- History Foundation, 47 – ICRISAT Colony-1 Brig sayeed Road, Secunderabad -500009 A.P India 901PP ISBN- 81-903963-0-7.

AGR18R102	RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY	L	P	C
		2	0	2

THEORY

UNIT I

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.

UNIT II

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; Social Values – definition, values and norms, characteristics of values, functions; Migration – concept, factors influencing migration.

UNIT III

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; Leadership – definition of leader and leadership, classification, functions, characteristics, roles, selection of leaders.

UNIT IV

Education – Psychology – Educational Psychology – Social Psychology – definitions, importance in extension; Basic principles of Human behaviour – Sensation, Attention, 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 – concept, Maslow’s hierarchy of needs, intrinsic and extrinsic motivation, techniques of motivation, importance in extension; Attitude – concept, factors influencing the development of attitudes.

REFERENCE BOOKS

1. Bhatia, H.R. 1968. *General Psychology*. Oxford and IBH Publishing Company, NewDelhi.
2. Chitambar, J.B. 1977. *Introductory rural sociology*. Wiley Eastern Ltd, New Delhi.
3. Desai, A.R. 2003. *Rural sociology in India*. Popular Prakasan, Bombay.
4. Partha Sarathi De., 2012. *Rural Sociology*. Pearson Education, New Delhi 125.
5. Plotnik, R. and Mollenauer, S. 1986. *Introduction to Psychology*. Random House, NewYork.

TAM18R181/ HSS18R181	தமிழ் இலக்கியங்களில் வேளாண்மையும் அறிவியல் தமிழ் பயன்பாடும் /Developmental Education	L	P	C
		0	1	1

nehf;fk;

,sepiy ntshz;ik gapYk; khzth;fSf;F jkpH; ,yf;fpa';fs; tHp ntshz;ik kw;Wk; ntshz;ik rhh;e;j
bjhHpy;El;g';fisa[k; bra;jpfisa[k; mwpar; bra;jy;- jw;fhy ntshz; bjhHpy;El;g';fnshL bghUj;jpg;
ghh;jjy; - ntshz;ik jtpu njhl;lf;fiy – tdtpay;- ntshz;bghwpapay; - kidapay; rhh;e;j fUj;Jf;fis
btspf;bfhzh;jy; - ntshz;;Jiwf;F ,d;wpaikahj fiyr;brhw;fs; - bkhHpg;bgah;g;g[- ghuk;ghpa
bjhHpy;El;g';fis mwpar;bra;jy; - khzth;fspd; vjph;fhyj; njitf;F mog;gilahd ngr;Rg;gaph;r;rp –
neh;fhziy vjph;bfhs;Sk; tifapy; bkd;jpwd;fshd jiyikg;gz;g[- MSikg;gz;g[- fhynkyhz;ik
Mfpatw;wpy; jpwk;bgwr;bra;jy; - khzth;fspd; Ma;t[f;fl;Liu jpwid tsh;jjy; - ntshz;ik ,jH;fs;/ E}y;fs;
Fwpj;J tpHpg;g[zh;it tH';Fjy; - fzpdp tHp jkpHpy; ntshz; bra;jpfis gjpntw;wk;/ gjptpwf;fk; bra;a[k;
Kiwfis mwpar;bra;jy; Mfpatw;iw nehf;fkhf bfhz;L ghlj;jpl;jj; tiuaiw
bra;jy;.

bra;Kiwg; gapw;rpf;

1. bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs;/ jhtutpay; mwpt[/ ntshz; khe;jh;
Fwpj;j bra;jpfis mwpjy;
2. r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - (vl;Lj;bjhif/ gj;Jg;ghl;L)
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ikmwptpay;
4. gs;S ,yf;fpa';fs;/ VbuGgJ–cHth; thH;tpay; bewpKiwfSk; ntshz;ikj;
bjhHpy; El;g';fSk;
5. ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; - kidapay; - NHypay;
6. ntshz;ikg; gHbkhHpf; - cHt[tpijmwptpay; - gUtk; - kiH - ehw;WeLjy; - vU
,Ljy; - ePh;g;ghrdk; - fisnkyhz;ik–gaph;ghJfhg;g[- mWtil–cHth; rKjhak;
7. ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs;
8. ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - ghujp/ ghujpjhrd; gilg;g[fs; -
g[Jf;ftpij.
9. gpiHapd;wpvGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH–
thf;fpag;gpiH–bka;g;g[j; jpUj;jk;
11. ghuk;ghpa ntshz;ikj; bjhHpy;El;g';fs;
12. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[- fhynkyhz;ik
13. MSikg;gz;g[nkk;ghL–kdpj cwt[j;jpwd;fs; tsh;jjy;
14. mwptpay; jkpH; tsh;r;rpepiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs; - mYtyff;
fojk;
15. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fiscUthf;Fk; Kiw–jug;gLj;Jjy; -
,yf;fpantshz; fiyr;brhw;fs;/ tl;lhuntshz;iktHf;Fr; brhw;fs; -
mfuhjpapay;
16. bkhHpbgah;g;g[- Kf;fpapjpf; - goepiyfs; - bkhHpbgah;ghshpd; ,d;wpaikahg;
gz;g[fs; - ntshz; bra;jpfisbkhHpbgah;jjy; - fl;Liur; RUf;fk; vGJjy;
17. fzpdpcyfy; jkpH; - tpf;fpgPoah–ntshz; bra;jpfisg; gjpntw;wk; bra;jy; -
ntshz; bra;jpfis ,izajstHpmwpjy;

nkW;ghh;it E}y;fs;

- fe;jrhkp.,y.br.ntshz;ika[k; gz;ghLk;/ jkpH;ehLntshz;ikg; gy;fiyf;fHfk;/
nfhak;g[j;J}h;/ 1974

- fe;jrhkp. ,y.br.,yf;fpaj;jpy; ntshz;ik/jkpH;ehLntshz;ikg;gy;fiyf;fHfk;/ nfhak;g[j;J]h; 1981.
- fe;jrhkp. ,y.br. ntshz;ikgHbkhHpfs;/ fiyr;bry;tk; gjpg;gfk;;/ nfhak;g[j;J]h; 1983.
- FHe;jrhkp.th.br.mwptpay; jkpH;/ ghujpgjg;gfk;/ brd;id
- kPdh;rpRe;juk;. kh. kw;Wk; V.,y.tprayl;Rkp./ jfty; bjhlh;gpy; jkpH; bkhHp g; gad;ghL/ nf.Mh;.v.Mg;brl; gphpz;lh;/ nfhit– 2002
- kzpnkiy.k.jkpH; bkhHpj; jl;jpy; ntshz; mwptpaypd; RtLfs;/ njtpgjg;gfk;/ jpUr;rpuhg;gs;sp/ 2002
- ,yf;fpaKk; ntshz;ika[k;/ midj;jpe;jpamwptpay; jkpH;f; fHfk;/ j";rht{h;;/ 2006
- jkpHhpD; kug[r;bry;t';fs;/ cyfj; jkpHuha;r;rpepWtdk;/ brd;id
- re;jpunrfud;/ ,uh/ bkhHpg;ghlk; - gilg;ghf;fj;jpwd; tsh;j;jy;
- ntshz;fiyr;brhy; ngufuhjp/ jkpH; ehLntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J]h;/ 2008.
- ghnte;jd;/ ,uh/ jkpHpy; mwptpay; ,jH;fs;/ rhKnty;/ @gp#; fpwp!; gjpg;gfk;/ nfhak;g[j;J]h;
- lhf;lh; ,uhjhbrhy;yg;gd;/ fiyr;brhy;yhf;fk;/ jkpH;g; gy;fiyf;fHfk;/ j";rht{h;

OR

HSS18R181 Developmental Education (0+1)

Practical schedule

1. Basic principles of learning. Binary terms viz –growth and development, education –for – life and life –long education, motivation and morale –occupation and profession, training and education, lateral thinking and conventional thinking, teaching and learning – discussion.
2. Bloom’s classification of educational objectives –Cognitive, Affective, Psychomotor domain(s) – discussion
3. Career development –opportunity for graduates of agriculture and allied sciences – discussion
4. Success story of a farmer –factors involved–role –play
5. Brainstorming –Demonstration
6. Simulation –Convergent task –demonstration
7. Simulation –Divergent task–demonstration
8. Role –pay –interpersonal communication –Fax, email –Transactional communication –ice breaker
9. Verbal and analytical skills–interactive CD-ROM
11. Writing and Editing –demonstration
12. Writing popular articles
13. Project Report –discussion on a mutilated cloze text
14. Project Report –Role play
15. Scientific articles –Selection, organization and presentation–a discussion
16. Writing a scientific article

REFERENCE BOOKS

1. Anderson, L. W. and David R. Krathwohl, D. R., et al (Eds..) (2001) A Taxonomy for

- Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Allyn & Bacon. Boston, MA (Pearson Education Group)
2. David H. Janessen (2009) Learning to solve problems: A handbook for solving learning Environments Routledge. USA
 3. Gay Lumsden, Donald Lymsaden, Carolyn Wieystoff (2009) Communicating in Groups and Teams: Sharing Leadership: Wadsworth Cengage Learning. Boston. USA
 4. Michael, Michalko. Thinkertoys: A Handbook of Creative-Thinking Techniques (2nd Edition) (June 8, 2006) Ten Speed Press. Canada
 5. Sudarsanam. R (1985) Development Education: Vibhuvan publishers. Coimbatore.

SEMESTER-II

AGR18R156	FUNDAMENTALS OF GENETICS	L	P	C
		2	1	3

THEORY

UNIT I

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes.

UNIT II

Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics.

UNIT III

Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics.

UNIT IV

Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance.

UNIT V

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

PRACTICAL SCHEDULE

1. Use of microscopes and study of cell shapes and cell organelles of active mitotic and meiotic tissues.
2. Principles of killing and fixing; preparation of stains and preservatives.
3. Study of the mitotic phases in root tips of onion/*Aloe sp.*
4. Study of behaviour of chromosomes in mitosis.
5. Procedure for fixing and observing different meiotic phases in the inflorescence of maize.
6. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/sorghum/forest tree.
7. Observation of bivalents, trivalents, quadrivalents and chromosome banding
8. Repetition of meiotic studies in maize/sorghum/pearl millet/forest tree and making temporary and permanent slides.
9. Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross.

10. Dihybrid ratio with dominance, with incomplete dominance and test cross
11. Simple interaction of genes-comb character in fowls; Dominant epistasis.
12. Recessive epistasis, Duplicate and additive epistasis.
13. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
14. Multiple alleles and polygenic inheritance
15. Estimation of linkage with F₂ and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; Working out interference, coincidence and drawing genetic maps.

REFERENCE BOOKS

1. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai – 15.
2. Benjamin Lewin. 2005. Genes IX Oxford University Press, Oxford.
3. Gupta P.K. 1993. Genetics, Rastogi publications, Meerut.
4. Reddi, O.S. 1992. Understanding Genetics. Sunil Sachdev Publishers, New Delhi – 64.
5. Russel, P.J. 2000. Fundamentals of genetics. Addition Wesley Longman Publishers, USA.
6. Singh, R.J. 2002. Plant cytogenetics. CRC Press, USA.

TEXT BOOKS

1. Gupta P.K. 1997. Cytogenetics. Rastogi Publications, Meerut.
2. Strickberger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
3. Singh, B.D. 2004. Fundamentals of Genetics, Kalyani Publishers, Chennai.
4. Verma, P.S. and V.K. Agarwal. 2007. Genetics. S.Chand and Company Ltd., New Delhi.
5. Stansfield, W.D. 1990. Theory and Problems of Genetics. Mc-Graw Hill Book Co., New York.

AGR18R157	AGRICULTURAL MICROBIOLOGY	L	P	C
		1	1	2

THEORY

UNIT I

Definition and scope of microbiology – microbes for human welfare and environment. Historical roots of microbiology; biogenesis and abiogenesis theory; germ theory of diseases and fermentation. Contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman.

UNIT II

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, moulds and actinobacteria. Preservation of microbial cultures.

UNIT III

Evolutionary relationship among the living organisms. Whittaker's Five Kingdom concept of living organism and Carl Woese systems. Three domains of life – similarities and differences; Modern approach to the bacterial systematics; Differentiation of bacteria, archaea and eukaryotes; Systematic bacteriology; prokaryotic diversity - Bergey's Manual of Systematic Bacteriology. Cell biology - bacterial size, shape and arrangement; cell structure and components of bacteria. Morphology of fungi and algae.

UNIT IV

Bacterial growth - population growth - growth cycles of population - measurement of growth; environment on growth – temperature, oxygen, pH and salts; energetics in bacteria; oxidation – reduction, electron carrier – overview of aerobic and anaerobic respiration and fermentation in bacteria.

UNIT V

General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages. Genetic elements of bacteria; bacterial chromosomal DNA and plasmid; gene arrangements. Mutation - types and mutagens. Genetic recombinations: Transformation, transduction and conjugation. Genetic engineering – an introduction. Basic concepts of immunology – antigen – antibody reactions and vaccines.

PRACTICAL SCHEDULE

1. Safety in Microbiology laboratory. Microscopes – handling light microscope.
2. Micrometry - measurement of microorganisms.
3. Aseptic techniques – working with equipment and apparatus.
4. Preparation of growth media for bacteria, yeast moulds and actinobacteria.
5. Isolation of microorganisms by serial dilution and plating technique.
6. Purification and preservation of bacteria and actinobacteria.

7. Purification and preservation of yeasts and moulds.
8. Staining techniques - positive and negative staining.
9. Differential staining - Gram and spore staining.
10. Turbidometric assessment of growth of bacteria.
11. Morphological and physiological characteristics of bacteria and actinobacteria.
12. Biochemical characteristics of bacteria and actinobacteria.
13. Identification of yeasts moulds and algae - morphological characterization.
14. Molecular identification of bacteria by 16s r DNA sequencing.
15. Isolation of bacteriophages.
16. Isolation bacterial mutants by UV irradiation/chemical mutagenesis.

TEXT BOOKS

1. Prescott, Harley and Klein, 2013. Microbiology, 9th edition, McGraw Hill Publishing.
2. Michael J. Pelczar, JR., E.C.S. Chan, Noel R. Krieg. 2005. Microbiology.
3. LuisM. de la Maza, Marie T. Pezzlo and Ellen Jo Baron. 1997. Color Atlas of diagnostic Microbiology, Published by Mosby - Year Book Inc.

REFERENCE BOOKS

1. Hans G. Schlegel, 2012. General Microbiology. 7th edition.
2. Ronald M. Atlas, 1997. Principles of Microbiology. Second edition.
3. Tortora, G.J., B.R. Funke and C.L. Case. 2009. Microbiology - An Introduction. 9th edition.

AGR18R158	INTRODUCTRY SOIL AND WATER CONSERVATION ENGINEERING	L	P	C
		1	1	2

THEORY

UNIT I

Introduction to Soil and Water Conservation. Surveying and Levelling – Chain, Compass and Plane Table survey – levelling – Land measurement and computation of area – Simpson’s rule and Trapezoidal rule.

UNIT II

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion - water erosion - causes - erosivity and erodibility - mechanics 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

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 – gully control structures – permanent and temporary structures. Farm ponds – percolation ponds- Watershed Management.

UNIT IV

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 - canal lining - Underground pipe line system - Surface irrigation methods - Borders, furrows and check basins - Drip and sprinkler irrigation– Agricultural drainage - Surface drainage systems – Sub-Surface drainage systems - Drainage coefficient-design of open ditches.

UNIT V

Groundwater occurrence – aquifers – types of wells – pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps – selection of pumps – operation and their maintenance.

PRACTICAL SCHEDULE

1. Chaining / taping on level ground
2. Survey of an area by chain survey (closed traverse)
3. Chaining across obstacles
4. Compass survey - observation of bearings - computation of angles.
5. Study of level and leveling staff
6. Differential or fly leveling – reduce levels by H.I method
7. Differential or fly leveling – reduce levels by rise and fall method
8. Calculation of soil loss using universal soil loss equation (USLE)
9. Measurement of Rain splash erosion
10. Study of different types of wells and its selection.
11. Study of reciprocating pump & centrifugal pump

12. Study of submersible pumps & jet pumps
13. Selection of pumps.
14. Layout of sprinkler and drip systems.
15. Problems on duty of water, irrigation efficiencies.

REFERENCE BOOKS

1. Kanetkar, T.P. & Kulkarni, S.V. 2004. Surveying & levelling. Part –I, A.V.G. Prakashan, Poona.
2. Suresh, R. 2005. Soil and Water Conservation Engineering. Standard Publishers & Distributors, New Delhi.
3. Gunshyam Das. 2005. Hydrology and Soil Conservation Engineering. Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Suresh, R. 2008. Land and Water Management Principles. Standard Publishers & Distributors, New Delhi.
5. Murthy, V.V.N. 2005. Land and Water Management. Kalyani publishing, New Delhi.

AGR18R159	FUNDAMENTALS OF CROP PHYSIOLOGY	L	P	C
		1	1	2

THEORY

UNIT I

Importance of Crop Physiology in Agriculture, Role of water – Water potential and components - Definitions - field capacity, water holding capacity of soil and permanent wilting point, Absorption and translocation of water and solutes, Transpiration - significance-antitranspirants.

UNIT II

Mineral nutrition – mobility and Mechanism of uptake - physiological role of nutrients, Physiological disorders - nutritional disorders (deficiencies and toxicities) - Difference between Physiological and nutritional disorders - diagnosis, identification of disorders - foliar, tissue testing. Management Techniques - foliar feeding, root feeding, trunk feeding and fertigation.

UNIT III

Photosynthesis - light reaction and Photosynthetic pathways - C₃, C₄ and CAM, Differences between C₃, C₄ and CAM pathways - Factors affecting photosynthesis, Photorespiration and significance Phloem and xylem loading - Source sink relationship.

UNIT IV

Growth - Growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity - Photoperiodism - Role of phytochrome in flowering and regulation of flowering. Vernalisation – devernalisation - Plant growth regulators and commercial applications - physiological role of auxins and GA, Physiological role of Cytokinin, Ethylene and ABA - novel growth regulators and retardants their uses in crop productivity, Post harvest Physiology - Physiology of seed germination, seed and bud dormancy and breaking methods, Parthenocarpy - Physiology of fruit ripening - climacteric and non-climacteric fruits - factors affecting ripening and storage, Abscission – senescence, Shelf life and quality changes – use of PGRS and nutrients.

UNIT V

Environmental stresses - water stress - physiological changes - adaptation to drought and its amelioration, Temperature stress - Physiological changes - low and high temperature - chilling injury - tolerance – alleviation, Low light and UV radiation stresses - salt stress - physiological changes and alleviation, Global warming – Carbon Sequestration physiological effects on crop productivity.

PRACTICAL SCHEDULE

1. Preparation of solutions.
2. Measurement of plant water status by different methods.
3. Estimation of stomatal index and stomatal frequency.
4. Measurement of leaf area by different methods.
5. Physiological and Nutritional disorders in crops plants.
6. Rapid Tissue Tests.
7. Estimation of chlorophyll Stability Index.

8. Estimation of RWC.
9. Determination of photosynthetic efficiency in crop plants.
10. Estimation of Nitrate reductase activity.
11. Growth Analysis - Determination of LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI.
12. Bioassay of cytokinin.
13. Bioassay of GA.
14. Estimation of proline accumulation to assess the water stress in crop plants.
15. Demonstration of crop response to growth regulators.
16. Field visit for foliar diagnosis.

REFERENCE BOOKS

1. Jain, J.K. 2007. Fundamentals of Plant Physiology, S.Chand & Company Ltd., New Delhi.
2. Pandey, S. N. and B. K.Sinha. 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
3. Purohit, S.S, 2005. Plant Physiology, Student edition, Jodhpur.
4. Ray Noggle, G. and Fritz, G. J. 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

AGR18R103	FUNDAMENTALS OF AGRICULTURAL ECONOMICS	L	P	C
		2	0	2

THEORY

UNIT I

Nature and scope of economics: Importance – Subject matter, science vs. art, positive vs. normative science - deductive and inductive methods - Different economic systems: merits and demerits – Definitions of Economics: Wealth, welfare, scarcity and growth definitions - Divisions of Economics – Micro and Macro economics - Agricultural Economics: definition and scope - Basic concepts: Goods, Service, Value, Cost, Price, Wealth, Welfare - Wants: Characteristics and classification.

UNIT II

Utility: Definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility and Law of Equi-marginal Utility: Definition – Assumptions - Limitations and Applications - Demand: Definition - Kinds of demand, Demand schedule, Demand curve, Law of demand, Determinants of demand - Extension and Contraction Vs Increase and decrease in demand - Elasticity of Demand: Types, Degrees of price elasticity of demand, Methods of measuring elasticity, Factors influencing elasticity of demand - Importance of Elasticity of demand - Engel's law of family expenditure - Consumer's surplus: Definition – Importance.

UNIT III

Concept of production – Factors of production – Land and its characteristics - Labour – Division of labour - Malthusian theory and modern theory of population - Capital – characteristics of capital - capital formation – Entrepreneur, characteristics and functions of entrepreneur - Supply definition – law of supply – factors influencing supply - elasticity of supply.

UNIT IV

Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage - Interest – liquidity preference theory – profit – Risk bearing theory of profit.

UNIT V

National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income - Measurement of National Income - Public Finance: Meaning, Principles. Public Revenue: Meaning, Classification of taxes - service tax - Cannons of taxation, public expenditure: principles - Inflation: Meaning, definition, kinds of inflation - Welfare Economics: Meaning, Pareto's optimality – Millennium Development Goals (MDG).

REFERENCE BOOKS

1. Dewett, K.K. 2002. Modern Economic Theory. Syamlal Charitable Trust, New Delhi.
2. Samuelson, P. 2004. Economics, Tata McGraw-Hill, New Delhi.
3. Koutsoyiannis, A. 1983. Modern Microeconomics. The Macmillan Press Ltd., Hongkong.
4. Varian, H. R. 1987. Intermediate Microeconomics. WW Norton & Company, New Delhi.

5. Seth, M.L. 2000. Principles of Economics. Lakshmi Narain Agarwal Co., Agra. New Delhi.

AGR18R160	FUNDAMENTALS OF PLANT PATHOLOGY	L	P	C
		3	1	4

THEORY

UNIT I

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

UNIT II

Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

UNIT III

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

UNIT VI

Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.) Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens.

UNIT V

Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

PRACTICAL SCHEDULE

1. General characters of fungi – Types of mycelia - Types of vegetative, asexual and sexual spores - asexual and sexual fruiting bodies.
2. Acquaintance with various laboratory equipments and microscopy.
3. Collection and preservation of disease specimen.
4. Preparation of media, isolation and Koch's postulates.
5. General study of different structures of fungi.
6. Study of symptoms of various plant diseases.
7. Study of representative fungal genera.
8. Staining and identification of plant pathogenic bacteria.

9. Transmission of plant viruses.
10. Study of phanerogamic plant parasites.
11. Study of morphological features and identification of plant parasitic nematodes.
12. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.
13. Study of fungicides and their formulations.
14. Methods of pesticide application and their safe use.
15. Calculation of fungicide sprays concentrations.
16. Field visit.

REFERENCE BOOKS

1. Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, Wiley E.Ltd. New Delhi.
2. Singh, R.S.1982. Plant Pathogens – The Fungi. Oxford and IBH Publishing Co., New Delhi.
3. Vidyasekaran, P. 1993. Principles of Plant Pathology – CBS Publishers & Distributors, New Delhi.

TEXT BOOKS

1. Agrios, G.N. 2005. Plant Pathology – (5th Edition). Academic Press, New York.
2. Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 2010. Introductory Mycology. John Wiley and Sons Ltd., NewYork.
3. Alice D, and Jeyalakshmi C. 2014. Plant Pathology. A.E Publications, Coimbatore.
4. Dube, H.C. 2009. A Textbook of Fungi, Bacteria and Viruses, Vikas Publishing House Pvt. Ltd., New Delhi.

AGR18R161	FUNDAMENTALS OF ENTOMOLOGY	L	P	C
		3	1	4

THEORY

UNIT I

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

UNIT II

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors—temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

UNIT III

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

UNIT IV

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

UNIT V

Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

PRACTICAL SCHEDULE

1. Observations on external features of grasshopper/cockroach and other members of phylum Arthropoda.
2. Methods of insect collection, preservation, display and storage.
3. Types of insect head and antenna.
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, house fly, moths and butterflies.
5. Structure of thorax and abdomen and their appendages — modifications in insect legs and wings — wing venation, regions and angles — wing coupling.
6. Types of immature stages of insects.
7. Study of digestive system.
8. Study of male and female reproductive systems.
9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota - Odonata and Ephemeroptera and Phasmida.
10. Observing the characters of Dictyoptera, Dermaptera, Embioptera, Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Mallophaga and Siphunculata.
11. Observing the characters of Exopterygota — Isoptera and Hemiptera — Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae) Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae).
12. Observing the characters of orders Thysanoptera and Diptera- Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombyliidae.), Cyclorhapha (Syrphidae, Drosophilidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae).
13. Observing the characters of Hymenoptera - Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evanidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethyidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae).
14. Observing the characters of Coleoptera - Adepaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae) Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae).
15. Observing the characters of Lepidoptera - Butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperidae), Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae).
16. Observing the characters of Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family.

REFERENCE BOOKS

1. Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}.
2. Snodgrass, R.E. 1994. *Principles of Insect Morphology*. CBS publishers and distributors, New Delhi. 667p.
3. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386p. {ISBN: 978-81-921477-0-3}.

TEXT BOOK

1. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol.I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7}.

AGR18R162	FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION	L	P	C
		2	1	3

THEORY

UNIT I

Extension – meaning – Agricultural Extension – definition, scope, Education – concepts, types. Extension Educational Process – difference between formal education and extension education. Extension Education – objectives, principles and philosophy of extension-steps in extension - teaching, teaching learning process.

UNIT II

Rural Development – meaning – definition, concept, objectives, importance and problems in Rural development. Rural Development in India – Community Development and Agricultural Extension Service in India – Stages of Rural Development – Pre-independence era, Post independence era.

UNIT III

Integrated Rural Development Programmes – Social Justices and Poverty alleviation programmes – Integrated Tribal Development Agency – Rural Youth Programmes. History of extension systems – IADP, HYVP, T&V, BBES – Extension and Development Programmes viz., ATMA, ATIC, IVLP, WDP.

UNIT IV

Panchayat Raj System – Meaning of Democratic Decentralisation and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.

UNIT V

Gender Dimensions – Women in Agriculture – Women Development Programmes – DWCRA – RMK – ICDS – MSY-TANWA.

PRACTICAL SCHEDULE

1. & 2. PRA tools and techniques.
2. & 4. Basic data generation from nearby village selected for PRA.
5. Conduct of PRA.
6. Review of PRA with presentations and consolidation of report.
7. & 8. & 9. Visit to rural development organisations.
10. & 11. Visit to progressive farms.
12. & 13. Practicals on techniques of monitoring and evaluation.
14. & 15. Practicals on extension teaching methods.
16. Practicals on programme planning.

TEXT BOOKS

1. Adivi Reddy A. 2001. Extension Education. Sree Laxmi Press, Bapatla, A.P.
2. Muthiah Manoharan P. and Arunachalam R. 2003. Agricultural Extension. Himalaya Publishing House, Mumbai.
3. Benor, Harrison and Baxter. 1984. Agricultural Extension – The Training and Visit System. A World Bank Publication, Washington DC, USA.

4. Dahama OP and Bhatnagar, OP. 1998. Education and Communication for Development Oxford and IBH Co, New Delhi.

REFERENCE BOOKS

1. Katar Singh. 1999. Rural Development – Principles, Policies and Management. Sage Publications India Pvt Ltd., New Delhi.
2. Ray GL. 1999. Extension Communication and Management. Noya prakash, Calcutta, West Bengal.
3. Singh A.K. 2000. Agricultural Extension. Impact and Assessment, Agri-bios (India), New Delhi.

HSS18R251	COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT	L	P	C
		1	1	2

THEORY

UNIT I

Soft skills and hard skills – career skills and corporate skills – lateral thinking ego styles – different types – on being a professional.

UNIT II

Attitude: Psychological and Sociological definitions – types of attitude (positive and negative) and consequences – suggestions to keep a good attitude. Emotional Intelligence (EI):

Introduction and Definitions – four branch model of EQ and its detailed explanation - five point scale to measure EI – suggestions to improve EI. Interpersonal skills: Study of character traits - discussion of formal interpersonal skills like greeting, enquiring, answering, complimenting and acknowledging. Self Development/Empowerment: Self awareness and motivation – Maslow's theory of hierarchy and needs – Self analysis through SWOC and Johari Window – Elements and seven rules of motivation – Goal setting based on principle of SMART – Strategies of self motivation – Knowledge enhancing through reading of Newspapers, magazines and journals.

UNIT III

Process of communication: Objectives of communication – Types of communication – Formal Vs informal communication – LSRW components of communication – Barriers to communication. Listening skills: Purpose and significance of listening – Process of listening – Different types of listening - How to be a good listener – Guidelines for effective listening – Barriers to listening – Tips to overcome the barriers. Reading skills: Purpose and significance of Reading – Benefits of reading – Process/Types of reading – Understanding/Inferring/Note making – SQ3R technique –How to be a good reader –Barriers/Distractions to good reading – Tips to overcome the barriers. Speaking Skills: Purpose and significance of speaking clearly – Verbal code and visual code - Benefits of good speaking - Process/ components of good speech – Informative speaking & its types – persuasive speaking & its types –Presentation skills – Barriers of speaking - Tips to overcome the barriers. Writing skills: Purpose and significance of writing – features of good writing – How to develop writing skills – choice construction, paragraph design, etc. – letter writing skills – formal & informal – parts of a good letter – layout & format of a letter – preparing a curriculum vitae – report writing – preparing a conference paper – writing a book review - editing – punctuation, spelling, grammar and vocabulary. Telephone skills: The right environment – formal greetings - telephone courtesies – effective listening skills – interpersonal skills – concluding formality.

UNIT IV

Interview skills – I: Definitions of interview – two types of group interview – preliminary requirements for success – telephone interview – specially designed interviews. Interview skills – II: Five stages of interview – how to answer the questions. Group discussion: Definition – contexts – why and how? – Techniques for successful participation – skills required – simulation – based - group discussion.

UNIT V

Leadership qualities: Definition - basic requirements – (responsibility - self – knowledge - knowledge of, and rapport with subordinates- knowledge of the assignment- goal setting- decision making – team work) leadership with primates – leadership and vision. Negotiation skills: Select definitions – functions of negotiation – two kinds of negotiation – phases of the process – rules – steps to improve negotiation skills. Time management: Basic skills of time management – relationship between stress management and time management – time management techniques for prudent time management – tips for time management. Stress management: Definition of stress –kinds - stress at work – causes, effects and solution - stress and stroke –different kinds of stroke – stress in interview.

PRACTICAL SCHEDULE

1. Reading and comprehension of general and technical articles.
2. Practice session on précis writing.
3. Practical exercises on summarizing and abstracting.
4. 5. & 6. Oral Communication –presentation by students – power point presentations – microteaching.
7. & 8. Practice sessions on group discussions and method demonstrations.
9. &10. Practice sessions on listening skill, indexing and bibliographic procedures.
11. &12. Preparation of field diary and lab records.
13. & 14. Preparation of AV aids - posters, cartoon, grid drawing, pattern drawing, collage, striptease chart and pull chart.
15. & 16. Practical training on handling projected visual aids.
17. Practical exercise on non verbal communication skills.

TEXT BOOKS

1. Hariharan, S., S.N. Sundararajan and S.P. Shanmugapriya. 2010. **Soft Skills**. MJP Publishers, Chennai.

REFERENCE BOOKS

1. Alex. 2009. **Soft Skills: Know Yourself And Know The World**. S. Chand & Co. Publishing House, New Delhi.
2. Beverly Jaeger. 2004) **Making Work for the Highly Sensitive Person**. Tata McGraw – Hill, USA.
3. Dipali Biswas. 2009. **Enhancing Soft Skills**. Shoraff Publishers and Distributors.
4. Gloria. J. Galanes, Kathreine Adams, John.K. and Brillhart. 2004. **Effective Group Discussion**. Tata McGraw – Hill, New Delhi.

SEMESTER – III

AGR18R251	Crop Production Technology – I (FOOD CROPS)	L	P	C
		1	1	2

THEORY

UNIT 1

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural and Package of practices and yield of food crops. Cereals and millets; rice, wheat, oat, maize, sorghum, pearl millet and minor millets.

UNIT II

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural and Package of practices and yield of pulses; pigeonpea, Chickpea, mungbean, urdbean, lentil, cowpea, cluster bean and mothbean.

UNIT III

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural and Package of practices and yield of oil seeds; Groundnut, soybean, sesame, castor, rapeseed, mustard and sunflower.

UNIT IV

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural and Package of practices and yield of fodder crops; fodder sorghum and fodder cumbu.

UNIT V

Pre-harvest sanitation spray, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of food crops. Study of crop varieties and important agronomic experiments.

PRACTICAL SCHEDULE

1. Identification of seeds, crops and other inputs of food crop cultivation.
2. Working out seed rate, real value, seed size, depth and germination related numerical.
3. Seed treatment and preparation of seed material for sowing.
4. Sowing methods of different food crops.
5. Preparation of seed material for planting of grasses.
6. Seed bed preparation of foodcrops including rice nursery and transplanting.
7. Irrigation operation in various food crops.
8. Fertilizer application in crops, including top dressing and foliar feeding.
9. Identification of weeds in cultivated crops field.
10. Morphological description of crops.
11. Determination of physiological maturity in standing crops.
12. Effect of seed size on germination and seedling vigour.
13. Seed extraction techniques for food crops.
14. Yield attributes and calculation on theoretical yield and harvest index.
15. Study of crop varieties and important agronomic practices for forage crops.
16. Visit of experiments research centers of related crops.

REFERENCE BOOKS

1. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agro bios (India), Jodhpur.
3. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
4. Singh, S.S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
5. Singh, S.S.and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

AGR18R252	FUNDAMENTALS OF PLANT BREEDING	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

Domestication, Acclimatization and Introduction; Centres of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept.

UNIT III

Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties.

UNIT IV

Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and prebreeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses.

UNIT V

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

PRACTICAL SCHEDULE

1. Plant Breeder's kit.
2. Study of germplasm of various crops.
3. Study of floral structure of self pollinated crops.
4. Study of floral structure of cross pollinated crops.
5. Emasculation and hybridization techniques in self pollinated crops.
6. Emasculation and hybridization techniques in cross pollinated crops.
7. Study of mutation breeding.
8. Application of DNA markers and Marker Assisted Selection (MAS).
9. Consequences of inbreeding on genetic structure of resulting populations.
10. Study of male sterility system.
11. Handling of segregating populations.
12. Methods of calculating mean, range, variance, standard deviation, heritability.
14. Designs used in plant breeding experiment.
15. Analysis of Randomized Block Design and components of genetic variance.
16. To work out the mode of pollination in a given crop and extent of natural out crossing and Prediction of performance of double cross hybrids.

REFERENCES BOOKS

1. Alard, R.W. 2000. Principles of Plant Breeding. John Willey & Sons, New York.
2. Chahel, G.S. and S.S. Ghosal. 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
4. Singh, P. 2001. Essentials of Plant Breeding - Principles and Methods. Kalyani Publishing House, New Delhi.
5. Jain, H.K. and M.C. Kharkwal. 2004. Plant Breeding - Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
6. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
7. Shekhawat, S. S. (ed). 2016. Advances and Current Issues in Agriculture, Vol.III. Shiksha Prakashan, S.M.S. Highway, Jaipur.

AGR18R253	AGRICULTURAL FINANCE AND COOPERATION	L	P	C
		2	1	3

THEORY

UNIT I

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage.

UNIT II

Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.

UNIT III

Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

UNIT IV

Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources.

UNIT V

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

PRACTICAL SCHEDULE

1. Preparation of farm layout.
2. Determination of cost of fencing of a farm.
3. Computation of depreciation cost of farm assets.
4. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
5. Determination of most profitable level of inputs use in a farm production process.
6. Determination of least cost combination of inputs.
7. Selection of most profitable enterprise combination.

8. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.
9. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.
10. Collection and analysis of data on various resources in India.
11. Techno-economic parameters for preparation of projects.
12. Preparation of bankable projects for various agricultural products and its value added products.
13. Basic guidelines for preparation of project reports - bank norms – SWOT analysis.
14. Preparation and analysis of financial statements – balance sheet and income statement.
15. Financial instruments and methods – e-banking, Kisan Cards and core banking.
16. Study of financial institutions: PACS, DCCB, Apex Banks, RRB, CBs, NABARD.

REFERENCE BOOKS

1. S. Subba Reddy and P. Raghu Ram. 1996. Agricultural Finance And Management, Oxford & IBH Pub. Co, New Delhi.
2. Kamat, G.S. 1978. New Dimensions of Cooperative Management, Himalyan Publishing House, Mumbai.
3. Nelson and Murray. 1988. Agricultural Finance. Kalyani Publishers, New Delhi.
4. Pandey, U.K. 1990. An Introduction to Agricultural Finance. Kalyani Publishers, NewDelhi.
5. Singh, J.P. 1988. Agricultural Finance Theory and Practices, Ashish Publishing House, NewDelhi.
6. Muniraj, R. 1987. Farm Finance For Development, Oxford & IBH Pub. Co., New Delhi.

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price

policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply curves and calculation of 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.

AGR18R254	AGRI-INFORMATICS	L	P	C
		1	1	2

THEORY

UNIT I

Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions.

UNIT II

Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications, Use of ICT in Agriculture.

UNIT III

Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management.

UNIT IV

Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture.

UNIT IV

Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.

PRACTICAL SCHEDULE

1. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data.
2. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.
3. Introduction to World Wide Web (WWW). Introduction of programming languages.
4. Database Management Systems (DBMS), its components in generating agricultural information.
5. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop- Info/CropSyst/ Wofost.
6. Computation of water and nutrient requirements of crop using CSM and IT tools.
7. Applications - Geographic Information Systems (GIS) - Remote Sensing – Geographic data and maps.
8. Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.
9. Relational Database Management System (RDBMS) – Client Server computing – Overview of Codd's rules.
10. Structured Query Language (SQL) Commands.
11. Building a Visual Basic Application – Writing codes – Working with controls –Managing Visual Basic data.

12. Database Management System (DBMS) and its components - Data modeling and its components.
13. VB Functions – Creating Visual Basic Function for MS Excel.
14. Commands – Join types – self JOIN – Database Security Commands using GRANT, REVOKE options.
15. Bio-informatics in Agriculture – Analysing protein sequences – DNA and RNA sequences.
16. Usage of SWISSPROT, EMBL, BLAST software for similarities searches – Bio-informatics software programmes.

REFERENCE BOOKS

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press.
2. Srivastava, G.S. 2014. An Introduction to Geo-informatics. McGraw Hill Education (India) Pvt. Ltd., New Delhi.
3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geo-informatics. Jain Brothers, New Delhi.
4. Introduction of Bioinformatics: Parrysmith and Attwood.
5. Internet of Molecular Biologist: Swindell.
6. A Textbook of Bioinformatics: Sharma, Munjal and Shanker, Rastogi publication.

AGR18R255	FARM MACHINERY AND POWER	L	P	C
		1	1	2

THEORY

UNIT I

Farm power in India: status, sources of Farm Power, I.C engines, working principles of I.C engines, two stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine. Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Power transmission system: clutch, gear box, differential and final drive of a tractor.

UNIT II

Tractors, Types, Selection of tractor and cost of tractor power. Cost analysis of tractor power, Estimation of field capacity and power requirements of implements. Tillage implements: Primary and Secondary tillage implements. Study of M.B. plough, disc plough, Measurement of plough size different parts, horizontal and vertical suction, determination of line of pull etc.,

UNIT III

Implements for intercultural operations, seed drills, paddy transplanters, plant protection equipment and harvesting equipment; Equipment for land development and soil conservation of seed-cum-fertilizer drills-furrow opener, metering mechanism and calibration.

UNIT IV

Familiarization with sowing and planting equipment, Familiarization with Plant Protection equipment, Study of different parts, registration alignment and operation of mower. Study of different inter cultivation equipment in terms of efficiency, field capacity.

UNIT V

Repairs and adjustments and operation of sprayers. Repairs and adjustments and operation of dusters; Study of paddy transplanters, harvesting and threshing equipments and machineries. Study, maintenance and operation of tractor.

PRACTICAL SCHEDULE

1. Study of different components of I.C. engine.
2. Study of working of four stroke engine.
3. To study air cleaning system of engine.
4. To study fuel supply system of engine.
5. Study of cooling and lubricating system.
6. Study of transmission system-clutch, gear box, differential, final drive and P.T.O.
7. Familiarization with brake, steering, hydraulic control system of engine.
8. Tractor driving – 1.
9. Tractor driving – 2.
10. Daily and periodic maintenance of tractor.
11. Study of power tiller and garden tractor.
12. Study of primary and secondary tillage implements: mould board plough, disc plough.
13. Study of secondary tillage implements- cultivators, harrows and hoes.
14. Study of seed metering mechanism and calibration of seed drill and numerical.
15. Study of different types of sprayers and dusters.

16. Study of reaper and thresher.

REFERENCE BOOKS

1. Principles of Farm Machinery – Roy Bainer, R.A. Kepner, E.L. Barger.
2. Farm Machinery and Equipment – C.P. Nakra.
3. Elements of Farm Machinery – J. Sahay.
4. Principles of Agricultural Engineering. 2012. Michael, A.M. and T.P. Ojha Jain. Brothers, Jodhpur.
5. Farm Tractors, Maintenance and Repair. 1989. Rai and Jain. Tata McGraw Hill Publ. New Delhi.

AGR18R256	PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES	L	P	C
		1	1	2

THEORY

UNIT I

Importance and scope of the vegetable cultivation, classification of vegetables, types of vegetable farming. Study of vegetable crops with respect to their origin, distribution, climate and soil requirement, sowing and planting ,varieties, nutrient requirement, irrigation, intercultural operations, harvesting , important insect pests diseases, **physiological** disorders, crop improvement and seed production techniques of Solanaceous vegetables (tomato, brinjal and chilli, capsicum) Cole crops (cauliflower, cabbage and knolkhol), Cucurbits (pumpkin, cucumber, gourd and melons). Legumes (pea, beans, cowpea and Guanr).

UNIT II

Origin, distribution, climate and soil requirement, sowing and planting, varieties, nutrient requirement, irrigation, intercultural operations, harvesting, important insect pests diseases, **physiological** disorders, crop improvement and seed production techniques of okra, bulb crops (onion and garlic), Root crops (radish, turnip, beet and carrot).

UNIT III

Origin, distribution, climate and soil requirement, sowing and planting ,varieties, nutrient requirement, irrigation, intercultural operations, harvesting , important insect pests diseases **physiological** disorders, crop improvement and seed production techniques of potato, topical tuber crops(sweet potato yams, colocasia, cassava and amorphophallus), Leafy vegetables (amaranthus, spinach and fenugreek), perennials (drum stick, curry leaf).

UNIT IV

Importance and scope of the spices cultivation, Study of spice crops with respect to their origin, distribution, climate and soil requirement, sowing and planting, varieties, nutrient requirement, irrigation, intercultural operations, harvesting, important insect pests diseases, **physiological**, disorders crop improvement and seed production techniques of **Major spices:** pepper, betel vine, cardamom, turmeric and ginger.

UNIT V

Origin, distribution, climate and soil requirement, sowing and planting, varieties, nutrient requirement, irrigation, intercultural operations, harvesting, important insect pests diseases **physiological**, disorders crop improvement and seed production techniques of **seed spices:** (coriander, Cumin, Fenugreek and Fennel), **tree spices** (Clove, **nutmeg**, **cinnamon**, **tamarind and curry leaf**) and **herbal spices**.

PRACTICAL SCHEDULE

1. Identification of vegetable seeds and plant parts.
2. Raising of vegetable seedlings in the nursery.
3. Planning and layout of kitchen garden.
4. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding

- and intercultural operations of Solanaceous vegetables (tomato, brinjal and chilli, capsicum).
5. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Cole crops (cauliflower, cabbage and knolkhol).
 6. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Cucurbits (Pumpkin, cucumber, gourd and melons).
 7. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Legumes (pea, beans, cowpea and Guanr).
 8. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Okra, Bulb crops (onion and garlic).
 9. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Root crops (radish, turnip, beet and carrot).
 10. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Potato, Topical tuber crops (sweet potato yams, colocasia, cassava and amorphophallus).
 11. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Leafy vegetables (amaranthus, spinach and fenugreek), perennials (drum stick, curry leaf).
 12. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger).
 13. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Apiaceae (Umbelliferae) (coriander) and Myrtaceae (Clove)
 14. Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of Cumin, Fenugreek and Fennel.
 15. Seed extraction of tomato and brinjal.
 16. Visit to commercial vegetable farms, Vegetable Markets, Research Stations and commodity boards.

REFERENCE BOOKS

1. Vegetable Crops - T.K. Bose and M.G. Som
2. Vegetable for the Tropical Region - PremNath, S.Velayadhan and D.P.Singh.
3. Technology for Vegetable Production and Improvement - P. Hazra and M.G. Som
4. Principles of Vegetable Production - S.P. Singh
5. Text book of Vegetable, Tuber Crops and Spices - S.Thamburaj and N. Singh.

AGR18R257	ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.

UNIT IV

Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public

awareness. 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, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

PRACTICAL SCHEDULE

1. Collection, processing and storage of effluent samples.
2. Determination of Biological oxygen demand(BOD) in effluent sample.
3. Determination of Chemical oxygen demand (COD) in effluent sample.
4. Estimation of dissolved oxygen in effluent samples.
Determination of sound level meter.
5. Estimation of respirable and non-respirable dust in the air by using portable dust sampler.
6. Determination of total dissolved.
7. Pollution case studies. Case Studies - Field work.
8. Visit to a local area to document environmental assets river and forest.
9. Visit to a local area to document environmental assets grassland, hill/ mountain.
10. Visit to a local polluted site-Urban/Rural - Visit to a local polluted site- Industrial/ Agricultural.
11. Study of common plants, common insects and common birds.
12. Study of simple ecosystems- pond, river and hill slopes.
13. Pollution case studies - Case Studies- Field work: Visit to a local area to document environmental assets hill/ mountai.
14. Pollution case studies - Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland.
15. Visit to a local polluted site-Urban/Rural/Industrial/ Agricultural, study of common plants, insects, birds.
16. Visit to a local polluted site- study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE BOOKS

1. Perspective of Environmental Sciences – Kaushik & Kaushik.
2. Air Environment and Pollution – S.S. Purohit.
3. Water Pollution causes, effects and control – P.K. Goel.
4. Biodiversity and Forest genetic resource – D.N. Tiwari.
5. Biodiversity : Planning for sustainable Development – J. Singh.
6. Text Book of Ecology and Environment – S.C. Joshi.

AGR18R258	LIVESTOCK AND POULTRY MANAGEMENT	L	P	C
		3	1	4

THEORY

UNIT I

Scope and importance of livestock and poultry in Agriculture - Mixed farming – integrated farming – nutritive value and feeding of livestock with agricultural by-products. Place of livestock in the national economy, different livestock development programmes of Govt. of India.

UNIT II

Feeding of livestock using vegetable waste and its nutritive value – Anti nutritional factors in agricultural and horticultural waste products – importance of green fodder and utilization as animal feed.

UNIT III

Classification and breeds of cattle - exotic and indigenous - Breeding and improvement of dairy cattle – management and housing–by-products of meat animals – market classes and grades of livestock. Feeds and feeding management – carrying capacity – systems of rearing – free range - semi intensive – intensive system of rearing - clean milk production – milking methods – advantages and disadvantages - machine milking – effect of adulterants on milk.

UNIT IV

Rabbits – breeds and their characteristics – intensive system of rearing – feeds and feeding– housing – types of housing - design characteristics of the physical environment - cage dimensions - system of Care and management of rabbits – Piggery - breeds, housing - types of housing - intensive system of rearing - feeding - vegetable waste – feeding - feed conversion efficiency - economics.

UNIT V

Poultry – common commercial strains of broiler and layer – housing – back yard poultry – systems of rearing – feeding – hen day and hen housed production – feed conversion ratio – broiler management – management of turkey and guinea fowl. Egg - incubation, brooding and standards. Poultry – feeds and additives - Poultry feeding standards, ration formulation and feeding programs.

PRACTICAL SCHEDULE

1. Identification of farm animals.
2. Handling and restraining of farm animals.
3. Judging of dairy animals.
4. Culling of dairy cattle and poultry.
5. Feeding and ration formulation for different categories of livestock.
6. Housing of dairy cattle.
7. Housing management of poultry.
8. Visit to livestock farms.
9. Economics of livestock production.
10. Computation of rations for livestock.
11. Formulation of concentrate mixtures.

12. Clean milk production, milking methods.
13. Economics of cattle and buffalo.
14. Economics of sheep and goat.
15. Egg incubation and brooding.
16. Planning and layout of housing for different types of poultry and livestock.

REFERENCE BOOKS

1. Banerjee, G.C. 2003. The Text Book of Animal Husbandry, Oxford Book Company, Calcutta.
2. Dairy India Year Book. 2001. A-25, Priyadarshini Vihar, Delhi.
3. Gopalakrishnan, C.A. and Lal, D.M.M. 2002. Livestock and Poultry Enterprises for Rural Development, Vikas Publishing House Private Limited, Ghaziabad, U.P.
4. ICAR, 2006. A Hand Book of Animal Husbandry.
5. Indian Poultry Industry Year Book. 2008. A25 Priyadarshini Vihar, Delhi.
6. Kadirvel, R., and Balakrishnan, V. 2001. Hand Book of Poultry Nutrition, Madras Veterinary College, TANUVAS., Chennai-7.
7. Maynard, C. and Loosli, S. 2003. Animal Nutrition, TataMcGraw Hill Publishing Company Limited., New Delhi.

MAT18R211	STATISTICAL METHODS AND DESIGNS	L	P	C
		1	1	2

THEORY

UNIT I

Statistics - Introduction, Definition of and its use and limitations; Definition of data, collection of data: Introduction to Sampling, Random Sampling and various methods of Random sampling, Frequency Distribution and Frequency Curves.

UNIT II

Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; the concept of Standard Error.

UNIT III

Tests of Significance - Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test - SND test for Means, Single Sample and Two Samples; Small Sample Test for Means - Student's t-test for Single Sample, Two Samples and Paired t-test.

UNIT IV

F-test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y. Interrelation between 'r' and the regression coefficients, fitting of regression equations.

UNIT V

Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

PRACTICAL SCHEDULE

1. Collection of data to understand sampling techniques.
2. Construction of Frequency Distribution Tables and Frequency Curves.
3. Computation of Arithmetic Mean, Median and mode.
4. Computation of Standard Deviation, Variance and Coefficient of Variation.
5. Computation of Measures of Central Tendency and Measures of Dispersion in Microsoft Excel.
6. Large sample test – test for single proportion and difference between two proportions.
7. Large sample test – test for single mean and difference between two means.
8. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only).
9. Paired t-test.
10. Chi square test for testing the association of a 2 x 2 contingency table.
11. Computation of Karl Pearson's correlation coefficient.
12. Fitting of simple linear regression equation y on x – correlation and regression using MS Excel functions.
13. Analysis of Completely Randomised Design (CRD) – for equal replications only.

14. Analysis of Randomised Block Design (RBD).
15. Analysis of Latin Square Design (LSD) – analysis of CRD, RBD and LSD using statistical package (AGRES).
16. Field visit.

REFERENCE BOOKS

1. Rangaswamy, R. 2009. A Text book of Agricultural Statistics. Wiley Eastern Limited, New Delhi.
2. Fundamentals of Statistics. Vol. I & II – A.M. Goon. M.K.Gupta and B.Dasgupta.
3. G. Nageshwara Rao. 2007. Statistics for Agricultural Sciences. BS Publications, Andhra Pradesh.

SEMESTER - IV

AGR18R259	CROP PRODUCTION TECHNOLOGY – II (COMMERCIAL CROPS)	L	P	C
		1	1	2

THEORY

UNIT I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Commercial crops. Sugarcane and Sugarbeet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

UNIT II

Cotton, Jute and **Mesta** - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

UNIT III

Sorghum, Maize, **Pearlmillet**, Guinea grass, **Cumbu - Napier**, Water grass, Buffalo grass, Elephant grass, Kolukkattai grass, Lucerne, Berseem, Desmanthus, Stylosanthus and Cowpea - Economic importance, soil and climatic requirement, varieties, cultural practices and yield.

UNIT IV

Daincha, Sunhemp *S.rostrata*, Glyricidia, Kolingi - Origin, geographic distribution, economic importance, soil and climatic requirement, Varieties, cultural practices, yield.

UNIT V

Tobacco, Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices.

PRACTICAL SCHEDULE

1. Identification of commercial crops in the crop cafeteria.
2. Nursery preparation and management for Sugarcane and Tobacco.
3. Acquire skill in field preparation, sowing and manuring of crops under pure and intercropping situations.
4. Acquiring skill in different seed treatment techniques and foliar nutrition of crops.
5. Estimation of plant population per unit area for crops.
6. Acquiring skill in after - cultivation practices in sugarcane - detrashing, Cotton – earthing up, Tobacco - topping.
7. Study on growth parameters of sugar, fibre, forage crops, Greenmanures and narcotics.
8. Study on yield parameters and estimation of yield in sugar/fibre.
9. Study on yield parameters and estimation of yield in forage and narcotics.
10. Cost and returns of important sugar, fibre forage and narcotics.
11. Visit to Sugarcane Breeding Institute/Research Station to study cultivation of sugarcane and its by products.
12. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products.
13. Visit to - Cotton Research Station, nearby ginning factory and Tobacco curing centre.
14. Visit to Dairy Unit/farmers field to acquire skill in hay, silo and silage making. Visit to farmers field to study sugarcane and cotton based cropping systems.

15. On/Off Farm visit to study forage crops and green manures.
16. Fodder preservation techniques

REFERENCE BOOKS

1. Rajendra Prasad. 2012. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
2. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 2010. Scientific Crop Production in India. Rama publishing House, Meerut.
3. Chidda Singh, Prem Singh and Rajbir Singh. 2011. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.

AGR18R260	PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAPs AND LANDSCAPING	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Processing and value addition in ornamental crops and MAPs produce.

PRACTICAL SCHEDULE

1. Identification of Ornamental plants.
2. Identification of Medicinal and Aromatic Plants.
3. Nursery bed preparation and seed sowing.
4. Training and pruning of Ornamental plants.
5. Lawn and Lawn making.
6. Planning and layout of garden.
7. Bed preparation and planting of MAP.
8. Protected structures – care and maintenance.
9. Intercultural operations in flowers and MAP.
10. Harvesting and post harvest handling of cut and loose flowers.
11. Processing of MAP.
12. Working out the benefit cost ratio for medicinal and aromatic crops.
13. Working out the benefit cost ratio for flower crops - Protected cultivation.
14. Propagation techniques of medicinal coleus, isabgol and aole.
15. Propagation techniques of ashwagandha and phyllanthus.
16. Visit to commercial flower/MAP unit.

REFERENCE BOOKS

1. Chaddha .K.L. and Rajendra Gupta. 1995. Vol. II. Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
2. Sharma, R. 2004. Agrotechniques of Medicinal Plants. Daya Publishing House, Delhi.
3. Pruthi, J.S. 1993. Major Spices of India. Crop Management & Post harvest Technology. ICAR, New Delhi.
4. Dashora, L.K. Production Technology of Plantation Crops, Spices, Aromatic & Medicinal Plants.

AGR18R261	RENEWABLE ENERGY AND GREEN TECHNOLOGY	L	P	C
		1	1	2

THEORY

UNIT I

Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, constructional details, Biogas production and its utilization, Agricultural wastes, Principles of combustion, pyrolysis and gasification. Types of gasifiers, Producer gas and its utilization. Briquettes, Types of Briquetting machines, uses of Briquettes, Shredders.

UNIT II

Solar energy, Solar flat plate and focusing plate collectors, Solar air heaters, Solar space heating and cooling, Solar energy applications/Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar Refrigeration system, Solar ponds, Solar photo voltaic systems, solar lantern, Solar street lights, solar fencing, Solar pumping systems.

UNIT III

Wind energy, Types of wind mills, Constructional details and application of wind mills. Liquid Bio fuels, Bio diesel and Ethanol from agricultural produce, its production and uses.

UNIT IV

Biogas technology - Science of production - feed stocks - factors affecting biogas production - types and capacity of biogas plants - KVIC, Janata and Deenbandhu model biogas plants - construction and working principles - comparison features of biogas plants. Applications of biogas – biogas requirements - biogas appliances - environmental considerations – enrichment and uses of biodigested slurry (BDS).

UNIT V

Green technology – Introduction, Definition, Need of Alternative materials, Green Materials, Biomaterials, Natural and synthetic Polymers. Photovoltaic (PV) thin films for solar cells; Organic Solar Cells; dye sensitized solar cells; Thermo photovoltaic (TPV) devices Fuel cells. The role of the fuel in the operation, performance and degradation of fuel cells.

PRACTICAL SCHEDULE

1. Study of fixed dom and floating drum type biogas plants.
2. Study of cross draft, updraft and down draft gasifiers.
3. Constructional details of KYIC and Janatha type biogas plants.
4. To study briquetting machine.
5. Study of box type solar cooker.
6. Study of solar water heating system.
7. Study of solar distillation system.
8. Study of solar dryer.
9. Study of solar animal concentrate cooker.
10. Study of solar photovoltaic water pumping system.
11. and visit to nearby solar photovoltaic water pumping system.
12. Study of solar photovoltaic sprayer.
13. Study of wind mill and Field visit to wind mills.

14. Study of improved cook stove.
15. To study the processing of Bio-diesel production from Jatropha.
16. Field visit to biogas plants.

REFERENCE BOOKS

1. G.D. Rai. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.
3. N.S. Rathore. A. K. Kurchania, N.L. Panwar. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.
4. K.C. Khandelwal. & S.S. Mandi. 1990. Biogas Technology.
5. Renewable Energy, Godfrey Boyle (Editor) ISBN: 0199261784 / ISBN-13: 9780199261789.
6. Solar Energy Utilization, Rai G.D 1984. Khanna Publishers, New Delhi.
7. Solar Energy, Sukhatme SP. 1985. Tata McGraw Hill publishing Co. Ltd., New Delhi.
8. Energy technology - Non conventional, renewable and conventional, Rao, S. and B.B. Parulekar, 2002. Khanna Publishers, New Delhi, India.
9. Renewable Energy Resources, John Twidell and Tony Weir - (Paperback - 24 Nov 2005).
10. Biotechnology and other Alternate Technology, Chakravarthy A. 1989. Oxford and IBH Publishing Co. Ltd. New Delhi.

FURTHER READING

1. Renewable Energy Sources and Conversion Technology, Bansal N.K. *et al.*, 1990. Tata McGraw Hill publishing Co. Ltd., New Delhi.
2. Non Conventional Energy Sources, Rai GD. 1996. Khanna publishers, New Delhi.
3. Biomass Briquetting and utilization, Srivastava *et al.*, 1995. Jain Brothers. New Delhi.

WEB RESOURCES

1. Journal of Renewable and Sustainable Energy - <http://jrse.aip.org/>
2. Bio-resource Technology - International Journal - <http://www.sciencedirect.com/>
3. Ministry of New and Renewable Energy - <http://www.mnre.gov.in/>

AGR18R201	PROBLEMATIC SOILS AND THEIR MANAEMENT	L	P	C
		2	0	2

THEORY

UNIT I: Soil quality and health

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

UNIT II: Problem soils and their management

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

UNIT III: Irrigation water and their standards

Irrigation water – quality and standards, utilization of saline water in agriculture.

UNIT IV: Remote sensing and GIS

Remote sensing and GIS in diagnosis and management of problem soils.

UNIT V: Bioremediation

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

TEXT BOOKS

1. Arun Kumar Saha and Anuradha Saha. 2012. Text book of Soil Physics. Kalyani Publishers. New Delhi.
2. Biswas T.D. and Mukherjee S.K. 1987. Text Book of Soil Science-Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, New Delhi
Fundamentals of Soil Science. 2009. ISSS Publication, New Delhi.
4. Steward, D.W.P. 1976. Soil Microorganisms and Plant growth, Oxford and IBH Publishing Co., New Delhi.

REFERENCE BOOKS

1. Brady, N.C. and Weil, R.C.2012.The nature and properties of soils.14 Edn,Pearson Publication.
2. Boul, S.W., R.J. Southard, R.C.Graham and P.A.McDaniel. 2005. Soil genesis and classification. 5th Ed. Iowa State University Press, Ames, IA.
3. Sehgal,J. 2005. A Text Book of Pedology Concepts and Application, Kalyani Publishers, New Delhi.
4. Soil Survey Staff. 2006. Keys to Soil Taxonomy. United States Department of Agriculture, Natural Resources Conservation Service.

AGR18R262	PRODUCTION TECHNOLOGY FOR FRUITS AND PLANTATION CROPS	L	P	C
		1	1	2

THEORY

UNIT I

Introduction, importance and scope of fruit and plantation crops. Classification of fruits according to climate. Selection of site, planning, establishment and layout of orchard. Propagation methods of fruit crops. Methods of training and pruning in fruit crops. Use of growth regulators in fruit production.

UNIT II

Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning intercultural operation, harvesting, yield and plant protection measures including physiological disorders - Mango, Banana, Citrus and Grapes.

UNIT III

Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning intercultural operation, harvesting, yield and plant protection measures including physiological disorders - Guava, Sapota, Papaya, Apple, **pear**, **peach** and Pineapple.

UNIT IV

Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning intercultural operation, harvesting, yield and plant protection measures including physiological disorders - Pomegranate, **Litchi**, Ber, Jack fruit, Aonla, Bale and Datepalm and **minor fruits**.

UNIT V

Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning intercultural operation, harvesting, yield and plant protection measures including physiological disorders - Coconut, Cashew, Areca nut, Oil palm, Tea, **Coffee and rubber**.

PRACTICAL SCHEDULE

1. Identification of fruit and plantation crops.
2. Study of horticultural tools and implements and their uses.
3. Plant propagation methods by seeds (**Scarification and stratification**)
4. Cuttings (soft wood, hard wood and semi-hardwood).
5. Method of Budding.
6. Method of Grafting.
7. Method of Layering.
8. Simple layering, Air layering other method of Layering.
9. Layout and planting systems.
10. Methods of pruning.

11. Training of important fruit crops.
12. Irrigation methods in fruit crops including drip – Micro irrigation.
13. Methods for establishment of orchard.
14. Methods of fertilizer application in fruit crops.
15. Visit to local commercial orchards with in state.
16. Important pests, diseases and physiological disorders of fruit and plantation crops
17. Preparation of growth regulator solutions for propagation; Application of growth regulators for improving fruit set, fruit size and quality.

REFERENCE BOOKS

1. Bose. T.K., Kabir. J., Das. P. and Joy P.P. 2000. Tropical Horticulture. NayaProkash. Calcutta.
2. Singh, Amar. 1986. Fruit Physiology And Production. Kalyani Publishers, New Delhi.
3. Singh. S.P. 1997. Commercial Fruits. Kalyani Publishers, New Delhi.
4. Mitra. S.K., Bose. T.K. and Rathore D.S. 1991. Temperate Fruits. Horticulture & Allied Publishers, Calcutta.
5. Parthasvathy. V. A. Chattopadhyay. P.K. and Bose T.K. 2006. Plantation Crpos. NayaProkash, Kolkatta
6. Bal. J.S. 1997. Fruit Growing. Kalyani Publisher, New Delhi.

AGR18R263	PRINCIPLES OF SEED TECHNOLOGY	L	P	C
		1	2	3

THEORY

UNIT I: Quality Seed Production

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 in Agricultural Crops

Foundation and certified seed production of important cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Fodder and vegetables.

UNIT III: Seed Certification and Seed Storage

Seed certification, phases of certification, procedure for seed certification, field inspection. 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 IV: Seed Genetic Purity Tests

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. Seed drying, processing and their steps, seed testing for quality assessment.

UNIT V: Seed Legislation and Marketing

Seed Act and Seed Act enforcement. Duties and powers of seed inspector, offences and penalties. Seeds Control Order 1983, 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 SCHEDULE

1. Identification of different agricultural crop seeds and their structures.
2. Seed production in Rice.
3. Seed production Wheat.
4. Seed production in Maize.
5. Seed production in Sorghum.
6. Seed production in Bajra
7. Seed production in Ragi.
8. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea.
9. Seed production in major oilseeds: Soybean, Sunflower and Groundnut
10. Seed production in major oilseeds: Rapeseed and Mustard.
11. Seed production in important vegetable crops.
12. Seed sampling and testing
13. Seed Physical purity test
14. Seed germination test.
15. Determination of Seed Moisture Content
16. Seedling Evaluation and reporting result.
17. Seed viability Test.
18. Seed and seedling vigour test.
19. Seed health test
20. Genetic purity test: Grow out test and electrophoresis.

21. Seed certification: Procedure, Field inspection, Preparation of field inspection report.
22. Visit to seed production farms
23. Visit to seed testing laboratories
24. Visit to seed processing plant.

REFERENCE BOOKS

1. Seed Technology – R.L. Agrawal.
2. Principles of Seed Technology – G.M. Kulkarni.

TEXT BOOKS

1. Structure Development and Reproduction in Angiosperms – V. Singh, P.C. Pande & D.K.Jain
2. Principles of Seed Science & Technology – L.O. Copeland & M.B. KcDonald.

AGR18R202	FARMING SYSTEM AND SUSTAINABLE AGRICULTURE	L	P	C
		1	0	1

THEORY

UNIT I

Farming System - scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system.

UNIT II

Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system.

UNIT III

Sustainable agriculture - problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, Conservation agriculture strategies in agriculture, LEIA (Low external input agriculture), LEISA, HEIA (High external input agriculture).

UNIT IV

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

UNIT V

Resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment.

REFERENCE BOOKS

1. Panda, S.C. 2004. Cropping Systems and Farming Systems. Agrobios (India), Jodhpur.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
3. Sharma, Arun K. 2002. A Handbook of Organic Farming. Agrobios (India) Ltd., Jodhpur.
4. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
5. Shukla, Rajeev K. 2004. Sustainable Agriculture. Surbhee Publications, Jaipur.
6. Palaniappan, S.P.1985. Cropping Systems in the Tropics: Principles and Management. Wiley Easter Ltd. and TNAU, Coimbatore.

AGR18R264	AGRICULTURAL MARKETING, TRADE AND PRICES	L	P	C
		2	1	3

THEORY

UNIT I

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets. Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.

UNIT II

Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits.

UNIT III

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

UNIT IV

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

UNIT V

Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

PRACTICAL SCHEDULE

1. Identification of marketing channels.
2. Study of Regulated markets.
3. Study of unregulated markets.
4. Study of livestock markets.
5. Price spread analysis.

6. Visit to market institutions, NAFED.
7. Study of SWC,CWC and STC.
8. Analysis of information of daily prices.
9. Computation of marketable and marketed surplus of important commodities plotting.
10. Study of demand and supply curves and calculation of elasticities.
11. Study of relationship between market arrivals and prices of some selected commodities.
12. Study of price behaviour over time for some selected commodities, Construction of index numbers.
13. Price forecasting; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity.
14. Collection of data regarding marketing costs, margins and price spread and presentation of report in the class.
15. Visit to cooperative marketing society. To study their organization and functioning.
16. Application of principles of comparative advantage of international trade.

REFERENCE BOOKS

1. Acharya, S.S. and Agarwal, N.L. 1994. Agricultural Price Analysis and Price Policy, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Acharya, S.S. and Agarwal, N.L. 2004. Agricultural Marketing in India, Oxford and IBH Publishing Co. New Delhi.
3. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma. 2017. Fundamentals of Agribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-418-6. First edition.

AGR18R265	INTRODUCTORY AGROMETEOROLOGY AND CLIMATE CHANGE	L	P	C
		1	1	2

THEORY

UNIT I

Meaning and scope of agricultural meteorology; Earth atmosphere - its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze.

UNIT II

Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature.

UNIT III

Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification.

UNIT IV

Artificial rainmaking. Monsoon - mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations.

UNIT V

Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting - types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

PRACTICAL SCHEDULE

1. Site Selection and Layout for Agromet Observatory - Calculation of local time-time of observation of different weather elements – reviewing agromet registers.
2. Measurement of Solar Radiation (Pyranometers), Sunshine Hours (Sunshine Reorder) - Working out Weekly and Monthly Mean for Graphical Representation.
3. Measurement of Air and Soil Temperature - Grass Minimum Temperature - Thermographs and Drawing Isolines.
4. Humidity Measurements - Use of Dry Bulb and Wet Bulb Thermometers – Psychrometers – Hygrograph - Measurement of Wind direction, Speed and Conversion (Kmph, Knot and $Msec^{-1}$) - Beaufort's Scale.
5. Measurement of Atmospheric Pressure - Fortin's Barometer – Barograph - Isobars Based on past data for different seasons.
6. Measurement of Rainfall - Ordinary and Self - Recording Rain Gauges - Measurement of Dew - Dew Gauge - Study of Automatic Weather Station.

7. Measurement of Evaporation - Open Pan Evaporimeter – Application of evaporation data –Measurement of Evapotranspiration – Lysimeter.
8. Heat Unit Concept - GDD, HTU, PTU for fixing Time of Sowing.
9. Probability analysis of Rainfall for Crop Planning.
10. Drawing Synoptic Charts for Understanding Weather.
11. Preparation of Crop Weather Calendars and Forecast Based Agro Advisories.
12. Preparation of pest weather calendar and pest forewarning.
13. Estimation of Length of Growing Periods Using Weekly Rainfall Data.
14. Water balance studies.
15. Identification of efficient cropping zone –RYI, RSI.
16. Mapping of Agro climatic Zones of India and TamilNadu and its Characterization.

REFERENCE BOOKS

1. Sacheti, A.K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.) NCERT Publication, New Delhi.
2. Lal. D.S. 2005. Climatology, Sharda Pustak Bhawan, Allahabad.
3. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.
4. Sahu, D.D. 2007. Agrometeorology and Remote sensing: Principles and Practices, Agrobios (India), Jodhpur.
5. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology, Kalyani Publishers, New-Delhi
6. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.

SEMESTER-V

AGR18R351	PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

UNIT I III

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

UNIT V

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

UNIT V

Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

PRACTICAL SCHEDULE

1. Methods of diagnosis and detection of various insect pests, and plant diseases.
2. Methods of insect pest measurement.
3. Methods of insect plant disease measurement.
4. Assessment of crop yield losses.
5. Calculations based on economics of IPM.
6. Identification of biocontrol agents.
7. Different predators and natural enemies.
8. Mass multiplication of Trichoderma.
9. Mass multiplication of Pseudomonas.
10. Mass multiplication of Trichogramma.
11. Identification and nature of damage of important insect pests and diseases and their management.
12. Crop (agroecosystem) dynamics of a selected insect pest and diseases.
13. Plan & assess preventive strategies (IPM module) and decision making.
14. Crop monitoring attacked by insect.
15. Crop monitoring attacked by pests and diseases.
16. Awareness campaign at farmers fields.

REFERENCE BOOKS

1. Aar, T.V.R. 1963. Hand Book of Economics Entomology for South India. Govt. Press Madras.
2. David, B.V. 2006. Elements of Economic Entomology. Popular Book Depot, Chennai.
3. Srivastava, K.P. and D.K. Butani. 1998. Pest Management in Vegetables (Part I & II) Research Periodicals and Book Publishing House, India.

AGR18R352	MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT	L	P	C
		2	1	3

THEORY

UNIT I

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.

UNIT II

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

UNIT III

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

UNIT IV

Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests.

UNIT V

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

PRACTICAL SCHEDULE

1. Introduction of analytical instruments and their principles, calibration and applications.
2. Colorimetry and flame photometry.
3. Estimation of soil organic carbon.
4. Estimation of alkaline hydrolysable N in soils.
5. Estimation of soil extractable P in soils.
6. Estimation of exchangeable K in soils.
7. Estimation of exchangeable Ca in soils.
8. Estimation of exchangeable Mg in soils.
9. Estimation of soil extractable S in soils.
10. Estimation of DTPA extractable Zn in soils.
11. Estimation of N in plants.
12. Estimation of P in plants.
13. Estimation of K in plants.
14. Estimation of S in plants.
15. Visit to STL and FTL Colloquium on soil testing laboratories - Soil test based fertilizer prescription.
16. Visit to fertilizer manufacturing/mixing unit.

REFERENCE BOOKS

1. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson. 2005. Soil Fertility and Fertilizers - An Introduction to Nutrient Management. 7th Edition, Prentice Hall. Upper Saddle River, NJ.
2. Kanwar. J.S. 1976. Soil fertility – Theory and Practice. ICAR- New Delhi.
3. Mengel, K. and E.A. Kirkby. 1987. Principles of Plant Nutrition, 4th ed. International Potash Institute, Worblaufen-Bern, Switzerland.
4. Horst. 1995. Mineral Nutrition of Higher Plants, 2nd edition. Marschner, Academic Press Inc. San Diego, CA.
5. Yawalkar, K.S., J.P. Agarwal and S.Bokde. 1972. Manures and Fertilizers Third revised edition, Agri Horticultural Publishing House, Nagpur.
6. Cooke G.W. 1972. Fertilizers for maximizing yield. Grenada Publishing Ltd, London.
7. Russell. E.J. 1973. Soil conditions and plant growth. Tenth edition English Language Book Society, London.
8. Westerman, R.L. (ed.) 1990. Soil Testing and Plant Analysis. 3rd. edition. Soil Science Society of America, Inc., Madison, WI.
9. Tandon, H.L.S. 1994. Fertilizer, Organic Manures, Recyclable Wastes and Biofertilizers Fertilizer Development and Consultation Organization, New Delhi.

WEB RESOURCES

1. www.fspublishers.org/ijab/past-issues/IJABVOL_5_NO_3/47.pdf
2. www.springerlink.com/index/1011256h8t325054.pdf
3. [www.ipni.net/ppiweb/bcrops.nsf/\\$webindex/.../Better_Crops_2009-4_L.pdf](http://www.ipni.net/ppiweb/bcrops.nsf/$webindex/.../Better_Crops_2009-4_L.pdf)
4. onlinelibrary.wiley.com/doi/10.1002/9780470431771.index/pdf
5. agtr.ilri.cgiar.org/agtrweb/Documents/Library/docs/.../Module4.htm
6. www.uoa.edu.er/academics/graduate/.../courses.html
7. www.fao.org/wairdocs/ilri/x5546e/x5546e08.htm
8. www.fao.org/wairdocs/ilri/x5546e/x5546e08.htm
9. www.uoa.edu.er/academics/graduate/.../courses.html
10. www.ncpahindia.com/articles/article17.pdf
11. www.energy.ca.gov/process/agriculture/ag_pubs/fertigation.pdf
12. www.soilandhealth.org/.../010117attrasoilmanual/010117attra.html

AGR18R353	PEST OF CROPS AND STORED GRAIN AND THEIR MANAGEMENT	L	P	C
		2	1	3

THEORY

UNIT I

Polyphagous pests: Red hairy caterpillar, White grub, Termite, Locust, Grasshopper. Crop pests: Distribution, biology, nature and symptoms of damage, and management of insect pests of rice, pearl millet, sorghum, maize, wheat, sugarcane, cotton, pulses, groundnut, castor, sesame, sunflower, mustard, soybean, brinjal, okra, tomato, cruciferous and cucurbitaceous vegetables, potato, chillies, onion, garlic, mango, citrus, pomegranate, guava, ber, apple, coconut and ornamental plants.

Stored grain pests: Coleopteran and Lepidopteran pests, their identification, biology and damage. Preventive and curative methods for control of stored grain pests. Practical: Identification, damage symptoms and management of insect pests of rice, pearl millet, sorghum, maize, wheat, sugarcane, cotton, pulses, castor, mustard, brinjal, tomato, okra, cruciferous and cucurbitaceous vegetables, onion, garlic, chillies, mango, guava, citrus, pomegranate, ber, coconut. Identification, biology, damage symptoms and management of stored grain and polyphagous insect pests.

UNIT II

Distribution, biology, nature and symptoms of damage, and management of insect pests of crops Polyphagous pests: Red hairy caterpillar, White grub, Termite, Locust, Grasshopper/ Rice: Brown plant hopper, Yellow stem borer, Rice hispa. Pearl millet: White grub (Covered in Polyphagous pests). Sorghum: Sorghum shoot fly. Maize: Maize stem borer. Wheat: Termite. Sugarcane: Sugarcane pyrilla, Whitefly, Shoot borer. Cotton: Jassid, Whitefly, Spotted bollworm, Pink bollworm, Red cotton bug. Pulses: Gram pod borer, Cutworm, Pea stem fly.

UNIT III

Groundnut: Aphid, White grub. Castor: Castor semilooper, Capsule borer. Sunflower: Head borer. Mustard: Aphid, Saw fly, Painted bug. Tobacco: Tobacco caterpillar. Soybean: Girdle beetle. Brinjal: Shoot and fruit borer. Tomato: Fruit borer. Okra: Shoot and fruit borer. Cruciferous vegetables: Cabbage caterpillar, Diamond back moth, Semi-looper, Tobacco caterpillar. Cucurbitaceous vegetables: Melon fruit fly, Red pumpkin beetle, Red vegetable mite. Potato: Tuber moth. Chillies: Fruit borer. Onion and Garlic: Thrips. Mango: Mango hopper, Stem borer, fruit fly. Citrus: Citrus psylla, Citrus caterpillar.

UNIT IV

Guava: Fruit fly. Pomegranate: Anar butterfly. Ber: Fruit fly. Coconut: Black headed caterpillar. Apple: San Jose scale, Woolly apple aphid. Ornamental plants: Rose aphid, hollyhock tinged bug, Jasmine budworm.

UNIT V

Identification, biology and damage of stored grain pests: Khapra beetle, Lesser grain borer, Rice weevil, Red rust flour beetle, Pulse beetle, Rice moth and Angoumois grain moth. Preventive and Curative methods for the control of stored grain pests.

PRACTICAL SCHEDULE

1. Identification, biology, damage symptoms and management of polyphagous insect

Pests.

2. Identification, biology, damage symptoms and management of insect pests of rice.
3. Identification, biology, damage symptoms and management of insect pests of pearl millet.
4. Identification, biology, damage symptoms and management of insect pests of sorghum.
5. Identification, biology, damage symptoms and management of insect pests of maize.
6. Identification, biology, damage symptoms and management of insect pests of wheat.
7. Identification, biology, damage symptoms and management of insect pests of sugarcane, cotton, pulses, castor, mustard.
8. Identification, biology, damage symptoms and management of insect pests of pulses, castor, mustard.
9. Identification, biology, damage symptoms and management of insect pests of brinjal, tomato, okra, cruciferous and cucurbitaceous vegetables.
10. Identification, biology, damage symptoms and management of insect pests of onion, garlic, chillies.
11. Identification, biology, damage symptoms and management of insect pests of mango, guava, citrus.
12. Identification, biology, damage symptoms and management of insect of pests pomegranate, ber, coconut.
13. Identification, biology, damage symptoms and management of stored grain insect pests.
14. Collection, preservation of insect pests of stored grains, field crops, vegetables and fruit trees.
15. Preparation of spray solutions and numerical problems.
16. Field visit of endemic areas.

REFERENCE BOOKS

1. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.
2. David B.V. 2003. Elements of Economic Entomology, Popular Book Depot, Chennai.
3. Pradhan, S. 1968. Insect Pests of Crops, National Book Trust, New Delhi.
4. Nayar, M.R.G.K. 1986. Insects and Mites of Crops in India, ICAR, New Delhi.
5. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.II, Kalyani Publishers, New Delhi.

AGR18R354	DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT - I	L	P	C
		2	1	3

THEORY

UNIT I

Symptoms, etiology, disease cycle and management of major diseases of following crops:
Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro.

UNIT II

Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic.

UNIT III

Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.

UNIT IV

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

UNIT V

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

PRACTICAL SCHEDULE

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

1. Classification and grouping of fungicides.
 2. Preparation of Bordeaux mixture (1%), Bordeaux paste (10%), and delivery system and calculation of recommended dose of fungicides.
 3. Mass multiplication of *Trichoderma viride* and methods of application.
 4. Mass multiplication of *Pseudomonas fluorescens*, *Bacillus subtilis* and methods of application.
 5. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
 6. Survey and Assessment of important plant diseases.
- Study of diseases symptoms and host-parasite relationship of:**
7. Rice, wheat and maize.

8. Sorghum.
9. Pearl millet, ragi and small millets.
10. Pigeonpea, urdbean, mungbean, chickpea, field bean and soybean.
11. Groundnut and gingelly.
12. Castor, sunflower, linseed, safflower and mustard.
13. Field visit.
14. Cotton and jute.
15. Sugarcane and sugar beet.
16. Tobacco, jatropa and mulberry.

REFERENCE BOOKS

1. Agrios, G. N. 2008. Plant Pathology, 5th edition, Academic Press, New York.
2. Chaube H.S and Pandhir. 2005. Crop diseases and their management. Prentice hall of India Pvt.Ltd.NewDelhi.
3. Dube, H.C. 2009. A text book of fungi, bacteria and viruses. Vikas publishing house Pvt. Ltd., New Delhi.
4. Mehrota, R.S. 1980. Plant Pathology, Tata Mc Grow Mill Pub. Co., New Delhi, pp. 771.
5. Narayanasamy, P. 2011. Microbial plant pathogens detections and disease diagnosis Vol. I. Springer publication.
6. Nene, Y.L. and Thapliyal, P.N. 1998. Fungicides in plant disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
7. Prakasam, V., Valluvaparidasan, V., Raguchander, T. and K.Prabakar. 1997. Field crop diseases, AE Publication, Coimbatore.
8. Prakasam, V., T.Raguchander and K.Prabakar, 2006. Applied Plant Pathology, A.E. publications, Coimbatore.
9. Rangaswami, G. 2005. Diseases of Crop plants in India. Prentice Hall of India Pvt. Ltd., New Delhi pp. 504.
10. Singh, R.S .1993. Plant Diseases, Oxford &IBH Publication, New Delhi.

FURTHER READING

1. Chattopadhyay, S.G. 1998. Principles and procedure of plant protection, Oxford and IBH publishing Co. Ltd., New Delhi.
2. Dickson, J.G. 1997. Diseases of field crops, Daya Publishing House, New Delhi.
3. Gupta V.K and Paul V.S. 2004. Fungi and Plant diseases. Kalyani Publishers, New Delhi.

AGR18R355	CROP IMPROVEMENT – I (FOOD CROPS)	L	P	C
		1	1	2

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: Crop Improvement in Poaceae

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of Poaceae: Key botanical features of Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet and list of small millets.

Unit III: Crop Improvement in Papilionaceae

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram, Green gram, Cowpea, Lablab, Horse gram and Groundnut.

Unit IV: Crop Improvement in Pedaliaceae, Asteraceae and Brassicaceae

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of Pedaliaceae - Gingelly; Asteraceae - Sunflower, Safflower,; Brassicaceae - Rapeseed and Mustard, Cabbage and Cauliflower.

Unit V: Crop Improvement in Solanaceae, Cucurbitaceae, Alliaceae

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of Chenopodiaceae: Solanaceae: Potato, Chilli, Tomato and Brinjal; Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic.

Practical schedule

1. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Poaceae: Rice.
2. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Wheat
3. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Maize.
4. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Sorghum.
5. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Pearl millet.
6. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Finger millet.
7. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Papilionaceae: Redgram, Bengal gram and Soybean.
8. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Papilionaceae: Blackgram, Greengram, Cowpea, Lab-lab, Horse gram and Groundnut.
9. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Pedaliaceae: Gingelly
10. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Asteraceae: Sunflower and Safflower
11. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Brassicaceae: Rapeseed and Mustard, Cabbage, Cauliflower, Malvaceae: Bhendi.
12. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Solanaceae: Potato, Chilli, Tomato and Brinjal.
13. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids in Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic
14. Visit to seed production plot and visit to AICRP centres.

Reference

1. Singh, B.D. 2005. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
2. Phundhan Singh. 2001. Essentials of plant breeding, Kalyani publishers, New Delhi.
3. Grierson D. 2012. *Plant Genetic Engineering*. Springer Netherlands. Lal R & Lal S. 1990. *Crop Improvement Utilizing Biotechnology*. CRC Press.

Text book

1. Chopra, V. L. 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Sharma, J. R. 1994. Principles and practice of plant breeding Tata McGraw-Hill publishing Co., New Delhi.

3. 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.
Sons, New Delhi.

AGR18R356	ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS MANAGEMENT	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agrienterprises.

UNIT III

Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation).

UNIT IV

Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill.

UNIT V

Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri entrepreneurship and rural enterprise.

PRACTICAL SCHEDULE

Assessing of

1. Entrepreneurial traits.
2. Problem solving skills.
3. Managerial skills.
4. Achievement motivation.
5. Exercise in creativity.
6. Time audit through planning.
7. Monitoring and supervision.
8. Identification of business idea.
9. Selection of business idea.
10. Preparation of business plan.

TEXT BOOKS

1. Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
2. Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, 'Production and Operations Management - Manufacturing and service, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Aswathappa, K, Human Resource Management: Text and Cases, Tata McGraw-Hill Pub. Co. Ltd. New Delhi, 5th Edition, 2008.

REFERENCE BOOKS

1. Philip Kotler, Marketing Management, Pearson Education, India, 2003.
2. Chandra Prasanna. 2000. Financial Management - Theory and Practice. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
3. R.K.Sapru, Project Management, Excel Books, New Delhi, 1997.

AGR18R357	GEOINFORMATICS AND NANO –TECHNOLOGY AND PRECISION FARMING	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS.

UNIT III

Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions.

UNIT IV

Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture.

UNIT V

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

PRACTICAL SCHEDULE

1. Introduction to GIS software and spatial data creation and editing.
2. Introduction to image processing software and visual and digital interpretation of remote sensing images.
3. Familiarization with different remote sensing equipments and data products.
4. Interpretation of aerial photographs and satellite data for mapping of land resources.
5. Visual and digital interpretation of remote sensing images.
6. Generation of spectral profiles of different objects.
7. Supervised and unsupervised classification and acreage estimation.
8. Use of GIS for soil spatial simulation and analysis.
9. Multispectral remote sensing for soil mapping.
10. Creation of thematic layers of soil fertility based on GIS and Creation of productivity and management zones using GIS.
11. Fertilizers recommendations based of VRT and STCR techniques.
12. Crop stress (biotic/abiotic) monitoring using geospatial technology.
13. Use of GPS for agricultural survey.
14. Formulation, characterization and applications of nanoparticles in agriculture.
15. Projects formulation and execution related to precision farming.
16. Visit to nanotechnology centre.

REFERENCE BOOKS

1. Burrough. P.A. 1983. Geographical information systems for natural resource assessment. Newyork, Oxford University press.
2. Burrough. P.A. 1986. Principles of Geographical information systems for land resource assessment. Clarendon Press, Oxford.
3. Chrisman. N.R. 1997. Exploring Geographic information systems, Johny wiley and sons, Newyork.
4. Curran. P. 1989. Principles of Remote sensing. Longman, London.
5. Joseph, T. and Morrison, M. 2006. Nano Technology in Agriculture and Food. anoforum.org.

AGR18R381	PRACTICAL CROP PRODUCTION – I (FOOD CROPS)	L	P	C
		0	2	2

PRACTICAL SCHEDULE

1. Crop planning, raising field crops in multiple cropping system,
2. Field preparation, seed treatment, nursery raising and sowing
3. Nutrient and water management,
4. Weed management and management of insect pests and diseases of crops.
5. Sowing of crops and observation of germination.
6. Thinning and gap filling. Intercultural operations - hoeing and weeding. Intercultural operations-hoeing and weeding. Water management - application of irrigation water and demonstrating methods of irrigation.
7. Top dressing of fertilizer (urea).
8. Insect and pest management (control) - application of insecticides.
9. Disease management (control) - application of fungicides.
10. Harvesting. Threshing, winnowing and storage. Marketing of produce.
11. Preparation of balance sheet including estimating cost of cultivation and net return per student as well as per team of a group of student.
12. Listening and note taking. Writing skills, oral presentation skills.
13. Field diary and ledger record, indexing, footnote and bibliographic procedures. Summarizing, abstracting. Individual and group presentation. Practice on SWOT Analysis.
14. Entrepreneurship development Programmes - SWOT analysis, generation, incubation and commercialization of ideas and innovations.
15. Government schemes and incentives for promotion of entrepreneurship.
16. Government Policy on Small and Medium Enterprises (SMEs)/SSIs.
17. Export and Import Policies. Contract farming and joint ventures, public- private partnerships.

REFERENCE BOOKS

1. Yawalkar, K.S. Agarwal J.P. and Bokde S. 1992. Manures and Fertilizers. Agri-Horticultural Pub. House, Nagpur – India.
2. Balasubramaniam, P. And Palaniappan, S.P. 2001. Principles and Practices of Agronomy. Agrobios (India), Jodhpur.
3. Reddy, S.R. 2000. Principles of Agronomy. Kalyani Publishers, New Delhi.
4. Singh, S.S. 1993. Principles and Practices of Agronomy. Kalyani Publishers, New Delhi.

AGR18R301	INTELLECTUAL PROPERTY RIGHTS	L	P	C
		1	0	1

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

REFERENCE BOOKS

1. Acharya, N. K. 2014. *Text Book of Intellectual Property Rights*. Asia Law House, Hyderabad.
2. Adukia, R.S. 2013. *Handbook on Intellectual Property Rights in India*. Jain Book Depot. New Delhi.
3. Catherine, J. 2007. *Intellectual property: patents, trademarks, copyrights, trade secrets*. Entrepreneur Press, Holland.
4. Elsy, C. R., Thomas, J. K. and Mohandas, H. 2006. *Primer on IPR in Agriculture*. Kerala Agricultural University, Vellanikkara.
5. Elsy, C. R., Joseph, J. and Thomas, J. K. 2014. *Protection and Management of IPR in Agriculture*. Kerala Agricultural University, Vellanikkara.
6. GOI. 2001 *The Protection of Plant varieties and Farmers Rights*. The Gazette of India 2(1) Ministry of Law, Justice and Company Affairs, GOI, New Delhi.
7. GOI. 2003. *The Biological Diversity Act, 2002*. The Gazette of India II (1) Ministry of Law, GOI, New Delhi.
8. Karki, M. M. S. 2009. *Intellectual Property Rights: Basic Concepts*. Atlantic Publishers, Mumbai.
9. Rosedar S.R.A. 2014. *Intellectual Property Rights(1stEd.)* LexisNexis.

IMPORTANT WEBSITES

1. www.ipindia.nic.in – CGPDT, India.
2. www.patentoffice.nic.in – Patent office, India.
3. <http://copyright.gov.in/> - Copyright Office, India.
4. www.plantauthority.gov.in – Plant Varieties and Farmers' Rights Authority, India.
5. <http://nbaindia.org/> - National Biodiversity Authority.
6. www.nipo.in – The Indian IPR Foundation.

SEMESTER-VI

AGR18R358	RAINFED AGRICULTURE AND WATERSHED MANAGEMENT	L	P	C
		1	1	2

THEORY

UNIT I

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India.

UNIT II

Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio-morphological characteristics of the plants.

UNIT III

Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices.

UNIT IV

Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions.

UNIT V

Concept, objective, principles and components of watershed management, factors affecting watershed management.

PRACTICAL SCHEDULE

1. Studies on climate classification.
2. Studies on rainfall pattern in rainfed areas of the country.
3. Pattern of onset and withdrawal of monsoons.
4. Working out drought years from rainfall data.
5. Effective rainfall and its calculation.
6. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.
7. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.
8. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation.
9. Studies on cultural practices for mitigating moisture stress.
10. Characterization and delineation of model watershed.
11. Field demonstration on soil & moisture conservation measures.
12. Field demonstration on construction of water harvesting structures.
13. Field demonstration contour bund and rubble pitched contour bund and intermittent terraces.
14. Visit to rainfed research station/watershed.
15. Delineation and mapping of watersheds.
16. Visit to model watersheds.

REFERENCE BOOKS

1. Singh, R.P. 1995. Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.
2. Singh, S.S. 1993. Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.
3. De, G.C. 1989. Fundamentals of Agronomy Oxford and IBH Publishing Co., New Delhi.
4. Reddy, T.Y. and Reddi, G.H.S. 1992. Principles of Agronomy, Kalyani Publishers, New Delhi.
5. Dhruva Narayan, V.V.; Singh, R.P., Bhardwaj, S.P. Sharma, M. Sikka A.K., Vithal, .P.R. and Das; S.K. 1947. Watershed Management for Drought Mitigation, ICAR Publication.

AGR18R359	PROTECTED CULTIVATION AND SECONDARY AGRICULTURE	L	P	C
		1	1	2

THEORY

UNIT I

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.

UNIT II

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

UNIT III

Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

UNIT IV

Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer).

UNIT V

Material handling equipment; conveyer and elevators, their principle, working and selection.

PRACTICAL SCHEDULE

1. Study of different type of green houses based on shape.
2. Determine the rate of air exchange in an active summer winter cooling system.
3. Determination of drying rate of agricultural products inside green house.
4. Study of green house equipments.
5. Visit to various Post Harvest Laboratories.
6. Study of special cultural practices for production of vegetable crops under protected cultivation.
7. Study of different media, solarization and fumigation for green house cultivation.
8. Determination of Moisture content of various grains by oven drying & infrared moisture methods.
9. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).
10. Determination of Moisture content of various grains by moisture meter.
11. Field visit to seed processing plant.
12. Visit to protected culture units.
13. Canopy management in precision farming.
14. Practicing design and layout of precision farming system.
15. Water use efficiency in annual, perennials and landscape horticulture.
16. Visit to commercial computerized irrigation control unit.

REFERENCE BOOKS

1. Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.
2. Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.

FURTHER READING

1. Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.
2. David Reed. 1996. Water, media and nutrition for green house crops. Ball publishing USA.
3. Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.

AGR18R360	DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT - II	L	P	C
		2	1	3

THEORY

UNIT I

Symptoms, etiology, disease cycle and management of following diseases: Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng.

UNIT II

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

UNIT III

Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose.

UNIT IV

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

UNIT V

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

PRACTICAL SCHEDULE

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

1. Classification and grouping of fungicides.
2. Preparation of Bordeaux mixture (1%), Bordeaux paste (10%), and delivery system and calculation of recommended dose of fungicides.
3. Mass multiplication of *Trichoderma viride* and methods of application.
4. Mass multiplication of *Pseudomonas fluorescens*, *Bacillus subtilis* and methods of application.
5. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
6. Survey and Assessment of important plant diseases.
 - a. Study of diseases symptoms and **host-parasite relationship of:**
7. Rice, wheat and maize.
8. Sorghum.
9. Pearl millet, ragi and small millets.
10. Pigeonpea, urdbean, mungbean, chickpea, field bean and soybean.
11. Groundnut and gingelly.

12. Castor, sunflower, linseed, safflower and mustard.
13. Field visit.
14. Cotton and jute.
15. Sugarcane and sugar beet.
16. Tobacco, jatropa and mulberry.
17. Horticultural crops

REFERENCE BOOKS

1. Agrios, G. N. 2008. Plant Pathology, 5th edition, Academic Press, New York.
2. Chaube H.S and Pandhir. 2005. Crop diseases and their management. Prentice hall of India Pvt.Ltd.New Delhi.
3. Dube, H.C. 2009. A text book of fungi, bacteria and viruses. Vikas publishing house Pvt. Ltd., New Delhi.
4. Mehrota, R.S. 1980. Plant Pathology, Tata Mc Grow Mill Pub. Co., New Delhi, pp. 771.
5. Narayanasamy, P. 2011. Microbial plant pathogens detections and disease diagnosis Vol. I. Springer publication.
6. Nene, Y.L. and Thapliyal, P.N. 1998. Fungicides in plant disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
7. Prakasam, V., Valluvaparidasan, V., Raguchander, T. and K. Prabakar. 1997. Field crop diseases, AE Publication, Coimbatore.
8. Prakasam, V., T.Raguchander and K.Prabakar, 2006. Applied Plant Pathology, A.E. publications, Coimbatore.
9. Rangaswami, G. 2005. Diseases of Crop plants in India. Prentice Hall of India Pvt. Ltd., New Delhi pp. 504.
10. Singh, R.S .1993. Plant Diseases, Oxford &IBH Publication, New Delhi.

FURTHER READING

1. Chattopadhyay, S.G. 1998. Principles and procedure of plant protection. Oxford and IBH publishing Co. Ltd., New Delhi.
2. Dickson. J.G. 1997. Diseases of field crops, Daya Publishing House, New Delhi.
3. Gupta V.K and Paul V.S 2004 Fungi and Plant diseases.Kalyani Publishers. New Delhi.

AGR18R361	POST - HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES	L	P	C
		1	1	2

THEORY

UNIT I

Importance of post-harvest processing 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

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

UNIT III

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

UNIT IV

Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying.

UNIT V

Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products.

PRACTICAL SCHEDULE

1. Applications of different types of packaging, containers for shelf life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Determination of physiological loss in weight and quality.
4. Assessment of physical, physiological and biochemical changes during ripening.
5. Assessment of maturity indices and methods of harvest.
6. Pre-harvest treatments to enhance the postharvest life.
7. Sorting, grading and washing of horticultural produce.
8. Post-harvest treatments enhance the postharvest life and packaging of fruits, vegetables, cut flowers, dry flowers and medicinal plants using different packing materials.
9. Demonstration of chilling and freezing injury in vegetables and fruits.
10. Extraction and preservation of pulps and juices.
11. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products.
12. Quality evaluation of products -- physico-chemical and sensory.
13. Packaging of cut flowers and dry flowers using different packing materials and vase life of cut flowers.
14. Packaging of medicinal and aromatic plants using different packing materials.

15. Waxing and methods of storage and drying technology of medicinal plants and postharvest disorders.
16. Visit to processing unit/ industry/ visit to cold storage, processing units and markets.

REFERENCE BOOKS

1. Salunkhe, D. K., N. R. Bhatt, B. B. Desai. 1990. Post harvest biotechnology of flowers and ornamental plants, Nayaprakash, Calcutta –700 006.
2. Saraswathy, S., T.L.Preethi, S.Balasubramanyan, J.Suresh, N.Revathy and S.Natarajan. 2007. Postharvest management of Horticultural Crops. Agrobios Publishers, Jodhpur.

AGR18R362	MANAGEMENT OF BENEFICIAL INSECTS	L	P	C
		1	1	2

THEORY

UNIT I

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee.

UNIT II

Role of pollinators in cross pollinated plants. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.

UNIT III

Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

UNIT IV

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

UNIT V

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

PRACTICAL SCHEDULE

1. Honey bee species, castes of bees.
2. Beekeeping appliances and seasonal management, bee enemies and disease.
3. Bee pasturage, bee foraging and communication.
4. Types of silkworm, voltinism and biology of silkworm.
5. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves and Species of lac insect, host plant identification.
6. Identification of other important pollinators, weed killers and scavengers.
7. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.
8. Identification and techniques for mass multiplication of natural enemies.
9. Visit to IPM laboratory.
10. Study of sampling techniques for the estimation of insect population. Practicable IPM practices.
11. Botanical insecticides- Neem based products Chemical control- Insecticides and their formulations.
12. Calibration of spray equipments. Calculation of doses/concentrations of insecticides. Calculation of doses/concentrations of insecticides. IPM case studies of one important field crop.
13. Poison bait preparation for rodent control and its application.

14. Rearing technique for honeybees. Rearing technique for silkworm. Rearing technique for lac insect.
15. Pest surveillance through light traps, pheromone traps and field incidence.
16. Rearing technique for silkworm/lac insect.

REFERENCE BOOKS

1. Metcalf, R.L and Luckman W.H. 1982. Introduction to Insect Pest Management. Wiley Inter Science publishing, New York.
2. G.S.Dhaliwal and Ramesh Arora. 2001. Integrated Pest Management. Concepts and Approaches. Kalyani publishers, New Delhi.
3. Larry P. Pedigo. 1991. Entomology and Pest Management. Mc Millan publishing company, New york.
4. Yazdani G.S. and Agarwal M.L. 1979. Elements of Insect Ecology. Naroji publishing house, New Delhi.

AGR18R363	CROP IMPROVEMENT – II (COMMERCIAL CROPS)	L	P	C
		1	1	2

THEORY

Unit I: Crop Improvement in Fiber and Oil Crops

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of fiber crops: Cotton, Jute and Mesta; Oil crops: Jatropha and castor.

Unit II: Crop Improvement in Fodder and Forage Crops

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of Fodder and Forage crops: *Cenchrus* and Guinea Grass, Napier, Pearl Millet-Napier, Cowpea, Desmanthus, Lucerne and Subabul.

Unit III: Crop Improvement in Narcotics, Green and Green Leaf Manures

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of Green and Green leaf manures crops: Daincha, Sunhemp, *Tephrosia purpurea* (Kolinji) and Glyricidia; Narcotics: Tobacco.

Unit IV: Crop Improvement in Sugar and Floral Crops

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of the crops Sugar crops: Sugarcane and Sugarbeet; Floral crops: Jasmine and Chrysanthemum.

Unit V: Crop Improvement in Plantation and Tuber crops

Centres of origin, distribution of species, wild relatives, 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); Hybrid seed production technology of the crops Coffee; Tea, Coconut, Arecanut and Oilpalm; Tubers: Tapioca.

Practical Schedule

1. Floral biology, emasculation, hybridization techniques and parentage of released varieties/hybrids sugarcane.

2. Floral biology, emasculation, hybridization techniques and parentage of released varieties in forage and fodder crops.
3. Floral biology, emasculation, hybridization techniques and parentage of released varieties in cotton.
4. Floral biology, emasculation, hybridization techniques and parentage of released varieties in jute and mesta.
5. Floral biology, emasculation, hybridization techniques and parentage of released varieties in green manure and green leaf manure crops.
6. Floral biology, emasculation, hybridization techniques and parentage of released varieties in cashew.
7. Floral biology, emasculation, hybridization techniques and parentage of released varieties in banana.
8. Floral biology, emasculation, hybridization techniques and parentage of released varieties in tapioca and sweet potato.
9. Floral biology, emasculation, hybridization techniques and parentage of released varieties in castor and jatropha.
10. Floral biology, emasculation, hybridization techniques and parentage of released varieties in jasmine and chrysanthemum.
11. Floral biology, emasculation, hybridization techniques and parentage of released varieties in plantation crops.
12. Estimation of Heterosis and Inbreeding Depression.
13. Lay out of field experiments and study of field techniques for seed production.
14. Visit to seed production plots and visit to AICRP centres.

REFERENCE BOOKS

1. Singh, B.D. 2005. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
2. Phundhan Singh. 2001. Essentials of plant breeding, Kalyani publishers, New Delhi.
3. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot. Chennai – 15.

TEXT BOOKS

1. Chopra, V. L. 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Sharma, J. R. 1994. Principles and practice of plant breeding Tata McGraw-Hill publishing Co., New Delhi.
3. Allard, R. 1989. Principles of plant breeding. John Wiley and Sons, New Delhi.

AGR18R382	PRACTICAL CROP PRODUCTION – II (COMMERCIAL CROPS)	L	P	C
		0	2	2

PRACTICAL SCHEDULE

1. Identification of sugar crops, fibre, forage, green manure and narcotics in the crop cafeteria.
2. Nursery preparation and management for Sugarcane and Tobacco.
3. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations.
4. Acquiring skill in different seed treatment techniques and foliar nutrition of crops.
5. Estimation of plant population per unit area for crops.
6. Acquiring skill in after - cultivation practices in sugarcane - detrashing, Cotton – earthing up, Tobacco - topping.
7. Study on growth parameters of sugar, fibre, forage crops, Greenmanures and narcotics.
8. Study on yield parameters and estimation of yield in sugar / fibre.
9. Study on yield parameters and estimation of yield in forage and narcotics.
10. Cost and returns of important sugar, fibre forage and narcotics.
11. Visit to Sugarcane Breeding Institute/ Research Station to study cultivation of sugarcane and its by products.
12. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products.
13. Visit to - Cotton Research Station, nearby ginning factory and Tobacco curing centre.
14. Visit to Dairy Unit / farmers field to acquire skill in hay, silo and silage making.
15. Visit to farmers field to study sugarcane and cotton based cropping systems.
16. On / Off Farm visit to study forage crops and green manures.

REFERENCE BOOKS

1. Agarwal, P.C. 1990. *Oilseeds in India*. Oxford and IBH, New Delhi.
2. Balasuramaniyan, P. and Palaniappan, S.P. 2003. *Principles and Practices of Agronomy*. Agrobios (India).
3. Barnes, A.C. 1964. *The Sugarcane*. Interscience Publishers, New Delhi.
4. Das, P.C. 1997. *Oilseed Crops of India*, Kalyani Publishers., New Delhi.
5. ICAR. 2013. *Hand Book of Agriculture*. ICAR, New Delhi.
6. KAU. 2016. *Package of Practices Recommendations – Crops*. Directorate of Extension, Kerala Agricultural University, Thrissur.
7. Lekshmikantan, M. 1983. *Technology in Sugarcane Growing*. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi.

AGR18R364	PRINCIPLES OF ORGANIC FARMING	L	P	C
		1	1	2

THEORY

UNIT I: Organic farming - Concepts and principles

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: Integrated Farming System approach – organic carbon: status and improvement strategies – conservation tillage.

UNIT II: Nutrient sources

Organic sources of nutrients – 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: Pest and disease management

Bio intensive pest and diseases management - physical, cultural, mechanical and biological methods – non-chemical weed management methods: preventive, physical, cultural, mechanical and biological control measures - good crop husbandry practices.

UNIT IV: Certification and exports

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

UNIT V: ITK

Indigenous Technical Knowledge (ITK) in organic agriculture – rationale and principles – soil, nutrient, weed, water, pest and disease management – benefits and problems in organic farming: promotional activities – economic evaluation of organic production systems.

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 raising 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. Exposure visit to bio-pesticide and pheromone manufacturing units.
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. Exposure on macro quality analysis of crop produces in laboratories.

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.

REFERENCE BOOKS

1. Nicholas Lampkin. 1994. Organic Farming. Farming Press London.
2. Arunkumar Sharma. 2008. A Hand book of Organic Farming. Agrobios Publishers.
3. Dahama, A.K. 2009. Organic Farming for Sustainable Agriculture, Agrobros publishers.
4. Veeresh, G.K. 2010. Organic Farming, Cambridge University Press.
5. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. Scientific Publishers.
6. Stockdale, E *et al.*, 2000. Agronomic and Environmental Implications of Organic Farming Systems. Advances in Agronomy, 70, 261-327.

Web resources

1. www.apeda.org
2. www.cowindia.org
3. www.earthfooda.co.uk
4. www.Newfarm.org/training
5. www.organicaginfo.org

AGR18R365	FARM MANAGEMENT, PRODUCTION AND RESOURCE ECONOMICS	L	P	C
		1	1	2

THEORY

UNIT I: Nature and Scope

Production Economics : Meaning - Definition – Nature and Scope - Farm Management: Definition - Objectives of Farm Management - Production Economics Vs Farm Management - Farm Management Decisions - Decision making process - Scope of farm management - Types and systems of farming: types - specialized and diversified - mixed – systems of farming – peasant farming – state farming – capitalistic – collective - co-operative farming.

UNIT II: Factor - Product Relationship

Factor - Product relationship: Meaning - Agricultural Production Function: Meaning – Definition - Laws of returns: increasing, constant and decreasing returns - Classical production function and three stages of production – Elasticity of production – Types/Forms of Production functions - Linear, Cobb - Douglas and Quadratic – Cost concepts and cost curves: total, average and marginal cost – Economics of scale - Determination of optimum input and output - physical and economic optimum.

UNIT III: Factor- Factor Relationship

Factor-factor relationship: Meaning - isoquant – definition and types - isoquant map - marginal rate of technical substitution - factor intensity - isocline- ridge line - returns to scale – elasticity of factor substitution - iso-cost line – principle of factor substitution and least cost combination of inputs – Expansion path - Effect of input price changes on the least cost combination.

UNIT IV: Product-Product Relationship

Product-product relationship: Meaning – production possibility curve – marginal rate of product transformation - Enterprise relationship: joint products – complementary – supplementary – competitive products – iso-revenue line – optimum combination of products – principle of equi-marginal returns – Principle of opportunity cost.

UNIT V: Farm Planning and Budgeting

Farm planning: importance – characteristics of good farm plan – farm planning procedure – Budgeting: definition and types – complete budgeting – partial budgeting – enterprise budgeting – cash flow budgeting – limitations of budgeting – Linear programming: Assumptions – Linear programming model defined – graphical solution - advantages and limitations – Risk and uncertainty: definition – types of risk and uncertainty – safeguards against risk and uncertainty.

PRACTICAL SCHEDULE

1. Estimation of optimum input – output combination.
2. Determination of least - cost combination.
3. Determination of optimum product combination.
4. Computation of cost concepts - cost of cultivation and cost of production of agricultural crops.
5. Cost of cultivation and production of perennial crops/horticultural crops.

6. Cost of production of livestock products.
7. Depreciation: methods of calculating depreciation.
8. Visit to a farm (government/private/corporate) to study the layout and organization.
9. Farm records and accounts: Usefulness, types of farm records–farm production records - farm financial records.
10. Visit to a private agricultural farm to collect information on farm business.
11. Farm inventory analysis: Examination of assets – valuation of assets by different methods.
12. Preparation and analysis of Net worth statement and Profit and loss statement.
13. Estimation of Break - even analysis.
14. Preparation of complete budget and partial budgets.
15. Preparation of farm plan.
16. Graphical solution to Linear programming problem.

REFERENCE BOOKS

1. Sankayan, P.L. 1983. Introduction to Farm Management, (New Delhi: Tata Mc Graw Hill Publishing Company Ltd).
2. Johl SS & Kapoor TR. 1973. Fundamentals of Farm Business Management. Kalyani Publ.India.
3. Kahlon AS & Singh K. 1992. Economics of Farm Management in India. Allied Publ. New Delhi.
4. Doll, J.P. and F. Orazem. 1983. Theory of Production Economics with Applications to Agriculture. John Wiley, New York.
5. Debertin, D.L. 1986. Agricultural Production Economics. Macmillan, New York.
6. Heady, E.O. and H.R. Jensen. 1954. Farm Management Economics, Prentice - Hall, Englewood Cliffs.
7. Jensen, H.R. 1977. 'Farm Management and Production Economics, 1946-70', A Survey of Agricultural Economics Literature, University of Minnesota Press, Minneapolis, Vol. 1, pp. 1-89.
8. Kay, Ronald D., and William M. Edwards, and Patricia Duffy. 2004. Farm anagement, Fifth Edition, McGraw-Hill, Inc., New York.
9. Panda SC. 2007. Farm Management & Agricultural Marketing. Kalyani Publ. Ludhiana India.

AGR18R302	PRINCIPLES OF FOOD SCIENCE AND NUTRITION	L	P	C
		2	0	2

THEORY

UNIT I

Introduction: Scenario of fruit and vegetable production and processing at national and international level - contribution of horticulture produces to human nutrition: nutritive value, nutraceutical properties – concept, principles and scope of processing and value addition of horticultural produces. Tools, equipments, lay out and other requirements of a small scale food processing unit.

UNIT II

Processing using sugar: principle – processing of jam, jelly, marmalade, squash, RTS, nectar, fruit bar, preserves and candies. Processing using salt: Principle – brining preservation of horticultural produces - preparation of pickles and sauces.

UNIT III

Drying and dehydration: definition, principle, method, suitability – Types of driers: solar, cabinet, spray drier, drum drier, fluidized bed drier, freeze drying - methods of concentration: open kettle, flash evaporators – equipments used. Processing of dehydrated fruit, vegetable and spice products, fruit pulps. Canning: principles, methods – preparation of canned products - spoilage of canned foods and its prevention.

UNIT IV

Preservation by low temperature: definition, principle, method, suitability – refrigeration, freezing - preparation of frozen foods – preservation by controlled atmosphere, modified atmosphere: definition, principle, method, suitability – processing by irradiation: definition, principle, method, suitability – application of irradiation in food industry.

UNIT V

Minimal processing of fruits and vegetables – techniques involved. Recent trends in processing – high pressure processing and processing using pulse electric field. Utilization of fruit and vegetable waste.

PRACTICAL SCHEDULE

1. Market survey of processed foods.
2. Packaging and evaluation of the shelf life of fruits at different temperatures.
3. Packaging and evaluation of the shelf life of vegetables at different temperatures.
4. Packaging and evaluation of the shelf life of fruits and vegetables under CAP and MAP.
5. Processing of jam and jelly.
6. Processing of squash and RTS.
7. Processing of fruit bar and candies.
8. Processing of pickles and sauces.
9. Steeping preservation of fruits and vegetables.
10. Processing of osmo dried fruit slices.
11. Processing of dehydrated vegetables.
12. Processing of dehydrated spices.
13. Canning of fruits.

14. Canning of vegetables.
15. Processing of frozen fruits and vegetables.
16. Visit to fruit and vegetable processing unit.

REFERENCE BOOKS

1. Baniji, S.M., Krishnaswamy, K. and Brahmam, G. N.V. 2013. *Text book of Human Nutrition*. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. *Dietary Guidelines for Indians- A Manual*. 2010. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.
3. Lal, G.,Siddappa, G.S. and Tandon, G.L. 1998. *Preservation of Fruits and Vegetables*. Published by ICAR, New Delhi.
4. *Nutrient Requirement and Recommended Dietary Allowances for Indians*. 2010. National Institute of Nutrition, Indian Council of Medical Research, New Delhi.
5. Srilakshmi, B. 2009. *Nutrition Science*. New Age International (P) Limited, Publishers, New Delhi.
6. Srilakshmi, B. 2010. *Food Science*. New Age International (P) Limited, Publishers, New Delhi.
7. Swaminathan, M. 2011. *Hand book of Food and Nutrition*. The Bangalore Printing and Publishing Company Ltd, Bangalore.

SEMESTER VIII

S. No.	SUB. CODE	SUBJECT NAME	L	P	C
1.	AGR18R482	Modules for Skill Development and Entrepreneurship -I	0	10	10
2.	AGR18R483	Modules for Skill Development and Entrepreneurship -II	0	10	10
		Total	0	20	20

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

S. No.	Course Code	Title of the module	L	P	C
1.		Production Technology for Bioagents and Biofertilizers	0	10	10
2.		Seed Production and Technology	0	10	10
3.		Mushroom Cultivation Technology	0	10	10
4.		Soil, Plant, Water and Seed Testing	0	10	10
5.		Poultry Production Technology	0	10	10
6.		Commercial Horticulture	0	10	10
7.		Floriculture and Landscaping	0	10	10
8.		Food Processing	0	10	10
9.		Agricultural Waste Management	0	10	10
10.		Organic Production Technology	0	10	10
11.		Commercial Sericulture	0	10	10
12.		Commercial Bee Keeping	0	10	10

Evaluation of Experiential Learning Programme/HOT

Sl. No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output Delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business Networking Skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	100

	PRODUCTION TECHNOLOGY FOR BIO-AGENTS AND BIO-FERTILIZERS	L	P	C
		0	10	10

	SEED PRODUCTION TECHNOLOGY	L	P	C
		0	10	10

	MUSHROOM CULTIVATION	L	P	C
		0	10	10

	SOIL, PLANT, WATER AND SEED TESTING	L	P	C
		0	10	10

	POULTRY PRODUCTION TECHNOLOGY	L	P	C
		0	10	10

	COMMERCIAL HORTICULTURE	L	P	C
		0	10	10

	FLORICULTURE AND LANDSCAPING	L	P	C
		0	10	10

	FOOD PROCESSING	L	P	C
		0	10	10

	AGRICULTURAL WASTE MANAGEMENT	L	P	C
		0	10	10

	ORGANIC PRODUCTION TECHNOLOGY	L	P	C
		0	10	10

	COMMERCIAL SERICULTURE	L	P	C
		0	10	10

	COMMERCIAL BEE KEEPING	L	P	C
		0	10	10

AGR18R266	AGRI-BUSINESS MANAGEMENT	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.

UNIT III

Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans.

UNIT IV

Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness.

UNIT V

Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

PRACTICAL SCHEDULE

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

REFERENCE BOOKS

1. Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
2. Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, 'Production and Operations Management - Manufacturing and service, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Aswathappa, K, Human Resource Management: Text and Cases, Tata McGraw-Hill Pub. Co. Ltd. New Delhi, 5th Edition, 2008.
4. Philip Kotler, Marketing Management, Pearson Education, India, 2003.
5. Chandra Prasanna. 2000. Financial Management - Theory and Practice. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
6. R.K.Sapru, Project Management, Excel Books, New Delhi, 1997.

AGR18R267	LANDSCAPING	L	P	C
		2	1	3

THEORY

UNIT I

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

UNIT II

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

UNIT III

Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents.

UNIT IV

Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping.

UNIT V

Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

PRACTICAL SCHEDULE

1. Identification of trees, shrubs, annuals, pot plants.
2. Propagation of trees, shrubs and annuals.
3. Care and maintenance of plants, potting and repotting.
4. Identification of tools and implements used in landscape design, training and pruning of plants for special effects.
5. Lawn establishment and maintenance.
6. Layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden).
7. Designing of conservatory and lathe house.
8. Use of computer software.
9. Visit to important gardens/ parks/ institutes.

REFERENCE BOOKS

1. Randhawa, G.S. and A. Mukhopadyay. 1998. Floriculture in India. Allied publishers Limited, New Delhi.

2. K.M.P. Nambisan 1992 – Design elements of landscape gardening – Oxford and IBH publishing Co, New Delhi.
3. Lancaster, P. 1991. Gardening in India. Oxford and IBH publishers Pvt. Ltd., Calcutta.
4. Gopalsamy Iyengar. 1990. Complete gardening in India. IBH. Bangalore.

TEXT BOOKS

1. McCarty, L.B. 2005. Best Golf Course Management Practices. 2nd Edition. Pearson Prentice Hall, Upper Saddle River, NJ.
2. S.K. Bhattacharjee, 2004. Landscape Gardening and Design with plants. Aavishkar Publishers and Distributors, Jaipur.

AGR18R268	AGRICULTURAL JOURNALISM	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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.

UNIT III

Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story.

UNIT IV

Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources. Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures.

UNIT V

Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.) writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outting.

PRACTICAL SCHEDULE

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

AGR18R269	AGROCHEMICALS	L	P	C
		2	1	3

THEORY

UNIT I

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.

UNIT II

Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides-Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb.

UNIT III

Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids. Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

UNIT IV

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassiumchloride, potassium sulphate and potassium nitrate.

UNIT V

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

PRACTICAL SCHEDULE

1. Sampling of fertilizers and pesticides.
2. Pesticides application technology to study about various pesticides appliances.
3. Quick tests for identification of common fertilizers.
4. Identification of anion and cation in fertilizer.
5. Calculation of doses of insecticides to be used.
6. To study and identify various formulations of insecticide available kin market.
7. Estimation of nitrogen in Urea.

8. Estimation of water soluble P₂O₅ and citrate soluble P₂O₅ in single super phosphate.
9. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer.
Determination of copper content in copper oxychloride.
10. Determination of sulphur content in sulphur fungicide.
11. Determination of thiram.
12. Determination of ziram content.

REFERENCE BOOKS

1. Handa.S.K.2004.Principles of Pesticide Chemistry.Agrobios.
2. Cremllyn, R.J. 1991. Agrochemicals – Preparation and mode of action. John Wiley and sons, New york.
3. Dutcher R.A., Jensen C.O. and Alttiouse P.M. 1951. Introduction to Agricultural Biochemistry – John Wiley & Sons Inc., New York.
4. Friend J.And Rhodes M.J.C., 1981. Recent Advances in the Biochemistry of Fruits and Vegetables – Academic Press, London.
5. George W.Ware, 1986. Fundamentals of Pesticides – A Self Instruction Guide – Thomas Publications, PO Box.9335, Freno, California 93791.
6. Hulme A.C., 1970. The Biochemistry of Fruits and their Products Vol.I & II – Academic Press, London.
7. Hulse J.H., Laing E.M. and Peasson C.E., 1980. Sorghum and Millets, their Composition and Nutritive Value – Academic Press, London.
8. Rameshwar A., 1993. Outlines of Plant Biochemistry – Noya Prakash, Calcutta.
9. Robert White, Stevens, 1971. Pesticides in the Environment Vol.I and Part I – Marcel Dekker Inc., New York.

AGR18R366	COMMERCIAL PLANT BREEDING	L	P	C
		2	1	3

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

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

UNIT III

Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.

UNIT IV

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

UNIT V

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

PRACTICAL 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, Tools and techniques for optimizing hybrid seed production.
5. Concept of rouging in seed production plot.
6. 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 sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops.
9. Sampling and analytical procedures for purity testing and detection of spurious seed.
10. Seed drying and storage structure in quality seed management.
11. Screening techniques during seed processing viz., grading and packaging.
12. Visit to public private seed production and processing plants.

REFERENCE BOOKS

1. Agarwal, R.L. 1991. SeedTechnology. Oxford & IBH Publishing Co. New Delhi.
2. Chaddha, K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Chopra, V.L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Hallauer A.R. and Miranda, J.B. 1989. Quantitative Genetics in Maize. Iowa State Univ. Press Amesterdum.
5. Poehlman, J.M. 1987. Breeding of Field Crops. Third Edition, AVI Publication, USA.
6. Ram, H.H. 2005. Vegetable Breeding – Principles and Practices. Kalyani Publishers, New Delhi.

AGR18R367	PROTECTED CULTIVATION	L	P	C
		2	1	3

THEORY

UNIT I

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate.

UNIT II

Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation.

UNIT III

Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.

UNIT IV

Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliun, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.

UNIT V

Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

PRACTICAL SCHEDULE

1. Raising of seedlings and saplings under protected conditions.
2. use of protrays in quality planting material production.
3. Bed preparation and planting of crop for production.
4. Inter cultural operations.
5. Soil EC and pH measurement.
6. Regulation of irrigation and fertilizers through drip, fogging ad misting.

REFERENCE BOOKS

1. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999.
2. Chakravarty, A. Oxford and IBH Pub. New Delhi.
3. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.
4. Principles of Agricultural Engineering, Vol. I. 1993. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.

AGR18R368	BIOPESTICIDES & BIOFERTILIZERS	L	P	C
		2	1	3

THEORY

UNIT I

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationals. Botanicals and their uses. Mass production technology of bio-pesticides.

UNIT II

Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides.

UNIT III

Impediments and limitation in production and use of biopesticide. Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia.

UNIT IV

Cynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.

UNIT V

Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers - Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

PRACTICAL SCHEDULE

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

11. Mass production of AM inoculants.

REFERENCE BOOKS

1. DeBach,P. 1974. Biological control by Natural enemies. Cambridge University Press.
2. Manfred Mackaur, Laster E.Ehler and Jens Roland. 1990. Critical Issues in Biological control- Intercept Ltd.
3. Project Directorate of Biological control. 1994. Technology for mass production of Natural enemies. Technical Bulletin.
4. Rabindra, R.J., Kennedy, J.S., Sathaiah, N., Rajasekharan, B. and Srinivasan, M.R. 2001. Microbial control of crop pests. TNAU.
5. Dhaliwal GS & Arora R. 2001. Integrated Pest Management: Concepts and Approaches.KalyaniPubl., New Delhi.
6. Dhaliwal, GS & Koul O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
7. Gautam, R.D. Biological Pest Suppression, Westvill Publising Co., New Delhi.

AGR18R369	MICRO PROPAGATION TECHNOLOGIES	L	P	C
		2	1	3

THEORY

UNIT I

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell).

UNIT II

Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture).

UNIT III

Organogenesis (callus and direct organ formation).

UNIT IV

Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites.

UNIT V

Somaclonal variation, Cryopreservation.

PRACTICAL SCHEDULE

1. Identification and use of equipments in tissue culture Laboratory.
2. Nutrition media composition.
3. Sterilization techniques for media.
4. Containers and small instruments.
5. Sterilization techniques for explants: Seeds, shoot tip and single node.
6. Callus induction.
7. Induction of somatic embryos regeneration of whole plants from different explants.
8. Hardening procedures.

REFERENCE BOOKS

1. Rao, M.M. 1990. Recent Developments in Multiplication of Planting Materials by Greenhouse and Tissue Culture Technologies. Short Course Manual of UAS, Dharward.
2. Sadhu, M.K.1989. Plant Propagation. Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi 110 002.
3. Kumar, U. 2002. Methods in Plant Tissue culture, Second Edition, Agro Bios, Jodhpur.
4. Parthasarathy, V. A. 2001. Biotechnology of Horticultural Crops Vol. I, II & III, Nayoprakash, Calcutta.

AGR18R370	WEED MANAGEMENT	L	P	C
		2	1	3

THEORY

UNIT I

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Weed biology and ecology, crop weed competition and allelopathy.

UNIT II

Concepts of weed prevention, eradication and control. Methods of weed control; physical, cultural, chemical and biological methods. Integrated weed management.

UNIT III

Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Concept of herbicide mixture and utility in agriculture.

UNIT IV

Introduction of selectivity of herbicides. Herbicides absorption and translocation. Mode and mechanism of action of herbicides. Herbicide compatibility with agro-chemicals and their application. Resistance and its management.

UNIT V

Weed management in major field and horticultural crops, shift of weed flora in cropping system, aquatic and problematic weeds and their control.

PRACTICAL SCHEDULE

1. Techniques of weed preservation.
2. Identification, characterization and classification of terrestrial weeds.
3. Identification, characterization and classification of aquatic weeds.
4. Assessment of weed seed bank and seed production of weeds.
5. Calculation of weed control index and weed control efficiency.
6. Study of information about herbicides, labels and herbicides dose.
7. Study of herbicides formulation and mixture of herbicides
8. Study of herbicides application techniques and equipments
9. Working out herbicides spray fluid requirements
10. Shift of weed flora study in long term experiments.
11. Study of physical method of weed control.
12. Study of cultural method of weed control.
13. Study of bio – herbicides in agriculture.
14. Study of phytotoxicity symptoms of herbicides in different crops.
15. Economic analysis of different method of weed control.
16. Visit to farm and identification of weeds.

REFERENCE BOOKS

- 1.Hance, R.J. and K. Holly. 1990. Weed Control Handbook: Principles. Blackwell Scientific Publications, Oxford, London.
- 2.Krieg, A. and J. M. Franj. 1989. Textbook of Biological Pest Control. Verlag Paul Pary, Humberg.
- 3.Musselman, L. J. 1987. Parasitic Weeds in Agriculture. Vol. I. Striga. CRO Press Inc. Florida, US.
- 4.Pierterse, A. H. and K.J. Murphy. 1990. Aquatic Weeds: The Ecology and Management of Nuisance Aquatic Vegetation. Oxford Univ. Press. Oxford. U.K.
- 5.Rao, V. S. 1983. Principles of Weed Science. Oxford and IBH Publishing Co. New Delhi.

TEXT BOOKS

1. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
2. Jaganathan R., and R.Jayakumar, Weed Management, Kalyani Publisher, New Delhi.
3. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1991. All about Weed Control. Kalyani Publishers, New Delhi.
4. Sankara Reddi, G.H. and T.Yellamanda Reddy, 1995. Efficient use of Irrigation Water, Kalyani Publishers, New Delhi.
5. Michael, A.M. 1986. Irrigation Theory and Practices, Vikas, New Delhi.

AGR18R371	SYSTEM SIMULATION AND AGROADVISORY	L	P	C
		2	1	3

THEORY

UNIT I

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.

UNIT II

Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production - concept and modelling techniques for their estimation.

UNIT III

Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification.

UNIT IV

Value added weather forecast, ITK for weather forecast and its validity.

UNIT V

Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

PRACTICAL SCHEDULE

1. Preparation of crop weather calendars.
2. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.
3. Working with statistical and simulation models for crop growth.
4. Potential & achievable production.
5. Yield forecasting, insect & disease forecasting models.
6. Simulation with limitations of water and nutrient management options.
7. Sensitivity analysis of varying weather and crop management practices.
8. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast.
9. Feedback from farmers about the agro-advisory.

REFERENCE BOOKS

1. Adhikary, M.M., Sarkar, A., Acharya, S.K. and Basu, D. 2006. Participatory Planning and Project Management in Extension Sciences Agrotech Publishing Company, Udhapur.
2. De, Dipak, 2011 A handbook of Extension education, JV Publishing House, Jodhpur.
3. Samanta, R.K and Chandra Gowda 2002 KVK- The Capacity Builder of Farmers, New Delhi, B.R. Publishing Corporation.
4. Samanta, R.K. 1991, Agricultural Extension in Changing World Perspective, New Delhi, Uppal Publishing House.

AGR18R372	FOOD SAFETY AND STANDARDS	L	P	C
		2	1	3

THEORY

UNIT I

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters.

UNIT II

Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures.

UNIT III

Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSA.

UNIT IV

Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling.

UNIT V

Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

PRACTICAL SCHEDULE

1. Water quality analysis physico-chemical and microbiological.
2. Preparation of different types of media.
3. Microbiological Examination of different food samples.
4. Assessment of surface sanitation by swab/rinse method.
5. Assessment of personal hygiene.
6. Biochemical tests for identification of bacteria.
7. Scheme for the detection of food borne pathogens.
8. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

REFERENCE BOOKS

1. Inteaz Alli.2004. Food Quality Italics Assurance: Principles and Practices. CRC Press, Boca.
2. Raton, Ronald, H. Schmidt and Gary E. Rodrick. 2003. Food Safety Handbook. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.
3. Hester, R.E. and Harrison R.M. 2001. Food Safety and Food Quality. Royal Society of Chemistry, Cambridge, UK.
4. Michael, M. Cramer. 2013. Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices. CRC Press, Boca Raton, FL, USA.

5. Norman, G. Marriott, and Robert, B. Gravani. 2006. Principles of Food Sanitation, 5th Ed. Springer Science+Business Media, Inc., NY, USA.
6. Hui, Y.H. Bernard L. Bruinsma, J. Richard Gorham, Wai-Kit Nip, Phillip S. Tong and Phil Ventresca. 2003. Food Plant Sanitation. Marcel Dekker, Inc., NY, USA.
7. Singh, B.D. 2014. Biotechnology - Expanding Horizons. Kalyani Publishers, New Delhi.
8. Pepper I.L. and Gerba C.P. 2005. Environmental Microbiology. Laboratory Manual, 2nd Ed. Elsevier Academic Press, Amsterdam.

NON CREDIT COURSES

1. NG18R1001 or 02 and 03-NSS or NCC and Physical Education (0+2)

Theory

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

Following activities are to be taken up under the NSS course:

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

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

2. NCA18R601 Human Value and Ethics (1+0)

Theory

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

3. NG18R4001 Educational Tour (0+2)

Objective:

The course will provide an opportunity to the students to study the functioning of important national and international institutes related to agriculture and allied fields.

Syllabus:

Visit to important National and International institutes related to agriculture, horticulture, forestry and allied fields in various regions of the country. Exposure to varied agro-climatic zones, crops grown, cultivation practices, socio-economic and cultural features of the farming community in different parts of the country.

***Red colour font: The content not present in the KSAH syllabus, which is present in the ICAR 5th Deans committee report (Missing content)**

***Blue colour font: The content present in the KSAH syllabus, which is not present in the ICAR 5th Deans committee repor (Extra content)**

***Black colour font: The content present in the both KSAH syllabus and ICAR 5th Deans committee repor**