



PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014

Curriculum for B.Sc. Horticulture Programme

2016-17 onwards

CURRICULAM

B.Sc. (HORTICULTURE) DEGREE PROGRAMME**DEPARTMENT WISE DISTRIBUTION OF COURSES****ABSTRACT**

Sl. No.	Department / Discipline	No.of Courses	Credit Hours	Total Credits
1.	Horticulture	23	31+32	63
2.	Agronomy	4	4+4	8
3.	Agricultural Economics	2	3+2	5
4.	Agricultural Extension	2	3+2	5
5.	Agricultural Entomology	4	6+4	10
6.	Agricultural Microbiology	1	1+1	2
7.	Agricultural Engineering	1	1+1	2
8.	Genetics and Plant Breeding	3	5+3	8
9.	Seed Science and Technology	1	2+1	3
10.	Soil Science and Agricultural Chemistry	3	3+3	6
11.	Plant Pathology	4	6+4	10
12.	Nematology	1	1+1	2
13.	Bio-Chemistry	1	2+1	3
14.	Crop Physiology	1	1+1	2
15.	Environmental Science	1	1+1	2
16.	Computer Science and Statistics	2	1+2	3
17.	Experiential Learning	2	0+28	28
	Total Credit Courses	56	71+91	162
	Non Credit Courses			
18.	English	2	0+2	2
19.	NSS/NCC	1	0+1	1
20.	PED	1	0+1	1
21.	Short Tour	1	0+1	1
22.	All India Tour	1	0+2	2
	Total Non-Credit Courses	6	0+7	7
	GRAND TOTAL	62	71+98	169

DEPARTMENT WISE DISTRIBUTION OF COURSES

DEPARTMENT OF HORTICULTURE

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
Basic Horticulture				
1.	HOR 101	Fundamentals of Horticulture	2+1	I
2.	HOR 102	Plant Propagation and Nursery Management	1+1	II
3.	HOR 301	Growth and Development of Horticultural Crops	1+1	V
4.	HOR 302	Post Harvest Management of Horticultural Crops	1+1	VI
Vegetable Science				
5.	VSC 101	Production Technology of Tropical and Sub Tropical Vegetables	2+1	II
6.	VSC 201	Production Technology of Temperate Vegetable Crops	1+1	III
7.	VSC 301	Breeding of Vegetable, Tuber and Spice Crops	2+1	V
8.	VSC 302	Crop Production in Vegetable Crops	0+1	V
Fruit Science				
9.	FSC 101	Orchard Management	1+1	II
10.	FSC 102	Production Technology of Tropical and Sub Tropical Fruits	2+1	II
11.	FSC 201	Production Technology of Temperate Fruit Crops	1+1	III
12.	FSC 202	Breeding of Fruit and Plantation Crops	2+1	IV
Floriculture and Landscape Gardening				
13.	FLG 201	Commercial Floriculture	2+1	III
14.	FLG 202	Ornamental Horticulture	2+1	IV
15.	FLG 301	Principles of Landscape Gardening	0+1	V
16.	FLG 302	Breeding and Seed Production of Ornamental Plants	2+1	VI
Spices, Plantation, Medicinal and Aromatic Crops				
17.	SPC 201	Production Technology of Plantation Crops	2+1	III
18.	SPC 202	Production Technology of Spices and Condiments	2+1	III
19.	SPC 301	Production Technology of Medicinal and Aromatic Crops	2+1	V
Food Science				
20.	FSN 211	Fundamentals of Food Technology	1+1	IV
21.	FSN 311	Processing of Horticultural Crops	1+1	VI
Forestry				
22.	FOR 101	Introductory Agroforestry	1+1	I
Rural Work Experience Programme				
23.	HOR 411	Rural Horticultural Work Experience	0+10	VII
		TOTAL	31+32	

DEPARTMENT OF AGRONOMY
AGRONOMY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	AGR 211	Weed management in Horticultural crops	1+1	III
2.	AGR 212	Principles of Agro-Climatology and Water Management	1+1	IV
3.	AGR 311	Introduction to Major Field Crops	1+1	V
4.	AGR 312	Organic Farming in Horticultural Crops	1+1	VI
		TOTAL	4+4	

AGRICULTURAL ENGINEERING

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	AEG 101	Farm Power and Machinery	1+1	II

DEPARTMENT OF PLANT BREEDING AND GENETICS
GENETICS AND PLANT BREEDING

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	GPB 111	Principles of Genetics and Cytogenetics	2+1	I
2.	GPB 211	Principles of Plant Breeding	2+1	III
3.	GPB 311	Principles of Biotechnology	1+1	V
		TOTAL	5+3	

SEED SCIENCE AND TECHNOLOGY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	SST 211	Seed Production of Vegetable, Tuber and Spice Crops	2+1	IV

CROP PHYSIOLOGY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	CRP 111	Introductory Crop Physiology	1+1	I

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY
SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	SAC 101	Introduction to Soil Science	2+1	I
2.	SAC 211	Soil, Plant and Water Analysis	0+1	III
3.	SAC 311	Soil Fertility and Nutrient Management	1+1	V
		TOTAL	3+3	

BIOCHEMISTRY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	BIC 101	Fundamentals of Biochemistry	2+1	II

ENVIRONMENTAL SCIENCE

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	ENS 301	Environmental Science	1+1	VI

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
AGRICULTURAL ECONOMICS

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	AEC 101	Principles of Agricultural Economics	1+1	II
2.	AEC 311	Horti - Business Management	2+1	VI
		TOTAL	3+2	

AGRICULTURAL EXTENSION

Sl.No.	Course No.	Course Title	Cr.Hr.	Semester
1.	AEX 211	Fundamentals of Extension Education	2+1	III
2.	AEX 302	Entrepreneurship Development	1+1	VI
		TOTAL	3+2	

COMPUTER SCIENCE AND STATISTICS

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	COM 111	Computer Applications in Horticulture	0+1	I
2.	STA 201	Applied Statistics	1+1	IV
		TOTAL	1+2	

DEPARTMENT OF AGRICULTURAL ENTOMOLOGY
AGRICULTURAL ENTOMOLOGY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	AEN 111	Fundamentals of Entomology	2+1	II
2.	AEN 211	Insect Pest of Fruits, Plantation, Medicinal and Aromatic Crops	2+1	IV
3.	AEN 311	Apiculture	0+1	V
4.	AEN 312	Insect Pests of Vegetables, Ornamental and Spice Crops	2+1	VI
		TOTAL	6+4	

NEMATOTOLOGY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	ANM 211	Nematode Management in Horticultural Crops	1+1	IV

DEPARTMENT OF PLANT PATHOLOGY
PLANT PATHOLOGY

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	PAT 111	Fundamentals of Plant Pathology	2+1	II
2.	PAT 211	Mushroom Culture	0+1	IV
3.	PAT 311	Diseases of Vegetables, Ornamentals and Spice Crops	2+1	V
4.	PAT 312	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	2+1	VI
		TOTAL	6+4	

AGRICULTURAL MICROBIOLOGY

Sl .No.	Course No.	Course Title	Cr.Hr.	Semester
1.	AGM 111	Introductory Microbiology	1+1	I

EXPERIENTIAL LEARNING COURSES

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
EXPERIENTIAL LEARNING - I				
1.	HEL 401	Commercial seed production	0+8	VII
2.	HEL 402	Composting technology		
3.	HEL 403	Production of biocontrol agents		
4.	HEL 404	Bioinoculants production technology		
EXPERIENTIAL LEARNING - II				
1.	HEL 405	Protected Cultivation and Precision Horticulture	0+20	VIII
2.	HEL 406	Nursery production and management		
3.	HEL 407	Post harvest technology and value-addition		
4.	HEL 408	Floriculture and landscape gardening		

A student can opt for any one of the courses mentioned above in VII and VIII semesters.

NON-CREDIT COURSES

Sl. No.	Course No.	Course Title	Cr.Hr.	Semester
1.	ENG 101	English for Effective Communication	0+1	I
2.	NCC 101 / NSS 101	National Cadet Corps / National Service Scheme	0+1	I
3.	PED 101	Physical Education	0+1	I
4.	PJN 301	Short Tour	0+1	V
5.	PJN 302	Soft Skills for Employability	0+1	VI
6.	PJN 401	All India Tour	0+2	VII
		TOTAL	0+7	

SEMESTER WISE DISTRIBUTION OF COURSES

SEMESTER I

Sl. No.	Course No.	Course Title	Cr.Hr
1.	HOR 101	Fundamentals of Horticulture	2+1
2.	FOR 101	Introductory Agroforestry	1+1
3.	AGM 111	Introductory Microbiology	1+1
4.	COM 111	Computer Applications in Horticulture	0+1
5.	CRP 111	Introductory Crop Physiology	1+1
6.	GPB 111	Principles of Genetics and Cytogenetics	2+1
7.	SAC 101	Introduction to Soil Science	2+1
8.	ENG 101	English for Effective Communication*	0+1
9.	NCC 101 / NSS 101	National Cadet Corps* / National Service Scheme*	0+1
10.	PED 101	Physical Education*	0+1
TOTAL			9+10 = 19

* Non-credit courses

SEMESTER II

Sl. No.	Course No.	Course Title	Cr.Hr
1.	HOR 102	Plant Propagation and Nursery Management	1+1
2.	FSC 101	Orchard Management	1+1
3.	FSC 102	Production Technology of Tropical and Sub Tropical Fruits	2+1
4.	VSC 101	Production Technology of Tropical and Sub Tropical Vegetables	2+1
5.	AEG 101	Farm Power and Machinery	1+1
6.	AEN 111	Fundamentals of Entomology	2+1
7.	PAT 111	Fundamentals of Plant Pathology	2+1
8.	BIC 101	Fundamentals of Biochemistry	2+1
9.	AEC 101	Principles of Agricultural Economics	1+1
10.	NCC 101 / NSS 101	National Cadet Corps* / National Service Scheme*	0+1
11.	PED 101	Physical Education*	0+1
TOTAL			14+9 = 23

* Non-credit courses continued from First semester

SEMESTER III

Sl. No.	Course No.	Course Title	Cr.Hr
1.	FLG 201	Commercial Floriculture	2+1
2.	FSC 201	Production Technology of Temperate Fruit Crops	1+1
3.	SPC 201	Production Technology of Plantation Crops	2+1
4.	SPC 202	Production Technology of Spices and Condiments	2+1
5.	VSC 201	Production Technology of Temperate Vegetable Crops	1+1
6.	AEX 211	Fundamentals of Extension Education	2+1
7.	AGR 211	Weed Management in Horticultural Crops	1+1
8.	GPB 211	Principles of Plant Breeding	2+1
9.	SAC 211	Soil, Plant and Water Analysis	0+1
10.	NCC 101 /	National Cadet Corps* /	0+1
	NSS 101	National Service Scheme*	
11.	PED 101	Physical Education*	0+1
TOTAL			13+9 = 22

* Non-credit courses continued from First semester

SEMESTER IV

Sl. No.	Course No.	Course Title	Cr.Hr
1.	FLG 202	Ornamental Horticulture	2+1
2.	FSC 202	Breeding of Fruit and Plantation Crops	2+1
3.	FSN 211	Fundamentals of Food Technology	1+1
4.	AEN 211	Insect Pest of Fruits, Plantation, Medicinal and Aromatic Crops	2+1
5.	AGR 212	Principles of Agro-Climatology and Water Management	1+1
6.	STA 201	Applied Statistics	1+1
7.	ANM 211	Nematode Management in Horticultural Crops	1+1
8.	PAT 211	Mushroom Culture	0+1
9.	SST 211	Seed Production of Vegetable, Tuber and Spice Crops	2+1
10.	NCC 101 /	National Cadet Corps* /	0+1
	NSS 101	National Service Scheme*	
11.	PED 101	Physical Education*	0+1
TOTAL			12+9 = 21

* Non-credit courses continued from First semester

SEMESTER V

Sl. No.	Course No.	Course Title	Cr.Hr
1.	HOR 301	Growth and Development of Horticultural Crops	1+1
2.	FLG 301	Principles of Landscape Gardening	0+1
3.	SPC 301	Production Technology of Medicinal and Aromatic Crops	2+1
4.	VSC 301	Breeding of Vegetable, Tuber and Spice Crops	2+1
5.	VSC 302	Crop Production in Vegetable Crops	0+1
6.	AEN 311	Apiculture	0+1
7.	AGR 311	Introduction to Major Field Crops	1+1
8.	GPB 311	Principles of Biotechnology	1+1
9.	PAT 311	Diseases of Vegetables, Ornamentals and Spice Crops	2+1
10.	SAC 311	Soil Fertility and Nutrient Management	1+1
11.	PJN 301	Short Tour *	0+1
TOTAL			10+11 = 21

* Non-credit course

SEMESTER VI

Sl. No.	Course No.	Course Title	Cr.Hr
1.	HOR 302	Post Harvest Management of Horticultural Crops	1+1
2.	FLG 302	Breeding and Seed Production of Ornamental Plants	2+1
3.	FSN 311	Processing of Horticultural Crops	1+1
4.	AEC 311	Horti - Business Management	2+1
5.	AEN 312	Insect Pests of Vegetables, Ornamental and Spice Crops	2+1
6.	AGR 312	Organic Farming in Horticultural Crops	1+1
7.	ENS 301	Environmental Science	1+1
8.	PAT 312	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	2+1
9.	AEX 302	Entrepreneurship Development	1+1
10.	PJN 302	Soft Skills for Employability *	0+1
TOTAL			13+10 = 23

* Non-credit course

SEMESTER VII

Sl. No.	Course No.	Course Title	Cr.Hr
1.	HOR 411	Rural Horticultural Work Experience	0+10
2.	HEL XXX	Experiential Learning – I	0+8
3.	PJN 401	All India Tour *	0+2
		TOTAL	0+20 = 20

* Non-credit course

SEMESTER VIII

Sl. No.	Course No.	Course Title	Cr.Hr
1.	HEL XXX	Experiential Learning – II	0+20
		TOTAL	0+20 = 20

ABSTRACT

Year	Semester	Theory	Practical	Total
FIRST	I	9	10	19
	II	14	9	23
SECOND	III	13	9	22
	IV	12	9	21
THIRD	V	10	11	21
	VI	13	10	23
FOURTH	VII	0	20	20
	VIII	0	20	20
TOTAL		71	98	169

I SEMESTER COURSES

Theory**Unit I: Basics of Horticulture**

Economic importance and classification of horticultural crops and their culture and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery management practices, soil and climate.

Unit II: Orchard and kitchen garden layout

Vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities.

Unit III: Nursery and canopy management

Production and practices for fruit, vegetable and floriculture crops, nursery techniques and their management. Principles and methods of pruning and training of fruit crops.

Unit IV: Cropping systems and orchard management

Types and use of growth regulators in horticulture, water management, weed management, fertility management in horticultural crops, cropping systems, intercropping, multi-tier cropping, mulching, bearing habits, factors influencing the fruitfulness and unfruitfulness.

Unit V: Rejuvenation of orchards and organic farming

Rejuvenation of old orchards, top working, frame working, principles of organic farming.

Practical

Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

References

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2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
3. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
4. Chattopadhyay, P.K.2001. A text book on Pomology (Fundamentals of fruit growing), Kalyani Publication, New Delhi.

5. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi.
6. Senn, T.L., F.S. Andrews and P.G. Halfacre, 1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co., New Delhi.
7. Jitendra Singh. 2006. Basic Horticulture. Kalyani Publishers, New Delhi.
8. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
9. Rajan, S. and B.L. Markose. 2007. Propagation of horticultural crops. New India Publishing, New Delhi.
10. Vijaikumar UmRao. 2008. Horticulture terms – Definitions and Terminology. IBD Publishers, Dehradun.

FOR 101

INTRODUCTORY AGROFORESTRY

1+1

Theory

Unit I

Definition of Forest – Indian forest – Status – Classification of forest and forestry – Role of forest – Silvics and silviculture – Locality factors – Regeneration factors

Unit II

Agroforestry – Definition – Aim – Objective – Need – Potential – Planning of Agroforestry – constraints – Diagnosis and Design.

Unit III

Agroforestry system – Sub system – Practice – Agri – silviculture – Silvipastoral – Horti-silviculture – Horti- silvipastoral – Shifting cultivation – Taungya – Home gardens – Alley cropping – Intercropping – Wind breaks – Shelterbelts – Energy plantations – Agroforestry systems for different agro climatic zones of Tamil Nadu

Unit IV

Social forestry concepts and applications -JFM- TNAP concept- Difference between social forestry and agroforestry- Agroforestry and social forestry projects- National-Overseas.

Unit V

Selection of tree species for Agroforestry - Choice of species - Modern silvicultural techniques in site selection- Land preparation- Planting- Tending and cultural operation- Economics of cultivation in Multipurpose Tree Species (MTP) viz., *Acacia catechu*, *Dalbergia sissoo*, *Tectona grandis*, *Populus spp*, *Morus spp*, *Grewia asiatica*, *Eucalyptus spp*, *Quercus spp*, Bamboo, Tamarind, Neem, *Melia dubia*

Practical

Identification of seeds and seedlings of multipurpose tree species - Nursery practices for *poplar*, *Grewia optiva*, *Morus alba*, *Acacia catechu*, *Dalbergia sissoo*, *Robinia*, *Leucaena* etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops:

silvipastoral - Alley cropping - Horti-silviculture- Agro-silvipasture - Fuel and fodder blocks. Visit to social forestry plantations – Railway line plantations - Canal plantations - Roadside plantations - Industrial plantations and shelterbelts - Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages - Economics and marketing of products raised in agro-forestry systems.

References

1. Avey, M.E., M.G.R. Cannel and C. Ong. 1991. Biophysical Research for Asian Agroforestry. Winrock International, USA & South Asia Books, USA. 292 p.
2. Bentley, W.R., P.K. Khosla and K. Secler. 1993. Agroforestry in South Asia – Problems and Applied Research Perspectives. Oxford & IBH Publishing Co., New Delhi. 390 p.
3. Burch, W.R. and J.K. Parker. 1992. Social Science Applications in Asian Agroforestry. Winrock International, USA & South Asia Books, USA. 187 p.
4. Dwivedi, A.P. 1992. Principles and Practices of Indian Silviculture. Surya publications, Dehradun. 469p
5. Gupta. R.K 1993. Multipurpose Trees for Agroforestry and Wasteland Utilization. Oxford and IBH Publishing company, New Delhi. 580p
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7. Negi, S.S. 1986. A Hand book of Social Forestry. International Book Distributors, Dehradun. 177p
8. Prasad, V.N. 1985. Principles of Social cum Community Forestry. International Book Distributors, Dehradun. 108p
9. Prasad. R and P. Bhatnagar, 1995. Social Forestry Experiences over a Decade. International Book Distributors, Dehradun. 229p
10. Puri, S and P.K. Khosla. 1993. Nursery Technology for Agroforestry-applications in Arid and Semi arid regions. Oxford and IBH Publishing company, New Delhi. 392p
11. Rajiv Kumar. 1993. Issues in Social Forestry. International Book Distributors, Dehradun. 173p
12. Tiwari. K.M. and Singh. R.V. 1984. Social Forestry Plantations. Oxford and IBH Publishing company, New Delhi. 79p.

AGM 111

INTRODUCTORY MICROBIOLOGY

1+1

Theory

Unit I: History and Scope of Microbiology

Contributions of Anton Von Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Spontaneous Generation theory; Germ theory of disease.

Unit II: Microscopy

Microscopy – principles and types; Compound Microscopes - Bright field, Dark field, Fluorescent and Phase contrast Microscopes; Electron Microscopes

Unit III: Microbial physiology

Prokaryotes Vs Eukaryotes; Bacterial size, shape, arrangement and morphology; Structure and organization of a bacterial cell; Bacterial growth, reproduction; Growth curve.

Unit IV: Virology and Microbial Genetics

Viruses, Bacteriophages – Lytic and Lysogenic cycles; Genetic recombination – Transformation, Conjugation and Transduction.

Unit V: Soil and Applied Microbiology

Microbial interactions; Organic matter decomposition; C:N ratio; Biological nitrogen fixation; Types and importance of biofertilizers.

Practical

Microscopy - light microscopes; Staining techniques - simple and differential staining; Sterilization – Principles and techniques, equipment and apparatus used for sterilization; Media preparation; Isolation and enumeration of soil microorganisms; Purification of microorganisms; morphological and biochemical characters of bacteria. Organic matter decomposition – measurement of CO₂ evolution; Demonstration of antibiosis. Isolation of N₂ fixing and phosphate solubilizing microorganisms; Mass production of bacterial biofertilizers; Quality control and method of application.

References

1. Black, J.G. 2005. Microbiology: Principles and Explorations, John Wiley, USA.
2. Michael Madigan, John Martinko, Kelly S. Bender and Jack Parker. 2014. Brock Biology of Microorganisms. 14th Edition. Benjamin Cummings. England.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. 2002. Microbiology. 5th Edition, WCB Mc Graw Hill, New York.
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5. Pelczar MJ, Chan ECS and Kreig NR. 1998. Microbiology, 5th edition. Tata McGraw-Hill.
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7. Subba Rao, N.S. 2006. Soil Microbiology (4th Edition of Soil Microbiology and Plant Growth). Oxford & IBH, New Delhi.

COM 111

COMPUTER APPLICATIONS IN HORTICULTURE

0+1

Unit I

Introduction to Computers: Hardware, Software, FOSS, Block diagram of a computer system, Random Access Memory, Hard disks, Input devices, Output devices Introduction to Internet – Browsers, Browsing World Wide Web through hyperlink, HTML, Email, CC, BCC,

Forward, Reply, Attachment Introduction to FOSS Operating System - Using Ubuntu Linux / equivalent - File management using Files, Trash Introduction to Proprietary Operating System - Using Windows / equivalent - File management using File Explorer, Recycle bin

Unit II

Introduction to Word processing software - Using MsWord / LibreOffice Writer / equivalent - Creating, editing, saving document, changing font, font size, font color, bold, italic, underline, align left, right, center, justify, cut, copy, paste Introduction to Electronic spreadsheet software - Using MsExcel / LibreOffice Calc / equivalent - Creating, editing, saving spreadsheet, formula, creating graphs Introduction to Presentation software - Using Ms Powerpoint / LibreOffice Impress / equivalent - Creating slide, animation, & transition Introduction to Database software Using MsAccess / LibreOffice Base / equivalent – Using wizard create Tables, Queries, Forms and Reports

Unit III

Introduction to Programming - Using C++ / equivalent - Create programs with cout, cin, if, if...else, for loop, single dimension array, switch.case statement. Introduction to Visual Programming - Using Qt / equivalent – Creating simple GUI with Push Button, Label, Line Edit Introduction to Multimedia - Raster Graphics Editing – Using GIMP / equivalent – Raster image, Rectangle Select Tool, Ellipse Select Tool, Free Select Tool, Fuzzy Select Tool, Move Tool, Layers Introduction to Multimedia - Vector Graphics Editing – Using Inkscape / equivalent – Vector image, Create and edit Text object, Select and transform objects, Create rectangles and squares, Create circles, ellipses and arcs, Duplicate selected objects, Export bitmap.

Unit IV

Introduction to Multimedia - Audio Editing – Using Audacity / equivalent – Import/Open audio file, Export/Save audio file to different format, Export/Save selection of audio file, Merge 2 audio files Introduction to Multimedia – Video Editing – Using Avidemux / equivalent – Import/Open video file, Export/Save video file to different format, Export/Save selection of video file, Add black border to video, Merge 2 video files

Unit V

Introduction to Statistical Analysis software R - Using R / equivalent - R Console, R Prompt > , q(), getwd(), Assignment operator = or <- , objects() , Saving workspace using save.image(), Loading workspace using load(), Diverting output using sink(), Import dataset from clipboard to dataframe using read. table(), Edit dataset using fix() function, data(), Stacked and Unstacked data form Statistical Analysis using R software - Using R / equivalent - Sum, Mean, Standard deviation, Descriptive Statistics, Correlation, Covariance, t test, ANOVA

References

1. E.Balagurusamy, Fundamentals of Computers, 2009, McGraw Hill Education
2. John Paul Mueller, Windows 8 For Dummies Quick Reference, 2012, Wiley
3. Christer Edwards, Instant Ubuntu, 2013, Packt Publishing
4. Wallace Wang, Office 2013 for Dummies, 2013, John Wiley & Sons Inc.

5. E.Balagurusamy, Object Oriented Programming in C++, Tata McGraw Hill Education
6. Sarah Stowell, Using R for Statistics, 2014, APress
7. Ubuntu Manual - <https://ubuntu-manual.org>
8. LibreOffice Getting Started Guide - <http://www.libreoffice.org/get-help/documentation>
9. Gnumeric Manual - <https://help.gnome.org/users/gnumeric/stable/gnumeric.html>
10. Elementary Statistics with R - <http://www.r-tutor.com/elementary-statistics>
11. Design Resources Server, IASRI(ICAR), India - www.iasri.res.in/design
12. Rajender Parsad, R. Srivastava, V.K. Gupta, Design and Analysis of Agricultural Experiments, IASRI(ICAR), India - <http://www.iasri.res.in/design/Electronic-Book/index.htm>
13. Rajender Parsad, V.K. Gupta, Lal Mohan Bhar, V.K. Bhatia, Advances in Data Analytical Techniques, IASRI(ICAR), India
14. <http://www.iasri.res.in/ebook/EBADAT/index.htm>
15. FLOSS Manuals - <http://en.flossmanuals.net/>
16. The GIMP User Manual - <http://docs.gimp.org>
17. GIMP 2.8 Plus Tutorials for Photographers - <http://www.gimp2tutorials.info/>
18. Inkscape 0.48 Illustrators Cookbook
19. HTML5 Programming with JavaScript For Dummies
20. Audacity Manual - <http://manual.audacityteam.org/>
21. Qt Documentation - <http://doc.qt.io/>
22. Avidemux FLOSS Manual https://en.flossmanuals.net/_booki/avidemux/avidemux.pdf

CRP 111

INTRODUCTORY CROP PHYSIOLOGY

1+1

Theory

Unit I: Water Relations in Plants

Role of water in plant metabolism - osmosis, imbibitions, diffusion, water potential and its components, measurement of water potential in plants - absorption of water, mechanism of absorption and ascent of sap; Stomata - Structure, distribution, classification, mechanism of opening and closing of stomata; Osmotic pressure - guttation, stem bleeding; transpiration – types – mechanism of transpiration - factors affecting transpiration - Antitranspirants.

Unit II: Plant Nutrition

Essentiality of nutrients – Arnons and Leibieg; classification – based on requirement, biochemical function and mobility in plants – macro, secondary and micronutrients; Mechanism of absorption and its role in plant metabolism. Deficiency and toxicity symptoms; sand, hydroponics and aeroponic culture; Foliar nutrition and fertigation – significance and relevance.

Unit III: Photosynthesis

Photosynthesis – significance - structure and function of chloroplast; Electromagnetic radiation - Photosynthetically active radiation – resonance transfer; dark

and light reactions, cyclic and non-cyclic electron transfer, CO₂ fixation – C₃, C₄ and CAM metabolism, advantages of C₄ pathway. Photorespiration and its implications, factors affecting photosynthesis.

Unit IV: Phytohormones

Physiological role hormones – precursor - Auxin, Cytokinin, Gibberellic acid, Absciscic acid and Ethylene in controlling plant processes – uses in crop productivity; New generation growth regulators – Brassinosteroids – triacontanol; Growth retardants – their uses in crop productivity.

Unit V: Stress Physiology

Different types of Abiotic stresses - water stress - deficit and excess - physiological changes – adaptation – drought escape, avoidance and tolerance; Temperature stress - Physiological changes - low and high temperature – adaptation – mechanism of tolerance; Cold stress - Chilling and freezing injury – tolerance; Salt stress - physiological changes- adaptation – extrusion , compartmentalization and exclusion - mechanism of tolerance.

Practical:

Solution preparation; Measurement of water potential, osmosis, root pressure, structure of the stomata, Distribution, opening and closing of the stomata, measurement, transpiration measurement Nutritional disorders - Importance of light and chlorophyll in photosynthesis, pigment identification in horticultural crops and studying the enzyme activity of catalase, estimation of phenols, bioassay for hormones, estimation of tolerance indices – proline, Chlorophyll stability index.

References

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2. Taiz, L., Zeiger, E. and, Ian M. Moller, 2015. Plant Physiology and Development. Publishers: Sinauer Associates, Inc., Massachusetts, USA
3. Pandey, S. N. and B. K. Sinha, 2006. Plant Physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
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5. Jain, J. K., 2007. Fundamentals of Plant Physiology. S. Chand & Company Ltd., New Delhi.

GPB 111

PRINCIPLES OF GENETICS AND CYTOGENETICS

2+1

Unit I: Mendelian laws and its modifications

Definition of genetics, heredity, inheritance, cytology, cytogenetics; Brief history of developments in genetics and cytogenetics; Terminologies- gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid; Pre-Mendelian ideas about heredity- Preformation theory, Lamarck's theory,

Darwin's theory, Germplasm theory and Mutation theory; Work of Mendel – characters studied, reasons for Mendel's success, laws of heredity, rediscovery of Mendel's work; Physical basis of heredity- chromosomal theory of inheritance, Morgan's work; Deviation from Mendelian inheritance: Allelic interactions – dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance; Non allelic interaction - interaction without modification in Mendelian ratio – Batson and Punnet's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1) ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1). iv.) Duplicate dominant epistasis (15:1) v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles- blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.

Unit II: Quantitative inheritance, Linkage and Crossing over

Quantitative inheritance – multiple factor hypothesis of Nilsson Ehle, Polygenes and their features, transgressive segregation, comparison of quantitatively and qualitatively inherited characters, modifiers; Linkage - coupling and repulsion theory of Bateson and Punnet, chromosomal theory of linkage of Morgan, complete and incomplete linkage, linkage group; Crossing over – significance of crossing over; cytological proof for crossing over of Stern's experiment, strength of linkage and recombination, two point and three point test cross, double cross over, interference and coincidence, genetic map.

Unit III: Sex determination, sex linkage and cytoplasmic inheritance

Sex determination- autosomes and allosomes, chromosomal theory of sex determination and different types, geneic balance theory of Bridges, barr bodies, metabolic differentiation theory; Gynandromorphs – sex reversal; Sex linked inheritance – criss cross inheritance, reciprocal difference, sex influenced and sex limited inheritance, holandric genes; Sex determination in plants – Melandrium, papaya, maize. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial, plastid colour in *Mirabilis jalapa*, iojap gene of maize, cytoplasmic male sterility in rice, kappa particles of paramecium; plasmid and episome.

Unit IV: Cytogenetics

Structure and function of cell and cell organelles, differences between prokaryotes and eukaryotes; Cell division – mitosis, meiosis and their significance, cell cycle; Chromosome structure- centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram, chromosome banding; Types of chromosomes based on position of centromere, based on structure and function; Special chromosomes - polytene, lampbrush, B, ring and isochromosomes; Chromosomal aberration - deletion, duplication, inversion and translocation, genetic and cytological implications; Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; nondisjunction, types of euploids and their origin, monoploid, polyploid - auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit V: Molecular genetics

DNA, the genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy, confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment; Structure of DNA – Watson and Crick model, central dogma of life; DNA replication- models of DNA replication, proof for semi conservative method of DNA replication, steps involved in DNA replication; RNA types - mRNA, tRNA, rRNA; Gene expression- transcription, translation, genetic code, protein synthesis; Regulation of gene expression – operon model of Jacob and Monod, structural genes and regulator genes, operon; Cistron, muton and recon; Split genes- exons, introns; Mobile genetic elements- transposable elements, transposons, jumping genes.

Practical

Study of cell and cell organelles – Preparation of fixatives and stains – pre treatment of materials for mitosis and meiosis – study of mitosis and meiosis. Study of genetic ratios of – monohybrid, dihybrid – incomplete dominance. Gene interaction - multiple alleles and multiple factors. Study of linkage, estimation of strength of linkage and recombination frequency in two point and three point test cross data and F_2 data – Drawing of genetic map – interference and coincidence

References

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3. Verma, P.S. and V.K. Agarwal. 2007. Genetics. S.Chand and Company Ltd./ New Delhi.
4. Gupta P.K., 1997. Cytogenetics. Rastogi Publications, Meerut
5. Stansfield, W.D. 1990. Theory and problems of genetics. Mc-Graw Hill Book Co., New York
6. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai –1
7. Benjamin Lewin 2005- Genes IX Oxford University Press, Oxford
8. Gupta P.K., 1993. Genetics, Rastogi publications, Meerut.
9. Reddi, O.S., 1992. Understanding Genetics. Sunil Sachdev Publishers, New Delhi 64.
10. Russel, P.J. 2000. Fundamentals of genetics. Addition Wesley Longman Publishers, USA.
11. Singh, R.J. 2002. Plant cytogenetics. CRC Press, USA

SAC 101

INTRODUCTION TO SOIL SCIENCE

2+1

Theory

Unit I: Soil definition and formation

Soil: Pedological and edaphological concepts, Origin of the earth, Earth's crust; Composition: Formation and classification of Rocks and minerals. Weathering, Soil forming factors and processes. Components of soils; Soil profile.

Unit II: Soil physical properties

Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure Classification, Soil aggregates, evaluation of soil structure and its significance, Bulk density and particle density of soils & porosity, their significance and manipulation, Soil consistency, soil crusting, Soil compaction, Soil Colour, Soil water- Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, conductivity, Drainage, Methods of determination of soil moisture. Thermal properties of soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth.

Unit III: Soil Chemical properties

Soil colloids- Properties, types and its significance, Soil pH, EC and buffering capacity and its significance. Soil organic matter, Composition, Decomposability, Humus, Carbon cycle, C: N ratio.

Unit IV: Soil organisms

Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

Unit V: Soil Survey

Soil survey- types and methods, soil classification, soil taxonomy, and soils of India and Puducherry.

Practical

Analytical chemistry -Basic concepts, techniques and calculations – Collection and processing of soil for analysis- Study of a soil profile – Identification of rocks and minerals. Determination of bulk density and particle density and porosity per cent, soil texture and mechanical analysis – Soil colour, Soil moisture determination, Hydraulic conductivity, Infiltration rate. Determination of pH, EC and Organic carbon.

References

1. Brady, N.C., 2002 The Nature and Properties of Soils (13th Edition) McMillan Co., New York. Indian Publisher – Eurasia Publishing House (P) Ltd., Ramnagar, New Delhi – 55
2. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, New Delhi
3. Fundamentals of Soil Science.2009 .ISSS Publication, New Delhi.
4. Daji A.J., (1970) A Text Book of Soil Science - Asia Publishing House, Madras.
5. Biswas T.D. and Mukherjee S.K., 1987. Text Book of Soil Science –Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Jenny, H. 1941. Factors of Soil Formation - A System of Quantitative Pedology. McGraw-Hill Book Company INC. New York.
7. Joffe, J.S. 1936. The ABC of Soils. Pedology Publication, New Jersey.

Practical

Introduction to listening, - kinds of listening, process of listening, - listening mechanism - listening TOEFL, IELTS, BEC.

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

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

Mechanics of writing, writing genres, five types of writing, précis paragraph writing, Essay writing- issue- based writing and argument based writing

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

References

1. Peter Roach 2009. English Phonetics and Phonology. A Practical Course: (4th edition), CUP, U.K.
2. Steven Brown and Dorokyn Smith 2006. Active Listening: CUP, U.K.
3. Christian Evans Carter 2010. Mindscapes: Critical Reading Skills: Wordsworth Publishing Company, Belmont, Calif. USA
4. Kory Floyd 2008. Interpersonal Communication: The Whole Story, Tata McGraw Hill Publishers.
5. John Langan. 2007. College Writing Skills with Readings Tata McGraw Hill Pub., USA.
6. Hariharan, S. 2003. English for Agriculture and Allied Sciences: Orient Longman, Hyderabad)
7. Interactive Software on Effective Communication. Learning to Communicate. TOEFL Books published by Orient Longman and Cambridge University Press.

General - Military History -Historical – geographical – Customs and Traditions of India - Defence services – Introduction to NCC – NCC Song - Aims of NCC – Principles of NCC - NCC organization - Duties of good citizen – system of NCC training – Drill - Foot drill – Arms drill – Guard of Honour – Ceremonial Drill – Weapon Training and Equipment – Communication – types - National Integration – Leadership - Civil affairs - Civil defence – Disaster management - Social service - Health and Hygiene - Environment and Ecology - Self Defence - Camps and Adventure training-Changing trends in Technology - Personality development-Communication Skills - Specialised subjects - Army or Navy or Air force.

Specialised subject – Navy - Naval Orientation - Naval communication - Navigation - Seamanship - Oceanic wealth-Gunnery - Fire Fighting and Damage control and Safety - Ship and Boat modeling - Submarine-Search and Rescue – Antisubmarine - Swimming

NSS 101

NATIONAL SERVICE SCHEME

0+1

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

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

PED 101

PHYSICAL EDUCATION

0+1

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

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

Skill development in anyone of the following games

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ATHLETICS

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

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

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

Fundamentals of Yoga

Introduction, Definition, Stages of Yoga, Benefits of Yoga

Asanas

Backward Bending Asanas (10 asanas); Forward Bending Asanas (10 asanas); Twisting Asanas (10 asanas); Inversion Asanas (10 asanas); Seated Asanas (10 asanas); Balancing Asanas (10 Asanas); Suryanamaskar

Aspects to be covered in each and every asana: Warm – up and preparation techniques, steps, breathing methods, approach to final postures, variation, modifications, benefits, contraindications, injury prevention.

Pranayamas

Nadi Shuddi Pranayama, Anuloma Viloma Pranayama, Seetkari Pranayama, Seetali Pranayama, Sadanta Pranayama, Bhastrika Pranayama, Ujjayi Pranayama, Moorchha Pranayama, Plavini Pranayama

Mudras

Aswini Mudra, Yoga Mudra, Maha Mudra, Shanmukhi Mudra, Veepareetha Karani Mudra.

II SEMESTER COURSES

Theory**Unit I: Basics of Propagation**

Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages.

Unit II: Seed dormancy mechanism

Seed dormancy (scarification & stratification) internal and external factors, nursery techniques, apomixis – monoembryony, polyembryony, chimera and bud sport.

Unit III: Propagation Structures and growth regulators

Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly houses, nursery (tools and implements), use of growth regulators in seed and vegetative propagation

Unit IV: Asexual propagation methods

Methods and techniques of cutting, layering, grafting and budding, physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers.

Unit V: Micro Propagation

Micro-grafting, hardening of plants in nurseries. Nursery registration act. Tissue culture.

Practical

Media for propagation of plants in nursery beds, pot and mist chamber. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings including opacity and grafting, etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labeling and packing of fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, poly house and their maintenance. Top grafting, bridge grafting and nursery management. Nutrient and plant protection applications during nursery.

References

1. Bose, T.K., S.K. Mitra, M. K. Sadhu and B. Mitra. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prakash 206, Bidhan Sarani, Calcutta. Six. India
2. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 1997. Plant Propagation – Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
3. Nanda, K.K and V.K. Kochhar. 1995. Vegetative Propagation of Plants. Kalyani Publishers, Ludhiana.
4. Sadhu, M.K.1989. Plant Propagation. Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi 110 002.
5. Singh, S.P. 1983. Mist Propagation. Metropolitan Publishing Company, 1, Nethaji Subhash Marg, New Delhi 110 032. India.
6. Kumar, U. 2002. Methods in Plant Tissue culture, Second Edition, Agro Bios, Jodhpur.
7. Razdan, M.K. 1993. An introduction to plant tissue culture plant tissue culture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

FSC 101

ORCHARD MANAGEMENT

1+1

Theory

Unit I

Definition- Importance - Objectives of orchard management - Merits and Demerits - Selection of location and site - Nature of soil and subsoil - Planning of suitable kinds and varieties of fruits-Proper planting distance and purchasing of plants from reliable nurseries.

Unit II

Methods of soil management- clean cultivation-sod culture-Sod mulch and inorganic and organic mulches. Maintenance of organic matter contents, soil erosion and controlling weeds- Herbicides-Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems.

Unit III

Soil management in relation to nutrient and water uptake - Effects on soil environment and moisture- Relation to soil properties and soil environment

Unit IV

Integrated nutrient management - Other integrated management in horticulture crops

Unit V

Crop regulation and quality crop - manual thinning, chemical thinning, selective harvesting, training, summer and winter pruning.

Practical

Planning and layout of orchard-Orchard components- Records maintenance in orchard- Planting and lay out of different planting systems of orchard - Study of clean cultivation - Inter-cropping systems in orchards - Visit to different local fruit orchards - Use of organic and inorganic mulches in orchards - Observations on weed growth under different systems of management - Use of different herbicides in orchards – irrigation systems in orchards.

References

1. Singh, S.P. Commercial Fruits – Kalyani Publishers, Ludhiana
2. Amar Singh, Fruit Physiology and Production – Kalyani Publishers, Ludhiana.
3. Chadha, K.L. Hand Book of Horticulture – I.C.A.R., New Delhi
4. Shyam Singh, S. Krishnamurthi and S. L. Katyal, Fruit Culture in India – I.C.A.R., New Delhi.
5. Kumar, N. Introduction to Horticulture - Oxford and IBH Publishing company Pvt. Ltd
6. Veeraraghavathatham, V., M. Jawaharlal, S. Jeeva, R. Rabindran, G. Umapathy
7. Jitendra Singh – Scientific Fruit culture - Basic Horticulture
8. Edmond *et.al.* Fundamentals of Horticulture - Mc Graw Hill book company, New Delhi.

FSC 102

PRODUCTION TECHNOLOGY OF TROPICAL AND SUB TROPICAL FRUITS

2+1

Theory

Unit I

Definition of Horticulture – Importance of Horticulture –Horticultural classification of fruits- Climatic Zones of horticultural crops – Scope and importance of tropical and sub-tropical fruits cultivation – Overview on global, national and regional level – Area, production and export potential – Horticultural zones of India and Tamil Nadu with emphasis on tropical and sub tropical fruits.

Unit II

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques– Main field preparation – Spacing - Planting- Planting density and cropping systems - After care – Nutrients, Water and Weed management – Training and Pruning – Flowering- Pollination and Fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and Storage – production constraints of : Mango, Banana, Citrus (Acid Lime, Lemon, Sweet Orange, Mandarin orange), Grapes, Sapota, Guava, Papaya, Jack.

Unit III

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques– Main field preparation – Spacing - Planting- Planting density and cropping systems - After care – Nutrients, Water and Weed management – Training and Pruning – Flowering- Pollination and Fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and Storage – production constraints of : Pomegranate, Pineapple, Avocado, Mangosteen, Litchi, Carambola, Durian and Passion fruit.

Unit IV

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques– Main field preparation – Spacing - Planting- Planting density and cropping systems - After care – Nutrients, Water and Weed management – Training and Pruning – Flowering- Pollination and Fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and Storage – production constraints of : Ber, Aonla, Annona, Bael.

Unit V

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques– Main field preparation – Spacing - Planting- Planting density and cropping systems - After care – Nutrients, Water and Weed management – Training and Pruning – Flowering- Pollination and Fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and Storage – production constraints of Carissa, Date palm, Phalsa, Fig.

Practical

Description and identification of varieties of Mango, banana and grapes, citrus, papaya, sapota, guava, pine apple, pomegranate, avocado, litchi, jack fruit, passion fruit, carambola, durian and mangosteen and minor fruits; arid zone and semi-arid zone fruits. Training and Pruning of Grapes, Mango, Guava and Citrus. Pre-treatment of Banana suckers and de-suckering in Banana - sex forms in Papaya.

Use of plastics in fruit production - Visit to commercial orchards and cold storage units - Manure and fertilizer application in different fruit crops Use of growth regulators and its application in fruit crops. Seed production in Papaya, latex extraction and preparation of crude papain Post harvest handling and production economics for tropical and sub- tropical fruits.

References

1. Bose, T. K., S. K. Mitra and D.Sanyal, 2001. Fruits: Tropical and subtropical. Volume I. Naya Udyog, Calcutta.
2. Chattopadhyay, T. K. 1994. A text book of Pomology (Vol 1-4). Kalyani Publishers, New Delhi.

3. Shanmugavelu, K. G. 1987. Production technology of fruit crops. SBA Publications, Calcutta.
4. Singh, S. P. 1995. Commercial Fruits, Kalyan Publishers, Ludhiyana.
5. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. Scientific Fruit culture, Suri Associates, Coimbatore.
6. Bose T.K., S. K. Mitra and M. K. Sadhu. 2003. Mineral Nutrition of Fruit Crops. Naya Prakash, Calcutta.
7. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
8. Singh, S. S. Krishanmurthi and S. L. Katyal. 1967. Fruit culture in India. ICAR, New Delhi.
9. Bose, T. K. 1996. Naya Prakash, Fruits of India – Tropical and sub – tropical. Calcutta
10. Bose, T.K., S.K. Mitra and D. Sanyal 2001 Fruits: Tropical and Subtropical (2 volumes), Naya Udyog, Calcutta.
11. Bose, T.K., S.K. Mitra, A.A. Farooqi and M.K. Sadhu (Eds) 1999. Tropical Horticulture Vol.1. Naya Prakash, Calcutta.

VSC 101 PRODUCTION TECHNOLOGY OF TROPICAL AND 2+1
SUB TROPICAL VEGETABLES

Theory

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economics of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and storage. Marketing of tomato, brinjal, chillies, sweet pepper, okra, amaranthus, cluster beans, vegetable cowpea, lab-lab, snap bean, cucurbits, tapioca, sweet potato, yam, dioscorea, colocasia, Onion, moringa, portulaca and basella, chekkurmanis.

Unit I

Tomato, brinjal, chilli and sweet pepper

Unit II

Okra, cowpea, cluster bean, lab lab and snapbean.

Unit III

Cucurbitaceous crops

Unit IV

Tapioca, sweet potato, yam, dioscorea, colocasia and Onion

Unit V

Moringa, amaranthus, basella and portulaca

Practical

Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and interculture; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation.

References

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AEG 101

FARM POWER AND MACHINERY

1+1

Theory

Unit I: Farm Power

Farm power in India - sources, IC engines - working principles, two stroke and four stroke engines, IC engine terminology, different systems of IC engine. Tractors - Types,

Selection of tractors and cost of tractor power - Tractor and implement selection for different agricultural operations

Unit II: Tillage implements

Tillage implements - primary and secondary tillage implements - ploughing methods - Field capacity and field efficiency.

Unit III: Sowing and planting machinery

Sowing methods - seed drills, seed cum fertilizer drills - implements for intercultural operations - wet land equipment - Paddy transplanters - field and nursery requirements

Unit IV: Plant protection equipments

Plant protection equipments - sprayer - dusters - their functions, classification - operation and maintenance.

Unit V: Harvesting machinery

Harvesting tools and equipment - reapers and combine - Harvesting machinery for groundnut, tuber crops - Sugarcane harvesters - Equipment for land development and soil conservation -Tools for horticultural crops.

Practical

Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine. Study of MB plough, disc plough, seed-cum-fertiliser drills, their mechanisms. Operation of tractor and implements - operation and maintenance power tiller - Study of different inter-cultivation equipments - Sprayers and dusters - their operation, repairs and adjustment - Harvester for paddy, sugarcane and horticultural crops - Field capacity and cost analysis

References

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2. Bindra, O.S. and Harcharan Singh, 1971. Pesticide application equipment. Oxford and IBH pub Co., New Delhi.
3. Srivastava, A.C., 1990. Elements of farm machinery. Oxford IBH pub Co., New Delhi.
4. Jagadishwar Sahay, 1992. Elements of agricultural engineering. Agro book agency, Patna -20.
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AEN 111

FUNDAMENTALS OF ENTOMOLOGY

2+1

Theory

Unit I: History and importance

Entomology as a science - its importance in Agriculture. History of Entomology in India, Position of insects in the animal kingdom and their relationship with other classes of

Arthropoda, Reasons for insect dominance.

Unit II: Morphology

General organisation of insect body wall - structure and function, cuticular appendages, moulting. Body regions - insect head, thorax and abdomen, their structures and appendages

Unit III: Anatomy and physiology

Elementary knowledge of digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects. Sense organs and their functions, Exocrine and endocrine glands. Life cycle of insects - immature stages - types of reproduction – metamorphosis- growth and development.

Unit IV: Taxonomy of apterygota and exopterygota

Taxonomy, Classification and nomenclature of insects. Distinguishing characters of agriculturally important orders and families of Apterygotes - Collembola and Thysanura, Exopterygotes - Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Siphunculata and Thysanoptera.

Unit V: Taxonomy of endopterygota

Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Strepsiptera and Neuroptera.

Practical

Observations on external features of grasshopper / cockroach, Methods of insect collection, preservation – Preparation of Riker mount. Types of insect head, antenna, mouth parts – Structure of thorax. Types of insect legs, wings and their modifications – wing coupling. Structure of abdomen, and its modifications. Metamorphosis in insects – immature stages in insects. Study of digestive and reproductive systems of grasshopper / cockroach – Observing the characters of agriculturally important orders and families.

References

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2. Cedric Gillott. 2005. Entomology (Third Edition). Springer, Netherlands.
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Theory

Unit I: Plant Pathogenic Organisms

Plant Pathology - Definition - Objectives - Scope - History of Plant Pathology and Economic importance of plant diseases - Terms and concepts in Plant Pathology - Causes of Plant Diseases - Parasitic and Non parasitic causes - Classification of Plant Diseases – Parasitic/ Biotic causes - Plant Pathogens - Protozoa, Fungi, Bacteria, *Candidatus* Phytoplasma, Fastidious vascular bacteria, Spiroplasma, Viruses, Viroids, Algae and Phanerogamic parasitic plants - Koch's postulates - Non parasitic/ Abiotic causes - Abiotic disorders.

Unit II: Phylogenetic Classification of Fungi

General characters of fungi - Somatic structures - Types of mycelia - Resting structures –Asexual and Sexual reproduction - Types of parasitism - Infection process - Survival and dispersal - Classification of **Kingdom: Protozoa** - important taxonomic characters and symptoms and life cycle of *Plasmodiophora brassicae*, *Flagellate Protozoa* - *Phytomonas* Classification of **Kingdom: Chromista** - important taxonomic characters - Classification of Phylum: *Oomycota*, Symptoms and life cycle of *Pythium*, *Phytophthora* and *Albugo Peronosclerospora*, *Sclerospora*, *Perenospora*, *Pseudoperenospora* and *Plasmopora*, Classification of **Kingdom: Fungi** - Classification of **Phylum: Chytridiomycota** and **Zygomycota** - important taxonomic characters - Symptoms and life cycle of *Synchytrium* and *Rhizopus*

Classification of **Phylum: Ascomycota** - important taxonomic characters - Taxonomic characters and symptoms of *Taphrina*, *Capnodium*, *Protomyces*, *Mycosphaerella*, *Lewia*, *Botryosphaeria* and *Venturia* - life cycle of *Taphrina* and *Venturia* - Taxonomic characters and symptoms of *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Sphaerotheca* - life cycle of *Talaromyces* and *Erysiphe* - Taxonomic characters and symptoms of *Nectria*, *Verticillium*, *Glomerella*, *Pestalotia*, and *Macrophomina* - life cycle of *Glomerella* - Classification of **Phylum: Basidiomycota** - important taxonomic characters - Taxonomic characters and symptoms of *Puccinia*, *Uromyces*, *Hemileia*, *Urocystis*, *Ustilago*, *Sporisorium*, *Tolyposporium*, *Ganoderma*, *Exobasidium*, *Thanetophorus* and *Athelium* - life cycle of *Puccinia*, *Ustilago* and *Ganoderma*

Unit III: Bacteria, Viruses, Viroids, Algae and Phanerogamic parasites

General characters of Bacteria - Taxonomy of bacteria – symptoms of Plant bacterial diseases – Infection process - Mode of entry - Survival and dispersal - General characters and symptoms caused by *Candidatus* Phytoplasma, Fastidious vascular bacteria, Spiroplasma, Viruses, Viroids, Algae and Phanerogamic parasitic diseases.

Unit IV: Plant Disease Epidemiology

Epidemiology of crop diseases - Types of disease epidemics - Role of host, pathogen and weather factors in disease epidemics - Disease surveillance, Assessment and forecasting - Methods of forecasting and assessment

Unit V: Plant Disease Management

Principles of plant disease management - Avoidance - Exclusion - Eradication – Resistance - Protection - Fungicides - classification - group of fungicides - Non systemic and systemic - common methods and special methods of application - Precautions and safety measures in handling of fungicides. - Biological control of crop diseases – biocontrol agents – Fungi, bacteria - Mechanisms - Plant extracts and Anti Viral Principles in plant disease management - Integrated Disease Management - Biotechnological approaches in disease management

Practical

Familiarity with lab and field equipments – Isolation and Identification of Plant pathogens – Koch Postulates - General characters of fungi - Study of Disease symptoms / Signs, Systematic position, Important taxonomic characters and Host parasite relationship of *Plasmodiophora* (Club root), *Spongospora* (Powdery scab), *Synchytrium* (Wart), *Pythium* (Damping off), *Phytophthora* (Late blight and Bud rot), *Albugo* (White blister), *Plasmopara*, *Peronospora*, *Pseudoperonospora* (Downy mildew), *Rhizopus* (Fruit rot), *Taphrina* (Leaf curl), *Protomyces* (Stem gall), *Capnodium* (Sooty mould), *Mycosphaerella* (Leaf spot), *Lewia* (Leaf blight), *Botryosphaeria* (Die back and stem end rot), *Venturia* (Scab), *Talaromyces* (Mould), *Erysiphe*, *Leveillula*, *Phyllactinia* *Uncinula*, *Podosphaeria* and *Sphaerthea* (Powdery mildew), *Nectria* (Wilt), *Verticillium* (Wilt), *Glomerella* (Anthracnose), *Pestalotia* (grey blight), *Macrophomina* (Dry root rot), *Puccinia*, *Uromyces*, *Hemileia* (Rust), *Urocystis*, *Ustilago* (Smut), *Ganoderma* (Basal stem rot), *Exobasidium* (Blister blight), and *Athelium* (Wet root rot), Symptoms of plant Bacterial, *Candidatus* Phytoplasmal, Spiroplasmal, Fastidious vascular bacterial, Viral, Viroids, Algal diseases and Phanerogamic parasitic plants - Various groups of fungicides and antibiotics - Preparation of Bordeaux mixture and Bordeaux paste - fungicidal spray solution – Methods of application - Production of immunized seedlings in citrus – Mass production and Methods of application of Biological control agents – *Trichoderma* and *Pseudomonas* - Preparation of botanical extracts, neem based extracts and antiviral principles - Survey and assessment of plant diseases.

References

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BIC 101

FUNDAMENTALS OF BIOCHEMISTRY

2+1

Theory

Unit I: Carbohydrates

Carbohydrates - occurrence and classification. Structure of monosaccharides, disaccharides and polysaccharides. Physical and chemical properties of carbohydrates - optical isomerism, optical activity, reducing property, reaction with acids and alkalis. Industrial uses.

Unit II: Lipids

Lipids - occurrence and classification. Important fatty acids and triacyl glycerol. Essential fatty acids. Physical and chemical constants of oils. Rancidity of oils. Waxes and phospholipids - types and importance. Plant pigments - structure and function of chlorophyll and carotenoids. Sterols - basic structure and their importance. Industrial applications of lipids.

Unit III: Proteins and Enzymes

Amino acids - classification and structure. Essential amino acids, Properties of amino acids - colour reactions, amphoteric nature and isomerism. Classification of proteins based on functions and solubility. Structure of proteins - primary, secondary, tertiary and quaternary. Properties and reactions of proteins. Enzymes - classification and Nomenclature. Mechanism of enzyme action. Factors affecting enzyme action. Competitive, non-competitive and uncompetitive inhibitors. Cofactors and coenzymes. Vitamins and minerals as coenzymes / cofactors. Isozymes. Industrial applications of enzymes.

Unit IV: Metabolism

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

Unit V: Secondary metabolites

Secondary metabolites - occurrence, classification and functions of phenolics, terpenes and alkaloids. Applications of secondary metabolites in food and pharma industries.

Practical

Qualitative tests for carbohydrates, estimation of reducing sugar, total sugar, starch and amylose. Qualitative tests for amino acids & proteins. Estimation of protein & amino acids. Estimation of free fatty acid and determination of oil content from oil seeds. Estimation of ascorbic acid. Estimation of phenol. Assay of an enzyme - Amylase. Chromatography of amino acids/sugars.

References

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AEC 101

PRINCIPLES OF AGRICULTURAL ECONOMICS

1+1

Theory

Unit I: Nature and Scope of Economics

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: Theory of Consumption

Utility : Definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility & 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: Theory of Production

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, types and importance of capital - capital formation – Entrepreneur, characteristics and functions of entrepreneur – Types of organization – Supply definition – law of supply – factors influencing supply - elasticity of supply.

Unit IV: Theory of Distribution

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: Macroeconomic Concepts

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 - Canons of taxation, public expenditure: principles - Inflation: Meaning, definition, kinds, Causes and control of inflation – Welfare Economics: Meaning, Pareto's optimality – Millennium Development Goals (MDG).

Practical

Law of Diminishing Marginal Utility - Law of Equi Marginal Utility - Individual and market demand - Indifference curve analysis and consumer equilibrium - Measurement of arc elasticity and point elasticity of demand - own price elasticity, income and cross elasticity of demand - consumer surplus - Population growth and food grain production - Supply elasticity - Causes of inflation and control measures – Types and functions of money - Computation of National income - Study of structural changes in the economy - welfare indicators.

References

1. Dewett, K.K.2002.Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
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New Delhi.

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New Delhi

III SEMESTER COURSES

Theory**Unit I**

Scope and importance of commercial floriculture in India – distribution of important flower crops – area and production – export potential – international and national floral industry. Institutions and developmental agencies involved in promotion of floriculture – TANFLORA, NHM, NHB, APEDA – Cropping systems in flower crops – Flower forcing. Soil and climate – Botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of rose, jasmine, chrysanthemum and tuberose.

Unit II

Soil and climate – botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of crossandra, marigold, nerium, gomphrena, celosia and China aster.

Unit III

Protected structures – controlled environmental conditions – Soil sterilization – factors influencing protected cultivation – cut flower production – flower forcing. Soil and climate – Botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of cut roses, carnation, gerbera, cut chrysanthemum and gladiolus.

Unit IV

Soil and climate – botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of orchids, anthurium, china aster, bird of paradise, Asiatic lily, heliconias, alstroemeria.

Unit V

Soil and climate – botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of flowering fillers viz., limonium, asparagus, ivy, gypsophila and baby eucalyptus.

Practical

Botany – description and identification of species and varieties in rose, jasmine, crossandra, chrysanthemum, tuberose, marigold, nerium, gomphrena, celosia, cut rose, carnation, gerbera, gladiolus, orchids and anthurium – propagation and planting – seed treatment and sowing – planting of tubers and suckers – lay out and planting of rose and

jasmine – media preparation and potting of orchids and anthurium – After culture practices in rose, jasmine, chrysanthemum, marigold and dahlia – harvesting, postharvest handling and storage – extraction of floral concrete from rose, jasmine and tuberose – visit to commercial fields, extraction units and flower markets – working out benefit cost ratio for loose flowers and cut flowers – preparation of project reports for fresh flower production and floral concrete extraction.

References

1. Bhattacharjee and De. L.C. 2004 – Advanced Commercial Floriculture.Vol.I & II.
2. Bhattacharjee, S.K., 2004 – Advanced commercial floriculture. Vol. I and II.
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5. Bose, T.K., Yadav, L.P., Pal. P., Parthasarathy, V.A., Das. P., 2003. Commercial flowers. Vol. I and II. Naya udyog, Kolkata - 6.
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FSC 201

PRODUCTION TECHNOLOGY OF TEMPERATE FRUIT CROPS

1+1

Theory

Unit I

Definition of temperate region- Temperate horticulture – Temperate fruits- Climatic conditions of temperate zone- Scope and importance of Temperate fruits cultivation – An overview on global, national economy - Area, production and export potential – Horticultural zones of India and Tamil Nadu with emphasis on temperate fruits.

Unit II

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques – Rootstock influence - Main field preparation – Spacing - Planting density - Planting and after care – Cropping systems - Nutrients, water and weed management – Training and pruning – Flowering, pollination and

fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and storage of Apple, pear, peach.

Unit III

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques– Rootstock influence- Main field preparation – Spacing - Planting density - Planting and after care – Cropping systems - Nutrients, water and weed management – Training and pruning – Flowering, pollination and fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and storage of Plum, Apricot.

Unit IV

Composition and uses – Origin and distribution – Species and cultivars – Varieties- Soil and climatic requirements – Propagation techniques– Rootstock influence- Main field preparation – Spacing - Planting density - Planting and after care – Cropping systems - Nutrients, water and weed management – Training and pruning – Flowering, pollination and fruit set – Use of plant growth regulators – Physiological disorders and remedies – Maturity indices and harvest – Post harvest handling – Ripening and storage of Strawberry, almond

Unit V

Cherry, persimmon, walnut, Kiwi, Queens land nut (Macadamia nut), pecan nut, hazel nut and chest nut.

Practical

Description and identification of varieties of apple, pear, peach and plum - Use of growth regulators in growth and development of temperate fruit crops - Nutrient management in temperate fruit crops - Physiological disorders of temperate fruit crops

Description and identification of varieties of apricot, almond, Cherry, strawberry, Kiwi, persimmon, walnut, pecan nut, hazel nut, chest nut and Queens land nut - Training and pruning methods followed in temperate fruit crops - Visit to private temperate fruit orchards - Economics for cultivation of temperate fruits

References

1. Singh, S.P. Commercial Fruits – Kalyani Publishers, Ludhiana
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SPC 201 PRODUCTION TECHNOLOGY OF PLANTATION CROPS 2+1

Theory

Unit I

Plantation crops, History, scope and importance, area and production, export and import potentials, role of plantation crops in economy of our country.

Unit II

Introduction, importance, area and production, origin and distribution, uses, soil, climate, propagation, preparation of pits, spacing and planting, planting systems, care of young palm, irrigation, soil moisture conservation, manuring and fertilization, methods of application of fertilizers, weeding, cropping system, physiological disorder, harvesting, yield, processing, deficiency disorders and byproducts for the following crops

Crops: Coconut, Arecanut, Oil Palm and Palmyrah

Unit III

Introduction, area and production, origin and distribution, uses, varieties, classification, climate, soil, propagation, preparation of land, shade regulation, spacing, planting, intercropping, irrigation, manuring, weeding, types of branching, pruning, top-working harvesting, processing, physiological disorder and byproducts .

Crops: Cocoa and Coffee.

Unit IV

Introduction, area, origin and distribution, production, export, soil, climate, types, varieties, propagation, preparation of main field and planting, shade regulation, irrigation, manuring, training and pruning inter cultural practices, mulching, weeding, cropping pattern, harvesting and processing.

Crops: Tea and Cashew

Unit V

Introduction, origin and distribution, area and production, uses, climate and soil, varieties and types of clones, propagation, spacing, planting, polyclonal seed garden manuring, cover crops, irrigation, weeding, tapping, tapping, use of growth regulators for latex flow, rain guarding, latex collection, yield of latex, processing and storage of rubber

Practical

Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cocoa gardens, manuring, irrigation; mulching, raising masonry nursery for palm, nursery management in cocoa. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics for coconut, arecanut, oil palm, cashew nut, cocoa, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, pruning, tipping and harvesting of tea.

References

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2. Harrer, C.R., 1963. The Culture and Marketing of Tea, Oxford University Press, London.
3. Marsh, A.C., M.K. Moss and E.W. Murphy. 1977. Composition of Food Spices and Herbs, Raw, Processed, Pre-prepared. Agri.Res.Serv. Hand Book 8 – 2. Washington.
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5. Thampan, P.K.1981. Hand Book of Coconut Palm. Oxford and IBH Publishing Co.Pvt.Ltd. New Delhi.
6. Pillai, K.H. 1984.Text Book of Plantation Crops, Vikram Publication, New Delhi.
7. Shanmugavelu, K.G. and Madhavrao, Spices and Plantation Crops - Madras popular Depot, *Sterling Road, Nungambakkam*.
8. Parthasarathy, V.A., P.K.Chatoopadhyay & T.K.Bose, Plantation crops Vol. 1&2- Naya Udyog, Kolkatta.

SPC 202

PRODUCTION TECHNOLOGY OF SPICES AND CONDIMENTS

2+1

Theory

Unit I

Introduction, history of spices, definition of spices and condiments, important spice crops of india, importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle. Institutes working on spices and condiments, role of organizations for improvement of spices and condiments.

Unit II

Origin and distribution, area and production, uses, botany, varieties, soil and climate, propagation, intercrop and mixed crop, shade and shade regulation, training and pruning, role of growth regulators, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology and value added products.

Crops: Black pepper, Cardamom, Turmeric, Ginger.

Unit III

Importance, origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing, storage and value added products.

Crops: Clove, Nutmeg, Cinnamon, All spice, Curry leaf, Tamarind and Kokum

Unit IV

Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products.

Crops: Coriander, Fenugreek, Fennel, Cumin, Dill, Celery, Bishop weed, Rosemary, Thyme, Vanilla, Saffron, Asafoetida

Unit V

Organic spice production, GAP in spices and condiments, cropping systems in spices and condiments.

Practical

Identification of varieties, propagation, seed treatment, sowing, layout, planting, hoeing and earthing up, manuring and use of weedicides, training and pruning, fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

References

1. Sharma, R.K., D.S.Bhati and Dr.B.N.Bhatta, Masalo ki Kheti" – *I.C.A.R., New Delhi*.
2. Purthi, J.S. 2006, Spices and Condiments – National Book Trust India *A.S.Green Park, New Delhi*.
3. Shanmugavelu, K.G. and Madhaorao, Spices and Plantation Crops - Madras popular Depot, *Sterling Road, Nungambakkam*.
4. Kumar, N. Introduction to Spices, Plantation, Medicinal and Aromatic crops. 1995. Oxford and IBH Publications, New Delhi.

Theory

Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, seed production, post-harvest technology. Marketing of potato, cabbage, cauliflower, Chow chow, knol-khol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, garlic, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke.

Unit I

Area, production, world scenario, industrial importance, export potential of temperate vegetable crops.

Potato.

Unit II

Cabbage, cauliflower, sprouting broccoli, Brussels sprout and Chinese cabbage, Chow chow

Unit III

Carrot, radish, beetroot, turnip and knol khol

Unit IV

Garlic, leek

Unit V

Peas and beans, green leafy cool season vegetables.

Practical

Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.

References

1. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. "Modern technology in vegetable production" New India Publishing Agency, New Delhi.
2. Prem Singh Arya and S. Prakash 2002. "Vegetable growing in India", Kalyani publishers, New Delhi
3. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. II & III Naya Prokash, Kolkata.
4. Sasanka Barooah. 1993. Vegetable growing In India, Kalyani Publishers, New Delhi
5. S. P. Singh, 1997. Principles of vegetable production Agrotech publishing Academy –

Udaipur

6. Hazra, P. and M. G. Som. 1999. Technology of vegetable production and improvement Naya Prakash, Calcutta
7. Veeraraghavathatham, A, Jawaharlal and Seemanthini Ramdoss. 1991. A guide on vegetable culture, Suri Associates, Coimbatore – 2.
8. Prem Singh Arya, 1999. Vegetable seed production in Hills, M.D. Publications Pvt. Ltd., New Delhi.
9. Bailey, L. H. 1999. Principles of vegetable cultivation, Discovery publishing House, New Delhi.
10. Swider, John. M., George W. Ware, J.P. Mccollum, 1992. "Producing vegetable crops", International book distributing co., Lucknow.
11. Gopalakrishnan, T.R. 2007. Vegetable Crops. New India Publishing Agency, New Delhi

AEX 211

FUNDAMENTALS OF EXTENSION EDUCATION

2+1

Theory

Unit I

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry/Horticulture extension: process, principles and selected programmes of leading national and international forest/horticulture institutes. People's participation in forestry programmes. Motivation of women community, children, youth and voluntary organizations for forestry/horticulture extension work.

Unit II

Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR. Reorganised extension system -ATMA, Extension infrastructure of GOI – NIRD, EEI, MANAGE.

Unit III

Communication: meaning, definition, elements, selected models, types and barriers. Audio – visual aids: importance, classification and selection. Extension Teaching Methods, factors influencing in selection – Individual method- Farm and Home visit, Result Demonstration. Group method- method demonstration, group discussion methods – Mass method – campagin, exhibition, farmers day- meaning, objectives and steps. Innovation-Diffusion, adoption and adopter categories. ICT application in horticulture.

Unit IV

Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal. (RRA).

Unit V

Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership.

Practical

Visit to study structure, functions, linkages and extension programmes of state department of Horticulture/ forests/NGO/Panchayats. All India Radio. Exercise on preparation and presentation of poster, charts, leaflet, folders. Script writing for radio and TV. Visit to All India Radio. Identification of village leaders. Visit to village to discuss about the prospects and problems of the village. Preparation and presentation of village horticultural production plan.

References

1. Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
2. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, New York
3. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
4. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

AGR 211 WEED MANAGEMENT IN HORTICULTURAL CROPS 1+1

Theory

Unit I: Introduction to Weeds

Weeds: Introduction, harmful and beneficial effects, characteristics of weeds, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy.

Unit II: Methods of Weed control

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

Unit III: Herbicides

Herbicides: advantages and limitations of herbicide usage in India. Herbicide classification, formulations, methods of application. Introduction to Adjuvants and herbicide antidotes and their use in herbicides.

Unit IV: Selectivity and activity of herbicides

Introduction to selectivity of herbicides. Herbicide absorption and translocation; Mode and mechanisms of action of herbicides. Herbicide mixtures and rotation. Interaction of herbicides with other agro chemicals, Herbicide resistance and Herbicide resistant crops.

Unit V: Weed management

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

Practical

Identification and preparation of herbarium of weeds; Survey of weeds in crop fields and other habitats; Biology of nut sedge, bermuda grass, parthenium and celosia. Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Economics of weed control practices; Tours and visits of problem areas.

References

1. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1991. All about Weed Control. Kalyani Publishers, New Delhi.
2. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
3. Rao, V. S. 1983. Principles of Weed Science. Oxford and IBH Publishing Co. New Delhi.
4. Jaganathan R. and R. Jayakumar. 2003. Weed Science Principles, Kalyani Publishers, New Delhi.
5. Hance, R.J. and K. Holly. 1990. Weed Control Handbook: Principles. Blackwell Scientific Publications, Oxford, London
6. Musselman, L. J. 1987. Parasitic Weeds in Agriculture. Vol. I. Striga. CRO Press Inc. Florida, US.

GPB 211

PRINCIPLES OF PLANT BREEDING

2+1

Theory

Unit I: Reproductive and pollination systems

Objectives and role of plant breeding - historical perspective, activities in plant breeding; Centres of origin – contribution of Vavilov, Harlan, Zhukovsky, law of homologous series; Plant genetic resources – importance, germplasm, types, activities, gene erosion, gene bank, collection, conservation, types of conservation, evaluation, national and international agencies, germplasm exchange; Modes of reproduction – sexual, asexual, self and cross fertilization; Modes of pollination- self, cross and often cross pollination, causes for self pollination and cross pollination; Self incompatibility – classifications, mechanisms, application, measures to overcome and limitations; Sterility – male sterility, classification, CMS, GMS, CGMS, TGMS, PGMS, gametocides, transgenic male sterility, their inheritance and applications; Apomixis – classification, applications, parthenocarpy and its types.

Unit II: Breeding methods of self pollinated crops

Plant introduction as a breeding method – types of introduction, objectives, quarantine, acclimatization, achievements, merits and demerits; Genetic basis of self pollinated crops – Vilmorin principle of progeny selection, Johannsen's pure line theory; Breeding methods for self pollinated crops: Pure line selection – procedure, merits and demerits, achievements; Mass selection – procedure, comparison of mass and pureline selection, achievements; Hybridization- objectives, types, choice of parents, combination breeding and transgressive breeding, selection in segregating populations; Pedigree breeding – procedure, mass pedigree, merits and demerits, achievements; Bulk breeding – procedure, merits and demerits, achievements, comparison of pedigree and bulk breeding methods; Single Seed Descent method – procedure, application, merits and demerits; Backcross breeding – genetic principles, prerequisites, procedures for transferring dominant and recessive genes, merits and demerits; Multilines and multiblenes; Population improvement approach in self pollinated crops.

Unit III: Breeding methods of cross pollinated crops

Genetic structure of a population in cross pollinated crop; Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement; Breeding methods of cross pollinated crops: Mass selection - modified mass selection, unit selection, progeny selection, half sib selection, full sib selection; Recurrent selection- principles, types, merits and demerits; Heterosis breeding – genetic basis, hybrid vigour and inbreeding depression, estimation of heterosis, procedure- development of inbreds, selection of inbreds for combining ability, types of hybrids, use of male sterility systems and manual emasculation in hybrid seed production, maintenance of parental lines, achievements, merits and demerits; Synthetics and composites – steps in development of synthetics and composites, achievements, merits and demerits.

Unit IV: Breeding methods of asexually propagated crops

Genetic structure of a population in asexually reproducing crop; Clone – features; Breeding methods – Clonal selection – procedure- achievements- merits and demerits; Hybridization and clonal selection – procedure, achievements, merits and demerits; Synthetics- procedure- polycross test, achievements; Chimeras and its types; Tree breeding – clonal orchards.

Unit V: Special breeding methods

Polyploidy breeding – classification, amphidiploid, induction of auto and allo polyploids, features, induced triploids and tetraploids, induced allopolyploids, achievements, limitations; Wide hybridization - importance, barriers and techniques for overcoming barriers - achievements; Mutation breeding – mutation and its features, spontaneous and induced mutations, mutagen and its types, procedure, applications, achievements, limitations; Stress breeding – abiotic and biotic stresses, virulence, pathogenesis, mechanisms of resistance, levels of resistance, vertical and horizontal resistance; Quality breeding - quality parameters, antinutritional factors, achievements; Basic biometrics – nature and significance of qualitative and quantitative variation, phenotypic, genotypic and environmental variability- heritability and genetic advance; Types of cultivars and procedure for release of new varieties.

Practical

Observation on reproductive and pollination systems in plants – Alternation of generation and life cycle; Description and drawing of different pollination systems – Mechanisms enforcing self and cross pollination; Breeder kit – emasculation technique – selfing and crossing techniques; Studies on segregating populations and maintenance of records; Morphology of pollen grains and assessment of pollen fertility and sterility in A, B and R lines; Maintenance of A, B, R and TGMS lines; Estimation of different types of heterosis; Irradiation – dosimetry, half life period – procedure for irradiation; Chemical mutagenesis – molar solution, procedure for treatment; Wild species- maintenance and utilization; Germplasm conservation and preservation, records maintained; Polyploid and its induction using colchicines; Screening method for biotic and abiotic stresses; Quality parameters of horticultural crops; Calculation of PCV, GCV, heritability, genetic advance; Layout of different breeding trails and procedure for release of varieties.

References

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. Satya, P. 2012. Plant Breeding- Genetic principles and Methodologies, Books and Allied (P) Ltd. Kolkata.
4. Jag Paul Sharma, 2014. Principles of Vegetable Breeding, Kalyani Publishers, New Delhi.
5. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot. Chennai – 15.
6. Chopra, V. L., 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
7. Sharma, J. R. 1994. Principles and practice of plant breeding Tata McGraw-Hill publishing Co., New Delhi.
8. Allard, R. 1989. Principles of plant breeding. John Wiley and Sons, New Delhi.
9. Russell, G. E. 1985. Progress in Plant Breeding. Butter Worths, England.
10. Chaudhary, H. K. 1980. Elementary principles of plant breeding. Oxford and IBH publication Co., New Delhi.

SAC 211

SOIL, PLANT AND WATER ANALYSIS

0+1

Practical

Methods of plant sample collection- processing of sample for analysis. Estimation of moisture, ash, crude protein, P, K and crude fibre in plant samples. Estimation of CEC, exchangeable cations, SAR and ESP – Analysis of irrigation waters – pH, EC, TSS, Anions and Cations – Quality appraisal of irrigation waters.

References

1. Dutcher R.A., Jensen C.O and Alttious P.M. 1951. Introduction to Agricultural Biochemistry - John Wiley and Sons Inc., New York.
2. Friend J. and Rhodes M.J.C. 1981. Recent advances in the biochemistry of fruits and vegetables. Academic Press, London.
3. Hulme A.C. 1970. The biochemistry of fruits and their products Vol.I & II- Academic Press, London.
4. Rameshwar. A. 1993. Outlines of plant biochemistry- Naya Prakash, Calcutta.

IV SEMESTER COURSES

Theory**Unit I**

Importance and scope of gardening – History of gardening – Gardens in India – definition, principles and concepts of landscape gardening - Types of garden – Hindu, Moghul, Persian, Japanese, English, French and Italian garden – Formal, Informal and Picturesque types – Bio – aesthetic planning – definition and need – ornamental landscaping in environmental protection.

Unit II

Garden components and adornments – importance and designing – plant components and non-plant components - rosary, topiary, trophy, rockery, pond, sunken garden, flower beds, arboretum, conservatory, roads, walks, paths, hedges, edges, carpet garden, arch, pergola, arbour, fountains, cascades, garden seats, statues, hanging baskets, trellis, ornamental vases, ornamental urns, Decks, Bird bath, Sundial and window boxes. Special types of gardens - principles and design – dish, terrarium, water and bog garden, traffic islands - roof garden, rockery, vertical garden and tree transplanting.

Unit III

Study of foliage and flowering plants and their design and values in landscaping – ornamental annuals - shrubs - trees – herbaceous perennials – climbers and creepers – palms and palmatum- ferns and fernery – cacti and succulents. Dry flower– principles and types - Flower arrangement – principles, designs and styles – ikebana, moribana - bouquet making - bonsai - methods, styles and maintenance.

Unit IV

Landscape architecture – design, planning and management of natural and built environments. Computer aided design (CAD) - landscape planning– home garden, public, urban and industrial gardening. Avenue planting – principles, plants suitability and planting.

Unit V

Importance and scope – turf grasses – species and types – selection of site –media and field preparation – types of lawn making – turf establishment for golf ground, cricket pitch and football field – turf management - renovation of lawns –astro turf and management.

Practical

Identification and description of annuals – shrubs – trees – herbaceous perennials – climbers and creepers – palms and ferns – cacti and succulents. Software tools in landscape architecture – landscape with CAD - Planning and designing of garden components – special types of gardens – avenue planting – site design creation – urban and rural planting- Dry flower and bonsai making - turf management - visit to gardens - visit to institutional garden, sports ground with lawn and to turf nurseries – renovation of lawns .

References

1. Mc Carty, L.B. 2005. Best Golf Course Management Practices. 2nd Edition. Pearson Prentice Hall, Upper Saddle River, NJ.
2. Bhattacharjee, S.K. 2004. Landscape Gardening and Design with plants. Aavishkar Publishers and Distributors, Jaipur.
3. Bose T.K., B. Chowdhury and S.P. Sharma 2001. Tropical garden plants in colour. Horticulture and Allied Publishers, Kolkata.
4. Auto CAD – 2010 Edition
5. Randhawa, G.S. and A. Mukhopadhyay. 1998. Floriculture in India. Allied publishers Limited, New Delhi
6. Nambisan, K.M.P. 1992 – Design elements of landscape gardening – Oxford and IBH publishing Co, New Delhi.
7. Lancaster, P. 1991. Gardening in India. Oxford and IBH publishers Pvt. Ltd., Calcutta.
8. Gopalasamy Iyengar. 1990. Complete gardening in India. IBH. Bangalore.

FSC 202

BREEDING OF FRUIT AND PLANTATION CROPS

2+1

Theory

Fruit breeding - History, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – in vitro breeding tools (important fruit and plantation crops).

Unit I: Coconut, arecanut, coffee, tea

Unit II: Cashew, cococa

Unit III: Rubber, oilpalm and palmyrah

Unit IV: Tropical and Sub tropical fruits

Unit V: Temperate and arid zone fruits

Practical

Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy.

References

1. Anil Kumar Shukla and B.B.Vashishtha. Fruit breeding – approaches and achievements: IBDC, Lucknow.
2. Janick, J and Moore J.N. Fruit breeding Vol. - I, II, III - John Willey & sons U.S.A
3. Singh, B.D. Plant Breeding, Kalyani Publishers. New Delhi / Ludhiana.

Theory**Unit I: Foods and their nutrients**

Importance of food and its function, food groups, food pyramid, physico-chemical properties of food, method of food preparation, nutrition, food in relation to health, malnutrition.

Unit II: Energy

Definition, determination of energy value of food, total energy requirement, Basal metabolic rate and its measurement, measuring total energy requirement, energy requirement during work and thermic effect of food.

Unit III: CHO [Carbohydrates], Proteins and fats

CHO: Classification, function, digestion and absorption source and utilization

Protein – Function, classification, digestion and absorption, functions of Amino acids, quality of protein, PER/ NPR/ NPU.

Lipids – Classification, Functions, sources, requirement digestion, absorption and utilization, saturated and unsaturated fatty acids.

Unit IV: Vitamins and minerals

Vitamins: Water soluble vitamins – Thiamin, Riboflavin and niacin, Folic acid and B12 – function, sources, effects of deficiency and its requirement. Fat soluble vitamins – A, D, E, K – function, source, deficiency and their requirement

Minerals: Micro minerals Iron, Iodine, Zinc-functions, utilization, deficiency and their requirement, macro minerals – calcium, phosphorus – functions, absorption, metabolism, RDA and source.

Unit V: RDA and assessment of nutritional status:

Balanced diet, RDA and factors affecting RDA, RDA for various age groups. Assessment of Nutritional status – Anthropometric, clinical, biophysical, functional, biochemical dietary assessments and vital health statistics.

Practical

Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reaction of fruits and vegetables. Microscopic examination of starches, estimation of energy value protein and fats of food, planning diet for various age groups.

References

1. Srilakshmi, B. 2008 "Nutrition Science" New Age International Publishers.
2. Srilakshmi, B. 2011 "Dietetics" New Age International Publishers
3. Swaminathan, M, 1998. Essential of food and nutrition, Volume I and II. The Bangalore printing and Publishing Co, Ltd, Bangalore.

AEN 211 INSECT PESTS OF FRUITS, PLANTATION, MEDICINAL 2+1 AND AROMATIC CROPS

Theory

Unit I: Insect ecology and components of pest management

Insect Ecology- Effect of abiotic and biotic factors on insect population. Pest – definition, categories of pests, factors governing pest outbreaks. Concept of economic threshold level and economic injury level. Principles and components of pest management

Unit II: Methods of pest control

Cultural, physical, mechanical and legal methods of pest control. Biological control – parasitoids, predators, viruses, bacteria, fungi and nematodes and their role in insect management. Host plant resistance – Types and mechanisms of resistance. Chemical control – Classification of pesticides, role of insecticides in pest management. Biorational pest management - Semiochemicals – pheromones, allomones , kairomones and synomones - role of pheromones in pest management. Insect growth regulators – moult inhibitors, JH mimics, insect antifeedants, repellants and botanicals in pest management. Biotechnology in pest management.

Unit III: Pests of fruits

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Guava, Sapota, Citrus, Banana, Grapevine, Jack, Jamun, Aonla, Pomegranate, Papaya, Ber, Apple, Pear, Peach and Plum, Pineapple.

Unit IV: Pests of plantation crops, medicinal and aromatic plants

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of coconut, arecanut, oil palm, cinchona, coffee, tea, cashew, rubber, cocoa, cardamom, pepper, betel vine, aswagantha, senna, hemp, belladonna, pyrethrum, camphor, costus, croton, datura, dioscorea, mint, opium, *Solanum viarum*, Tephrosia, neem, teak, subabul, eucalyptus.

Unit V: Stored product pests

Storage insects, distribution, host range, bioecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue problem in fruits, plantations, medicinal and aromatic crops and their tolerance limits.

Practical

Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect pests affecting fruits, plantation, medicinal and aromatic crops in field and storage.

References

1. Ayyar, 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. Butani, D.K. 2009. Insects and Fruits. Periodical Expert Book Agency, New Delhi.
4. Butani, D.K. and M.G.Jotwani, 1984. Insects of Vegetables. Periodical Expert Book Agency, New Delhi.
5. Srivastava, K.P. and D.K.Butani, 1998. Pest Management in Vegetables (Part I & II) Research Periodicals and Book Publishing House, India.

AGR 212

PRINCIPLES OF AGRO-CLIMATOLOGY AND WATER MANAGEMENT

1+1

Theory

Unit I: Agro Climatology and Weather Parameters

Agro climatology - Atmosphere - Composition and vertical layers of atmosphere- Factors affecting climate and weather – Agroclimatic zones of India, Tamil Nadu and Puducherry; Weather parameters - Solar radiation, Light, Air and Soil temperature, Relative Humidity, Wind, Atmospheric pressure, Precipitation, Evapotranspiration and Transpiration; PET- Its effect on horticultural crops

Unit II: Climate Change and Weather Forecasting

Climate change- climate variability – definition and causes of climate change - Impact of climate change on Horticulture. -Weather forecasting types and Agromet Advisory Services.

Unit III: Importance of Water and Soil-Water-Plant relationship

Importance of water - Water resources and irrigation potential of India, Tamil Nadu and Puducherry - Role of water in plant growth- Water relations – Soil-plant-water relationship - Soil-plant atmospheric continuum – Hydrological cycle – Soil water movement – soil moisture constants - Moisture extraction pattern – Absorption of water –Plant water stress and its effect and methods to overcome stress

Unit IV: Crop Water Requirement, Scheduling of Irrigation and Methods

Crop water requirement – consumptive use – Definition and estimation – Factors affecting water requirement – Critical stages of irrigation and water requirement of horticultural crops. Scheduling of irrigation – Different approaches - Methods of irrigation:

surface, sub-surface sprinkler and drip irrigation – Micro irrigation: layout, suitability, merits and scope – Water use efficiency – Methods to improve WUE – Water management for different horticultural crops.

Unit V: Quality of Irrigation Water and Drainage

Quality of irrigation water – Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation – Agricultural drainage, importance and methods of drainage.

Practical

Site selection and lay out of Agromet Observatory. Sunshine recorder - Maximum, Minimum, Grass minimum and Soil thermometers - Dry and wet bulb thermometers - Wind vane - Anemometer - Rain gauge - Ordinary and Self-recording; - Evaporimeters – Lysimeters - Dew gauge. Estimation of soil physical parameters (Bulk density and Particle density) and soil moisture – Measurement of irrigation water through water measuring devices (flumes and weirs) – Calculation of irrigation water requirement (problems) – Acquiring skill on land shaping for different surface irrigation methods – Operation and economics of sprinkler and drip irrigation systems – Estimation of crop water requirement – Scheduling of irrigation based on different approaches – Water Use Efficiency (WUE) - Irrigation water quality - Methods of drainage and observation of drainage structures.

References

1. Gopalaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.
2. Mavi, H.S., 1996. Introduction to Agrometeorology, oxford and IBH Publishing Co., New Delhi.
3. Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
4. Yellamanda Reddy, T. and G.H. Sankara Reddi, 2004. Principles of Agronomy, Kalyani Publishers, Ludhiana.
5. Narayanan .AL.2015. Principles of Agricultural Meteorology, Sri Velan Pathipagam, Chidambaram.
6. Lenka, D. 1999. Irrigation and Drainage. Kalyani Publishers.
7. Michael, A.M. 1997. Irrigation: Theory and Practice Vikas Publishers
8. Rao, Y.P and S.R.Bhaskar. 2008. Irrigation technology – theory and practice. Agrotech publishing company, Udhaipur.
9. Ramachandrappa, B.K and H.V.Nanjappa.2008. Fertigation technology. Agro-bios, Jodhpur.
10. Thokal, R.T., D.M. Mahale and A.G. Powar. 2004. Drip irrigation system-clogging and its prevention. Pointer publishers, Jaipur.
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12. Sankara Reddy, G.H. and T. Yellamanda Reddy. 1997. Efficient use of irrigation water. Kalyani Publishers
13. Panda, S.C. 2006. Principles and Practices of water management. Agro-bios Publishers

Theory**Unit I**

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Arithmetic Mean; Median, Mode, Geometric mean and Harmonic mean for raw data, Properties Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation for raw data.

Unit II

Probability: Definition and concept of probability; Binomial and Poisson distribution Normal Distribution and its properties; Introduction to Sampling: Random Sampling; 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 Sample); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples (with equal variance) and Paired t test. Chi-square test for application of attributes and test for goodness of fit of Mendelian ratios.

Unit IV

Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient ' r '. Properties. Linear Regression: of Y on X and X on Y. Inter-relation between ' r ' and the regression coefficients, fitting of regression equations. Properties of regression coefficients.

Unit V

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

Practical

Construction of Frequency Distribution Tables and Frequency Curves; Computation of Arithmetic Mean for Un-Grouped and Grouped data; Computation of Median for Un-Grouped data; Computation of Mode for Un-Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped data; SND test for Means, Single Sample; SND test for Means; Two Samples; Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient ' r '; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

References

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3. S.C. Gupta & V.K. Kapoor, Fundamentals of Applied Statistics, 2006, Sultan Chand & Sons, New Delhi.
4. Chandel, S.R.S., 1999, A hand book of Agricultural Statistics, Achal Prakashan Mandhir, Kanpur.
5. Gomez, K.A. and Gomez, A.A., 1984, Statistical Procedures for Agricultural Research, John Wiley and Sons, New York.
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ANM 211 NEMATODE MANAGEMENT IN HORTICULTURAL CROPS 1+1

Theory

Unit I: Introduction and economic importance

Introduction to Nematology – History of development of Nematology - economic importance of nematodes- beneficial nematodes

Unit II: Morphology, anatomy and taxonomy

Morphology of nematodes. Anatomy of nematodes – digestive, excretory, nervous and reproductive system of nematodes. Biochemical/molecular tools for nematode identification - Taxonomy of nematodes upto super family and classification of nematodes based on parasitism.

Unit III: Lifecycle, symptom and interaction

Life cycle of important nematodes – *Meloidogyne*, *Globodera*, *Rotylenchulus*, *Tylenchulus*, *Radopholus* and *Pratylenchus*. Symptoms of nematode damage interaction of nematodes with other microorganisms.

Unit IV: Nematode management

Principles of nematode management - legislative (plant quarantine); physical methods (soil solarisation, hot water treatment, seed cleaning); cultural methods (deep ploughing, fallowing, crop rotation, antinemic plants, other land management practices); host plant resistance to nematodes; Improved techniques for nematode resistance breeding; biological control (nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR bacteria and predators); chemical control. Integrated nematode management.

Unit V: Nematode diseases of crops

Nematode diseases of fruits (banana, citrus, grapevine, papaya) – vegetables (tomato, brinjal, bhendi, chilli, potato) - spices (turmeric, pepper, cardamom) flowers

(crossandra, rose, jasmine, tuberose) plantation crops (tea, coffee, betel vine) mushroom, medicinal and aromatic plants and nematode problem in protected cultivation.

Practical

Sampling techniques for nematode assay. Processing of soil samples for extraction of active nematodes - Extraction of nematodes by centrifugal floatation method and separation of cyst nematodes - Extraction of nematodes from plant samples. Staining techniques, direct examination of nematodes and warring blender technique. Killing, fixing, preservation and counting of nematodes - Processing and mounting of nematodes. Observation of morphological characters of *Tylenchida* (*Hoplolaimus*) and *Dorylaimida* (*Xiphinema*) - Identification of nematodes *Helicotylenchus* and *Tylenchorhynchus* – *Pratylenchus*, *Longidorus*, *Xiphinema* – *Hemicriconemoides*, *Aphelenchoides*, *Tylenchulus*. Study of life stages of *Meloidogyne*, *Globodera*, *Rotylenchulus* and *Radopholus*. Nematode disease symptoms in fruits, vegetables, spices, flower crops and medicinal and aromatic plants. Nematicides, bio control agents, application methods and calculation of dosages.

References

1. Walia, R. K. and Bajaj, H. K. 2003. Text Book on Introductory Plant Nematology, ICAR, New Delhi.
2. Parvatha Reddy, P. 1987. A Treatise on Phytonematology, Agricole Publication, New Delhi. P 381.
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6. Southey, J. F. 1970. Laboratory methods for work with plant and soil nematodes. Her Majesty's Stationery Office, London.
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8. Webster, J. 1972. Economic Nematology. Academic Press, London, p. 396.
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PAT 211

MUSHROOM CULTURE

0+1

Practical

Unit I: Introduction to mushroom Science

Definition of Mushroom - Importance and History of mushroom cultivation - Global and National Scenario – Nutritional and Medicinal Values of Mushrooms, Mushroom Nutraceuticals – Morphology of mushrooms - Life cycle of mushroom - Edible and Poisonous mushrooms – Edible mushrooms – *Pleurotus*, *Calocybe*, *Agaricus* and *Volvariella* - Mushroom varieties and strains

Unit II: Mushroom Cultivation Technology

Genetics and Breeding of Cultivated Mushrooms: Matting types - Homothallism and Heterothallism, Primary and Secondary control systems, Parasexuality, Homokaryotic fruiting - Approaches to Breeding : Selection, mutation and hybridization – Tissue culture, Single and multispore isolates – Biotechnological methods for strain improvement - Laboratory techniques: Equipments, instruments and essentials for Spawn and mushroom production - Safety procedures for handling laboratory equipments - Culture media - Sterilization techniques - Mushroom Culture Preparation and Preservation Techniques - Spawn Production Technology – Spawn: types - mother spawn and bed spawn - Cultivation techniques of Oyster mushroom, Milky mushroom, Button mushroom and Paddy straw mushroom - Mushroom cultivation in Integrated farming system - Recycling of spent mushroom.

Unit III: Problems in Mushroom Cultivation

Pest and Disease management - Competitor Moulds – Fungal, bacterial and viral Diseases - Insect Pests – Nematodes in Mushroom Production and Their Management – Abiotic disorder of mushroom – Integrated pest management in mushroom mushroom cultivation – Exclusion – Cultural control – Biological control and chemical control

Unit IV: Economics of mushroom cultivation

Principles of enterprise management - Cost analysis and Project preparation - Agricultural Finance: Sources of finance and acquisition - Assets required for mushroom cultivation - Natural assets – Social assets – Human assets - Physical Assets – Financial Assets - Economics of Spawn Production - Economics of Oyster mushroom production - Economics of Milky mushroom production - Economics of button mushroom production - Economics of Paddy straw mushroom production -

Unit V: Post harvest technology of mushrooms

Post harvest technology: methods of preservation and value addition - Mushroom recipes - Cooking methods, Value added products, pickling, sauce, ketchup and chutney, Instant food mixes, extruded and bakery products, Quality and Sensory evaluation

References

1. Aneja, K. R.1996. Experiments in Microbiology, Plant Pathology, Tissue culture and cultivation Mushroom (2nd Edition). Wishwa Prakashan, New Delhi, 451 pp.
2. Bahl, N. 2000. Handbook on Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 166 pp.
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8. Krishnamoorthy, A.S., M.Muthusamy., T.Marimuthu, V. Narasimhan and A. Muthusankaranarayanan. APK2 Milky Mushroom. Extn. Bulletin. Regional Research Station, TNAU, Aruppukottai.
9. Marimuthu, T., A.S. Krishnamoorthy., K. Sivaprakasam and R. Jeyarajan. 1989. Oyster mushroom production. The Vijay books, Sivakasi.
10. Nair, M.C., C. Gokulapalan and Lulu Das 1994. Advances in Mushroom Biotechnology. Scientific Publishers, Jodhpur.
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14. Raveendran, N., K. Loganathan., K. Mani., K. Mahendran and D. Suresh Kumar. 2003. Agribusiness Management. Department of Agricultural and Rural Management, CARDS, TNAU, Coimbatore -3.
15. FAO. 2000. Mushroom production training for disabled people: a progress report, Sustainable Development Department, Rome.
16. Manjit Singh, Bhuvnesh Vijay, Shwet Kamal and G.C. Wakchaure. 2011. Mushrooms. Cultivation, Marketing and Consumption, Directorate of Mushroom Research (ICAR), Solan (India).
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SST 211

SEED PRODUCTION OF VEGETABLE, TUBER AND SPICE CROPS

2+1

Theory

Unit I: Introduction to Seed Production

Seed Production- Principles – Difference between seed and grain –Importance and scope of vegetable seed production –History of Indian Seed Industry - Deterioration of crop varieties – Factors affecting deterioration and their control- Maintenance of genetic purity during seed production – Seed quality - Definition, Characteristics of good quality seed – Different classes of seed – Generation system of seed multiplication- Seed Multiplication ratio - Seed Replacement Rate- Factors affecting vegetable seed production.

Unit II: Seed Production & Certification

Seed Production - Methods of seed production in Solanaceous vegetables-Tomato-Brinjal -Chillies-Okra-leguminous vegetables- Cluster Bean-Cowpea-French bean-Dolichos lab lab-Garden pea- Cucurbits-Cucumber-Gourds-Pumpkin-Musk melon-Water melon-Root vegetables-Carrot-Radish-Turnip-Beet root-Cole crops-Cabbage- Cauliflower-Knol Khol-Tuber-Potato-Bulb crop-Onion-Leafy vegetables-Palak-Fenugreek- Amaranthus, Moringa-Exotic-

Baby corn - Seed Certification, Phases of Certification, Procedure for seed certification, Field inspection and Field counts etc.

Unit III: Post Harvest Handling

Seed Drying – Principles- moisture equilibrium between seed and air –Types of Drying –Seed Driers-Seed processing – Air screen machine and its working principle, different upgrading equipments and their use –Seed extraction- Seed treatment – Importance- types- Equipments used (Slurry and Mist –O-matic treater) - Seed quality enhancement - Establishing Seed Testing Laboratory.

Unit IV: Seed Storage and Marketing

Seed packing– Types of containers-Seed storage- Principles of seed storage - Stages of seed storage - factors affecting seed longevity during storage - conditions required for good storage – Seed godown sanitation – Seed marketing – Seed demand forecasting and planning- marketing structure - marketing organizations - sales generation activities, promotional media, pricing policy-Factors affecting seed marketing.

Unit V: Seed quality control

Seed Policy - Seed Act and Rules - Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories. Seed Law Enforcement - Duties and Powers of Seed Inspectors, offences and penalties. Seed Control Order 1983, New Seed Bill 2004 and other issues related to seed quality regulation – Intellectual property rights, patenting, WTO, PPV & FR Act-Varietal Identification through Grow-out Test and Electrophoresis.

Practical

Identification of seed and seed structure - Seed quality analysis in Horticultural crops - Principles and procedures - Seed sampling –Physical purity analysis- Germination testing- Moisture determination - Viability test - Vigour tests - Seed dormancy and breaking methods – Seed health test - Studies on Physiological maturity, Harvesting, Threshing & Seed Extraction- techniques- Seed Quality enhancement - Visit to seed production plots and examining field standards - Varietal identification- Emasculation & pollination, Planting ratios, isolation distance, roguing, yield assessment, etc. in seed production plots- Grow out tests and electrophoresis for varietal identification - Seed production planning- Visit to Seed Processing Unit - Visit to seed testing laboratory and Seed Certification Agency.

References

1. S.P.Singh. 1999. Seed production of commercial vegetables. Kalyani Publishers. New Delhi.
2. Raymond A.T. George. 1985. Vegetable seed production. Longman and London, New York.
3. P.S.Arya. 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.
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7. Singhal NC. 2003. Hybrid Seed Production in Field Crops. Kalyani Publishers, New Delhi.
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 9. Ramalingam, C., K. Sivasubramnaiam and A. Vijayakumar. 1997. A guide to seed legislation. Rassi Computers, Madurai.
 10. Agrawal PK. (Ed.). 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi.
 11. Tunwar NS & Singh SV. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.

V SEMESTER COURSES

Theory**Unit I: Definition, stages and photosynthetic productivity**

Growth and development - definitions, optimum leaf area index (LAI), photosynthetic productivity, canopy development; different stages of growth and growth regions.

Unit II: Growth analysis

Structure and function of cells, cell division, cell enlargement and differentiation, growth curves, growth analysis in horticultural crops.

Unit III: Plant growth regulators

Plant growth regulators - auxin, gibberellin, cytokinin, ethylene, inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening.

Unit IV: Flowering and its physiology

Flowering-factors affecting flowering, physiology of flowering, photoperiodism-long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training, translocation of assimilates.

Unit V: Physiology of ripening and seed development

Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and methods of breaking dormancy in horticultural crops. Factors affecting fruit set and development, physiology of ripening of fruits- climacteric and non-climacteric fruits.

Practical

Leaf area index, growth analysis parameters including harvest index, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, rapid tissue test, seed dormancy, seed viability by tetrazolium test, seed germination and breaking seed dormancy with chemicals and growth regulators, biostimulants.

References

1. Prasad, S and V. Kumar, Principles of Horticulture, Agro Botanica, 4E176 IN, Vyas Nagar, Bikaner – 334 303.
2. Carl Leopold, A. Plant growth and development, Mc Graw Hill Pub. New York, San Francisco, Toronto.

Practical

Principles and elements of landscape design, plant material for landscaping, symbols, tools and implements used in landscape design, layout of formal gardens, informal gardens, special type of gardens (bog garden, sunken garden, terrace garden, rock garden) and designing of conservatory and lath house. Landscape design for specific areas.

References

1. Mc Carty, 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.
3. Bose T.K., B. Chowdhury and S.P. Sharma 2001. Tropical garden plants in colour. Horticulture and Allied Publishers, Kolkata.
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5. Randhawa, G.S. and A. Mukhopadhyay. 1998. Floriculture in India. Allied publishers Limited, New Delhi
6. K.M.P. Nambisan 1992 – Design elements of landscape gardening – Oxford and IBH publishing Co, New Delhi.
7. Lancaster, P. 1991. Gardening in India. Oxford and IBH publishers Pvt. Ltd., Calcutta.
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Theory**Unit I**

History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements, harvesting and processing.

Crops: Betel vine, Periwinkle, Rauvolfia, Dioscorea, Isabgol, Gloriosa, Cinchona and Pyrethrum.

Unit II

Importance and uses, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements, harvesting and processing.

Crops: Senna, Coleus, Aswagandha, Aloe, Centella, Insulin Plant, Noni and Indian long pepper

Unit III

History, importance and uses-industrial and cosmetic values, area and production, future prospects, opportunities and constraints in the cultivation of aromatic plants, Extraction methods for essential oil crops – distillation methodology and advantages and disadvantages of water distillation, water and steam distillation, enfleurage or cold fat extraction, Maceration or Hot fat extraction, Solvent extraction, Expression, Supercritical Fluid Extraction (SCFE), storage of essential oils, Technical terms used in the trade.

Unit IV

Importance and uses, origin, distribution, area and production, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.

Crops: Lemongrass, Citronella grass, Palmarosa, Lavender, Geranium and Patchouli.

Unit V

Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, transplanting, spacing, manures and fertilizers, irrigation, interculture, harvesting and yield.

Crops: Ambrette (Musk), Bursera, Ocimum, Davana, Vetiver, Mint and Sweet flag

Practical

Collection of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction of essential oils.

References

1. Atal, C.K and B.M. Kapur. 1982. *Cultivation and Utilization of Aromatic Plants*. RRL, CSIR, Jammu.
2. Farooqi, A.A and A.H.Sriram. 2000. *Cultivation Practices for Medicinal and Aromatic Crops*. Orient Longman Publ.
3. Farooqi, A.A, M.M. Khan and M. Vasundhara. 2001. *Production Technology of Medicinal and Aromatic Crops*. Natural Remedies Pvt. Ltd.
4. Hota, D. 2007. *Bio Active Medicinal Plants*. Gene Tech Books. Jain S.K. 2000. *Medicinal Plants*. National Book Trust.
5. Khan, I.A and A. Khanum. *Role of Bio Technology in Medicinal and Aromatic Plants*. Vol.IX. Vkaaz Publ.
6. Kurian, A and M. Asha Sankar 2007. *Medicinal Plants*. Horticulture Science Series, New India Publ. Agency.
7. Panda, H. 2002. *Medicinal Plants Cultivation and their Uses*. Asia Pacific Business Press.

Theory

Centres of origin, plant bio-diversity and its conservation. Models of reproduction, pollination systems and genetics of important vegetable, tuber and spice crops. Self-incompatibility and male sterility, its classification and application in crop improvement. Principles of breeding self-pollinated crops, pure line selection, mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method, bulk method, modified bulk method, single seed descent method and back cross method. Polyploidy breeding. Mutation breeding. Principles of breeding cross pollinated crops, mass selection, recurrent selection, heterosis breeding, synthetics and composites. Application of biotechnology in crop improvement.

Unit I: Solanaceous vegetables

Unit II: Cole crops

Unit III: Cucurbits

Unit IV: Bulb crops, root crops, potato

Unit V: Leafy vegetables, okra, leguminous crops, tuber and spice crops

Practical

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic variability, heritability, genetic advance. Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

References

1. Chopra, V.I. 1990. Plant Breeding Theory and Practices, Oxford and IBH Publishing Co., New Delhi.
2. Harihar Ram. 1998. Vegetable Breeding – Principles and Practices. Kalyani Publishers, New Delhi.
3. Hayward, M.D., Bosemark, N.O. and Romagosa (eds) 1993. Plant Breeding – Principles and Prospects, Chapman and Hall, London.
4. Kumar, N. 2006. Breeding of Horticultural Crops – Principle and Practices. New India Publishing Agency, PitamPura, New Delhi.
5. Roy, Darbeshwar. 2000. Plant Breeding – Analysis and Exploitation of Variation. Narosa Publishing House, New Delhi.
6. Singh B.D. 2002. Plant Breeding, Principles and Methods. Fifth Edition, Kalyani Publishers, New Delhi.

Practical

Hands on experience to the students on crop production aspects, practical training and experience in vegetable production in one transplanted crop (tomato or brinjal or chillies) and one direct sown crop (bhendi or amaranthus or radish or aggregatum onion) – seed treatment – raising nursery – sowing seeds – field preparation – transplanting, manuring, irrigation, fertigation, weed control, after culture – growth regulators – plant protection – maturity indices and harvesting – maintenance of cultivation sheet – working out cost benefit ratio.

References

1. Nem Pal Singh, A.K. Bharadwaj, Abnish Kumar and K.M.Singh.2004. Modern Technology on Vegetable Production. International Book Distributing Company, Lucknow.
2. Prem Singh Arya. 2002. A Text Book of Vegetable Culture, Kalyani Publishers, New Delhi.
3. Bose, T.K., J. Kabir and V.A. Parthasarathy. 2002. Vegetable Crops (Vol.I and II). Naya Prakash, New Delhi.
4. Bailey, L.H. 1999. Principles of Vegetable Cultivation. Discovery Publishing House, New Delhi.
5. Veeraghavathatham. D., M Jawaharlal and Seemanthini Ramdas. 1991. A Guide on Vegetable Culture. A. E. Publication, Coimbatore.
6. Shanmugavelu, K.G. 1989. Production Technology of Vegetable Crops. Oxford India Publication, New Delhi.

Practical

Importance and history of apiculture, different species of bees, morphology, anatomy, colony organization and life cycle, bee-keeping equipment, social behaviour, reproduction, queen rearing, bee pasturage, seasonal management, economics of beekeeping. Bee enemies, diseases of bees, role of bees in increasing the productivity of horticultural crops in India economy, bee products and their uses. Recent trends in apiculture. Acquaintance with honey bee species, morphology, structural adaptation, biology-castes-bee-keeping equipment, bee forage plants. Collection and preservation of bee flora, enemies and diseases of bees. Handling of bee colonies and manipulation for honey production.

References

1. Ayyar. T.V.R.1963. *Handbook of Economic Entomology for South India* - Govt Press, 516p
2. David, B V and T Kumaraswami. 1982. *Elements of Economic Entomology* - Popular Book Depot, Madras, 536p

3. Grout, R A 1963. The Hive and the Honey bee - Dadant and Sens Inc., Hamilton, Illinois. 556 p.
4. Jean Prost, P and Paul Medon. 1994. *Apiculture*, Oxford and IBHPub. Co Pvt. Ltd., New Delhi, 659 p
5. Singh, S. 1975. Bee keeping in India - *Indian Council of Agricultural Research*, New Delhi, 214 p

AGR 311

INTRODUCTION TO MAJOR FIELD CROPS

1+1

Theory

Unit I: Introduction

Classification and distribution of major field crops (Cereals, Pulses, Oilseeds, Cash crops and Fodder crops) ; definitions and concepts of multiple cropping, mixed cropping, intercropping, relay and alley cropping and crop rotation

Unit II: Cereals

Cereals: Rice, Maize, Wheat, Barley, Sorghum, Pearl millet, Finger millet and Minor millets - Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting

Unit III: Pulses

Pulses: Red gram, Black gram, Green gram, Bengal gram, Horse gram, Cowpea and Soybean - Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting

Unit IV: Oil seeds

Oil seeds: Ground nut, Sesame, Sunflower, Castor, Safflower, Rape seed and mustard – Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting

Unit V: Cash crops, Fodder Crops and Green Manuring

Cash crops: Sugarcane and Cotton - Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting

Fodder Crops: Sorghum, Maize, Bajra-Napier Hybrid grass, Guinea grass, Cowpea, Lucerne, Hedge Lucerne and Berseem - Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting

Green Manuring: Importance and classification

Practical

Identification of crop plants, seeds and weeds - Calculation of seed rate - Seed treatment techniques – Nursery preparation and management for Rice, Pearl millet and Finger millet - Raising of crop cafeteria - Main field preparation and Sowing - Estimation of population – Nutrient management - Weed management - Study of growth and yield

parameters - Harvesting of major field crops and Yield estimation – Preparation of cropping scheme

References

1. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 1998. Scientific Crop Production in India. Rama publishing House, Meerut
2. Singh. S.S. 1997. Crop management under irrigated and rainfed conditions. Kalyani Publishers, New Delhi
3. Daniel Sundararaj, D. and G.Thulasidas.(1993). Botany of Field Crops. (2nd Ed.). Macmilan India Ltd
4. Massod Ali, S.K.Chaturvedi and S.N.Gurha.2001. Pulses for sustainable agriculture and nutritional security.Indian Institute of Pulses Research, Kanpur, India.
5. Hand Book of Agriculture. 2006. Indian Council of Agrl. Research, New Delhi.
6. Crop Production Guide. 2013. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
7. Palaniappan, S.P. and K. Sivaraman, 1996. Cropping Systems in Tropics. Principles and Management, New Age Intel (P) Ltd., Publication.
8. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
9. Chidida Singh, Prem Singh and Rajbir Singh 2003. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.

GPB 311

PRINCIPLES OF BIOTECHNOLOGY

1+1

Theory

Unit I: Basics in molecular biology

Structure of nucleic acids-an overview: nucleoides, DNA structure, central dogma of life; replication, transcription and translation; regulation of gene expression, fine structure of gene; Genome- Genomics, omics' terminology

Unit II: Plant tissue culture

History and concepts; General techniques- sterilization, media and their nutritional requirements, explants, callus induction, morphogenesis, organogenesis and embryogenesis, environmental conditions, hardening, nomenclature; Tissue culture techniques- meristem culture, anther and pollen culture, embryo culture, ovule culture, protoplast and fusion culture, and cell suspension culture, their types, applications and achievements.

Unit III: Principles of recombinant DNA technology

Restriction endonucleases, isolation of desired gene, vectors, constructing recombinant DNA, transformation, gene cloning, selection of recombinant cells, polymerase chain reaction, blotting techniques, DNA sequencing methods.

Unit IV: Genetic transformation in plants

Direct gene transfer- types, microinjection, electroporation, particle bombardment, achievements, limitations; Indirect gene transfer- *Agrobacterium* mediated gene transfer, selectable markers, reporter genes, promoters, achievements in resistance, nutritional quality etc.

Unit V: Molecular markers in crop improvement

DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Role of molecular markers- gene mapping and gene tagging, marker assisted breeding, MAS and its application in crop improvement.

Practical

Laboratory organization –sterilization techniques-Preparation of MS medium - Inoculation of explants - shoot tip and embryo culture-Extraction of plasmid and plant genomic DNA. DNA Quantification -quality assessment. Electrophoresis of DNA. Restriction digestion, ligation, competent cell preparation, bacterial transformation, blue white colony screening. *Agrobacterium* mediated transformation and confirmation of genetic transformants- PCR. Genotyping with RAPD and SSR– Mapping QTL analysis using softwares.

References

1. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice. Elsevier Publication.
2. Gupta, P.K. 2005. Elements of Biotechnology. Rastogi Publication, India.
3. Malacinski, M. and D. Friefelder. 2003. Essentials of molecular biology. IV Ed. Jones and Bartlett publishers, Boston
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7. Brown, T.A. 2006. Gene cloning - An introduction. V Ed. Chapman Hill, U.K.

PAT 311

**DISEASES OF VEGETABLES, ORNAMENTALS AND
SPICE CROPS**

2+1

Theory

Unit I: Vegetable crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of tomato, brinjal, chilli, bhendi, cucurbits, crucifers, peas, beans, cabbage, cauliflower, carrot, radish, beetroot and knol- khol

Unit II: Tuber crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of potato, sweet potato, cassava, yam and colacasia

Unit III: Ornamental Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of Jasmine, rose, crossandra, chrysanthemum, marigold, carnation, dahlia, zinnia, tuberose and geranium.

Unit IV: Spice crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of onion, garlic, fenugreek, ginger, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, curry leaf and cinnamon.

Unit V: Post harvest diseases of vegetables and ornamental crops and their management

Post harvest diseases of vegetables and ornamental crops, factors influencing post harvest diseases - preharvest and post harvest factors - Management of post harvest diseases - physical, chemical, biological methods – Postharvest treatments for organic produces – Application methods - Integrated management of post harvest diseases - Emerging technologies for postharvest disease control

Practical

Study of symptoms and host parasite relationship of the following crops :
Vegetables: tomato, brinjal, chilli, bhendi, cucurbits, crucifers, peas, beans, cabbage, cauliflower, radish, knol- khol, **Tuber crops:** potato, beetroot, sweet potato, carrot, cassava, yam and colacasia, **Ornamental Crops:** Jasmine, rose, crossandra, chrysanthemum, marigold, carnation, dahlia, zinnia, tuberose and geranium, **Spices and condiments:** onion, garlic, fenugreek, ginger, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, curry leaf and cinnamon and Post harvest diseases of vegetables and ornamental crops and their management.

References

1. Agrios, G. N. 2008. Plant Pathology, 5th edition, Academic Press, New York.
2. Mehrotra, R.S. and Agarwal, A. 2006. Plant Pathology (6th edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, India
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4. Das Gupta, M.K. and Mandel, W.C. 1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Co. Pvt. Limited, New Delhi.
5. Neeta Sharma and Mashkoo Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Company, India
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7. Rangaswami, G. and Mahadevan, A. 2004. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi
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11. Arjunan.G. Karthikeyan, G, Dinakaran, D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
12. Madhu Meeta, 2005. Diseases of Ornamental Plants in India: Reference Book Cum Bibliography/. 320 p.,
13. Alfred Steferud, 2005, Diseases of Vegetable Crops. Delhi, Biotech Books, xi, 210 p., ISBN 81-7622-137-6.
14. Snowden, A.L.1990. A color atlas of post harvest diseases and disorders. Vol. I and II Wolfe Scientific Limited.

SAC 311 SOIL FERTILITY AND NUTRIENT MANAGEMENT 1+1

Theory

Unit I: Essential Nutrients

Soil fertility and soil productivity.Essential and beneficial plant nutrients- functions, deficiencies and toxicities.Concepts and methods of soil fertility evaluation.

Unit II: Nutrient Dynamics

Sources, forms, mobility, transformations, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron and molybdenum in soils.Luxury consumption and Hidden hunger-pH in plant nutrition.

Unit III: Fertilizers

Fertilizers – Definition and classification, sources, properties, compositions and reactions of macro and micronutrient fertilizers in soil. Complex, mixed fertilizers, Water soluble fertilizers and Micro nutrient mixtures- preparation, characteristics and compatibility - Fertilizer Control Order (FCO). Methods of fertilizer application.

Unit IV: Manures

Bulky and concentrated organic manures-FYM, Composts, Green Manures, Green leaf manures-Oil cakes. Organic matter decomposition-Role of microorganisms-Humus formation-importance of C:N ratio.

Unit V: Management

Nutrient management concepts – STCR, INM, IPNM, SSNM and RTNM.Salt affected soils- Acid, Saline, alkali and Calcareous soils-Characteristics and Management.

Practical

Soil Nutrient Analysis - Available macro and micronutrients - Fertilizer Nutrient Analysis- Analysis of nutrient contents in fertilizers – Organic manure Analysis-Determination of nutrient contents – Soil test based fertilizer prescription.

References

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.
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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

PJN 301

SHORT TOUR

0+1

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

VI SEMESTER COURSES

Theory**Unit I: Importance, post harvest handling**

Importance of post-harvest technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants.

Unit II: Factors influencing shelf life and fruit ripening

Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce. Physiological and bio-chemical changes, hardening and delaying ripening process.

Unit III: Pre harvest, pre storage and post harvest treatments

Pre-harvest treatment and pre-cooling, pre-storage treatments and post-harvest treatments of horticultural crops.

Unit IV: Packaging

Packaging methods and types of packages, recent advances in packaging. Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments.

Unit V: Storage and transport

Different systems of storage, cold chain management and modes of transport.

Practical

Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseases. Visit to markets, packaging houses and cold storage units.

References

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.
3. Jacob John, P., 2008. A Handbook on postharvest management of fruits and vegetables. Daya publishing House, Delhi.
4. Pandey, P. H. 1998. Principles and practices of post harvest technology. Kalyani Publishers, New Delhi.

5. Ranganna, S. 1997. Handbook of analysis and quality control for fruits and vegetables products, Tata, Mc Graw – Hill Publishers Co. Ltd., New Delhi.

FLG 302 BREEDING AND SEED PRODUCTION OF ORNAMENTAL 2+1
PLANTS

Theory

Unit I: Breeding methods

Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental plants. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility

Unit II: Breeding for improvement of characters

Disease resistance. Development of promising cultivars of important ornamentals.

Unit III: Introduction

Introduction to Flower Seeds and the Flower Seed Industry-Scopes and Importance of commercial Floriculture in Production techniques of ornamental plants-Factors considered for efficient seed production in Ornamental plants.

Unit IV: Seed Production methods in Annuals

Methods of seed production in ornamental plants - Annuals and biennials-Marigold, Zinnia, Ageratum, Alyssum, Aster, Calendula, Dahlia, Geranium, Pansy, Petunia, Snapdragon, Balsam, Hollyhock, Begonia, Cockscomb, Cosmos, Coreopsis, Gaillardia, Gomphrena - Climbers -Clitoria, Quamoclit, *Thunbergia alata*, Nasturtium.

Unit V: Seed Production methods in perennials

Herbaceous perennials-*Vinca rosea* –*Golden rod*-*Aster amellus* Ornamental trees - *Delonix regia*, *Peltophorum ferrugenum*, *Samanea saman*, *Cassia siamea*, *Acacia auriculiformis*, *Cordia sebestena*.

Practical

Introduction, selection, hybridization, selfing, emasculation and crossing; Mutation and Polyploidy breeding and Biotechnological breeding techniques in ornamentals. Floral biology, selfing, emasculation and crossing technique in Rose, Jasmine, Marigold, Anthurium, Gladiolus, Orchids, Gaillardia, Gerbera, Zinnia, Ageratum, Alyssum, Aster and Calendula.

Seed collection - Methods of seed extraction - Identification of seed and seed structure - Seed germination and viability testing - Seed Dormancy & Methods of breaking of seed dormancy - Seed germination, test evaluation and seed enhancement techniques in ornamental plants. Study of seed storage, seed package and packaging materials- Visit to ornamental seed production plots and Commercial flower seed production industries

References

1. Chadha, K.L. "Advances in Horticulture" – Ornamental Plants Vol.12 part I & II. Malhotra Publishing House - New Delhi.
2. Bose, T.K. and L.P.Yadav 1988. "Commercial Flowers" – Naya Prakash Calcutta.
3. Singh, B.D. Plant Breeding. Kalyani Publishers. New Delhi / Ludhiana.
4. McDonald, M. Flower seeds - Biology and Technology- Department of Horticulture and Crop Science, Ohio State University, USA, F Kwong, PanAmerican Seed Company, West Chicago, USA, F Bongers, Wageningen University
5. McDonald, M.B. and L.O. Copeland, 1997. Seed Production - Principles and Practices. Chapman & Hall, New York, NY, 749 pp.
6. Salunkhe, D.K., B.B. Desai and N.R Bhat. 1987. Vegetable and flower seed production. 486 pp
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8. Bose, T.K and L.P.Yadav. 1988. Commercial Flowers - Naya Prakash, Calcutta.
9. Swarup, V and L.P.Yadav. 1988. Ornamental Horticulture – Naya Prakash, Calcutta.
10. Arora, J.S 1998. Introductory ornamental Horticulture - Publishers, Ludhiana.

FSN 311

PROCESSING OF HORTICULTURAL CROPS

1+1

Theory

Unit I: Production and processing scenario of fruits and vegetables

Fruits and vegetables production and processing, scope of fruits and vegetables preservation industry, constraints in popularization of food processing technology, future of fruits and vegetables processing, principles and guidelines for location, tools, equipments, layout and other requirements of small scale processing units.

Unit II: Principles and method of preservation

- (i) Asepsis, high temperature – pasteurization, sterilization, canning, low temperature, chemicals – sulphur dioxide, Benzoic acid, filtration, sugar, carbonation, fermentation, salt, acids, oil and spices, antibiotic and irradiation.
- (ii) Freezing – methods, changes during freezing and storages, thawing, freezing process for fruit and vegetables
- (iii) Drying and dehydration – definition, types of driers: Solar, cabinet, spray drier, drum, fluidized bed drier, freeze drying schedule for drying.

Methods of concentration: Open kettle, blast evaporators, changes during concentration

Canning: Principle and process of canning, spoilage of canned foods and its prevention.

Unit III: Principles of processing and value addition

Processing using sugar – principles – processing of Juices, squashes, syrups, cordials, R.T.S, Jam, Jelly, marmalade, preserve candies, crystallized fruits, chutneys and sauces / ketchups

Processing using salt: Pickles - preservation with salt, vinegar, oil, mixture of salt, oil, spices and vinegar, problems in pickle making

Tomato processing: Puree, Sauces / ketchups. Mushroom processing – drying pickles, ketchups.

Unit IV: Recent technologies in fruits and vegetable processing

Minimal processing of fruits and vegetables – Techniques involved. Recent trends in processing – high pressure processing and processing using pulse electric field - utilization of fruits and vegetable waste.

Unit V: Food safety and quality control of processed products

Quality management systems in processed foods, standards for food safety and quality control and food law – ISO, BIS, HACCP, FSSAI, GFSI, BRC, SQF

Practical

Equipment used in food processing units. Survey on processed foods – shelf life studies of fruits and vegetables at different temperature and atmospheric condition. Preparation of Jam, jelly, squash, R.T.S, pickles, dehydrated, canned and frozen products.

References

1. Srivastava, R.P and Sanjeev Kumar, Fruit and Vegetable preservation, 3rd edition International Book distributing Co. 2002.
2. Rathore, N.S., Mathur, G.K. and Chasta, S.S. Post harvest management and processing of fruits and vegetable ICAR. New Delhi 2012
3. Shaifur Rehman, M.2007 Hand book of food preservation. Second edition CRC. Press London journals
4. Journal of food science and Technology. Indian food Industry beverage and food world

AEC 311

HORTI-BUSINESS MANAGEMENT

2+1

Theory

Unit I: Farm Management

Farm Management: Definition – Objectives of Farm Management – Scope– Farm Management Decisions. Factor – Product relationship: Meaning – Agricultural production function: Meaning – Laws of returns-Classical production function and three stages of production – Determination of optimum input and output – physical and economic optimum. Cost concepts and cost curves – economies of scale. Factor-factor relationship: Meaning- isoquant – iso-cost line – least cost combination. 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 -Risk and uncertainty. Farm planning – Budgeting: definition – partial and complete budgeting.

UNIT II: Marketing

Market and Marketing: definitions, components and dimensions of a market. Agricultural Marketing: Concepts and definitions, scope and subject matter. Classification of markets. Role of market functionaries - market forces and price determination. Marketing of agricultural Vs manufactured goods. Marketing functions: buying and selling-packaging and transportation -- grading and standardization-- storage and warehousing --processing and value addition. Marketing channels: definition and channels for different products. Market integration: definition and types. Marketing efficiency: meaning and definition. Marketing costs, margins and price spread. Factors affecting marketing costs. Reasons for higher marketing costs. Ways of reducing marketing costs

UNIT III: Finance

Agricultural finance-importance-nature and scope-definition. Agricultural credit-meaning, definition, need, classification. Sources of credit-Role of institutional and non institutional agencies-advantages and disadvantages. Rural indebtedness. Institutional agencies-Commercial banks-nationalization, AD Branches-Area Approach-Priority Sector Lending, Regional Rural Banks, Lead bank, Kisan Credit Card(KCC) Scheme, Scale of Finance. DIR Scheme. Higher Financial Institutions-RBI, NABARD, Insurance and Credit Guarantee Corporation of India, Rural credit policies. Tests of farm credit-3 C's, 5 R's and 7 P's. Microfinance. Financial management-Financial statements and ratio analysis. Project appraisal – undiscounted and discounted measures.

Unit IV: Agribusiness

Agribusiness – Definition – Structure of Agribusiness (input, farm and product sectors) Agribusiness Management – Importance of Agribusiness in Indian Economy. Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management. Forms of Business Organisation – Sole Proprietorship – Partnership – Private and Public Limited, Cooperatives. Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning – Characteristics of Sound plan. Objectives – MBO. Organizing – Principles of Organizing – Concept of Departmentation – Delegation – Centralization – Decentralization.

Unit V: Management Functions

Staffing – Concept – Human Resource Planning - Process. Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's Need Hierarchy Theory - Types – Techniques. Leadership – Definition – Styles – Difference between leadership and management. Controlling – Concept - Steps – Types – Importance – Process. Functional areas of business – Operations, Human Resources, Finance and Marketing – Scope and meaning. Laws and Policies related to Agri/Horti-Business.

Practical

Problems on factor-product relationship- determination of least-cost combination- determination of optimum product combination-computation of cost

concepts- cost of cultivation and cost of production horticultural products - depreciation-methods of calculation of depreciation. Visit to village shandy and important marketing institutions/Commodity boards. Visit to agri/Horti hi-tech bank branch / commercial banks/ NABARD. Project appraisal – undiscounted and discounted measures. Exercise on Operations Management in agribusiness firms - Inventory Management - Inventory types, costs and Economic Order Quantity- ABC analysis - Exercise on Logistics and Supply Chain Management. Market Research and Segmentation –Marketing mix- 4Ps of marketing –New agri/horti-business venture proposal preparation.

References

1. Johl SS & Kapoor TR. (2012). Fundamentals of Farm Business Management. Kalyani Publ.India
2. V.T Raju and D.V.S. Rao (2009) Economics of Farm Production and Management, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Kahlon AS & Singh K. (1992). Economics of Farm Management in India. Allied Publ. New Delhi
4. Acharya S. S. and N. L. Agarwal, 2016. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Subba Reddy, S. and P. Raghu Ram 2000. Agricultural Finance and Management, Oxford & IBH, New Delhi
6. Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
7. Aswathappa, K, Human Resource Management: Text and Cases, Tata McGraw-Hill Pub. Co. Ltd. New Delhi, 5th Edition, 2008.
8. Philip Kotler, Marketing Management, Pearson Education, India, 2003.
9. Chandra Prasanna. 2000. Financial Management - Theory and Practice. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. R.K.Sapru, Project Management, Excel Books, New Delhi, 1997.

AEN 312 INSECT PESTS OF VEGETABLES, ORNAMENTALS AND 2+1 SPICE CROPS

Theory

UnitI: Economic importance of insects in vegetables, ornamental and spice crops

Economic importance of insects in vegetables, ornamental and spice crops, Ecology and pest management in these crops, Pest surveillance in important vegetables, ornamental and spice crops.

Unit II: Pests of Vegetables

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Crucifers, Cucurbits, Moringa, Amaranthus, cowpea, lab lab.

Unit III: Pests of Ornamental crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Marigold, Tuberose, daisy, lily, Nerium and Gloriosa, Coleus, Phyllanthus, and Aswagantha.

Unit IV: Pests of Spices

Distribution, bionomics, symptoms of damage and management strategies of insect of Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, fenugreek, mustard, fennel, clove, nutmeg, all spice, cinnamon, tamarind, vanilla, paprika, Cocoa, Cardamom, black Pepper.

Unit V: Pests of stored products and insecticide residues

Insect pests of processed vegetables and ornamental crops, bioecology, injury and IPM, insecticidal residues problems in vegetables and ornamental crops, tolerance limits.

Practical

Study of symptoms, damage, collection, identification, preservation, assessment of damage/ population of important insect- pests affecting vegetable, ornamental and spices crops in field and during storage.

References

1. Butani, D.K. and M.G.Jotwani, 1984. Insects of Vegetables. Periodical Expert Book Agency, New Delhi.
2. Srivastava, K.P. and D.K.Butani, 1998. Pest Management in Vegetables (Part I & II) Research Periodicals and Book Publishing House, India.
3. Ayyar, T.V.R. 1963, Hand Book of Economics Entomology for South India. Govt. Press Madras.
4. David, B.V. and V.V. Ramamurthy, 2011. Elements of Economic Entomology. Namrutha publications, Madanandapuram, Porur, Chennai- 600116
5. A.Regupathy and R.Ayyasamy. 2013. A Guide on crop pests. Soory Desktop publisher, Coimbatore.
6. A.S.Atwal and G.S.Dhaliwal.2004. Agricultural pests of South Asia and their management. Kalyani publishers, Ludhiana, Punjab- 141 008
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8. M.R.G.K. Nair. 1995. Insects and mites of crops In India. Allied publisher Ltd. New Delhi.
9. S.F.Hameed and S.P.Singh.1998. Hand book of pest management. Kalyani publishers. New Delhi.

Theory**Unit I: Types of farming and impacts of green revolution farming**

Types of farming – Impacts of green revolution farming – Fate of chemicals in agro ecosystem

Unit II: Organic farming - Concepts and principles

Ecology and Principles of ecology. Biodiversity: importance and measure to preserve biodiversity. Organic farming: Definition - Scope - principles and concepts - history of organic farming - global scenario –pre requisites for Organic farming: Integrated Farming System approach – organic carbon: status and improvement strategies – conservation tillage.

Unit III: Nutrient sources

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

Unit IV: 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 V: Certification and exports & Indigenous Technical Knowledge (ITK) in Organic Agriculture

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

Raising of vegetable crops – experiencing organic farming practices – soil, seed, nutrient, weed, water, pest and diseases - hands on experience on bio composting, vermicomposting, organic base solutions preparations, bio-inoculants – Raising of vegetable & ornamental nursery – Macro quality analysis - grading, packaging, post-harvest management – visit to organic farms, certification agencies and market outlets

References

1. Nicholas Lampkin 1994. Organic farming. farming press London.
2. Arunkumarsharma 2008. A Hand book of organic farming. Agro bios Publishers.
3. Dahama, A.K.2009.Organic farming for sustainable agriculture, Agrobios publishers.

4. Veeresh, G.K. 2010. Organic farming, Cambridge university press.
5. Palaniappan, S.P. and K. Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.
6. Stockdale, E *et al.*, 2000. Agronomic and environmental implications of organic farming systems. *Advances in Agronomy*, 70, 261-327

ENS 301

ENVIRONMENTAL SCIENCE

1+1

Theory

Unit I: Introduction to Ecology and Environment

Introduction – Ecology – Environment : components, segments (hydrosphere, atmosphere, lithosphere and biosphere) - Ecosystem concepts – Species, Population, Community and Succession, Species interaction – Energy efficiencies and Energy flow – Food chain, food web and ecological pyramids, cropping pattern

Unit II: Natural resources and Biodiversity

Natural resources – Soil, Water, Air, Mineral, Energy, Forest resources; Bio diversity - importance, hot spots and conservation

Unit III: Environmental Pollution

Pollution: Problems, types and sources – Soil, Water and Air pollution: Sources, effects and control measures - Noise Pollution: Sources, effects and control measures - Radioactive, thermal and nuclear pollution - Global warming and climate change: GHG emission, GH effect, impact on environment and agriculture- mitigation strategies.

Unit IV: Solid and liquid waste management

Types of wastes - Industrial wastes, Agricultural wastes, Domestic wastes and e wastes: Characteristics and Environmental Impact - Solid waste management techniques: Principles and practices. Waste water treatment Techniques – Physical, chemical and biological methods. Standards for waste water disposal.

Unit V: Environmental protection

Disaster management – Floods, earthquakes, cyclones and land slides. Global treaties, conventions – National and state level organizations: TNPCB, CPCB — Environmental Laws and Acts – Environmental Education – CDM – Prevention of land degradation - Afforestation

Practical

Estimation of population indices of an agro-ecosystem – Diversity of flora and fauna in agricultural ecosystem - Laboratory safety and handling of chemicals and Glass wares - Characterization of waste water and collection and sampling methods - Estimation of pH, EC and total Solids – Dissolved oxygen, biochemical oxygen demand and chemical oxygen demand- acidity, alkalinity, hardness, chlorides and sulfates - Visit to Common effluent treatment plant and degraded ecosystem - Assessment of water quality indicators (bio-

indicators - coli forms) - Treatment of waste water : Physical , chemical and biological methods – Monitoring Air Pollution – Solid waste management - Composting of various solid wastes using microorganisms and vermicomposting – Heavy metals in contaminated soil and water ecosystem.

References

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2. Sharma, P.D. 2009, Ecology and Environment, Rastogi Publications, Meerat, India
3. William P. Cunningham and Mary Ann Cunningham, 2007. Principles of Environmental Sciences, Tata McGraw hill Publishing company, New Delhi.
4. Stanley E. Manahan. 1997. Environmental Science and Technology. Lewis Publishers New York.
5. Sharma P.D. 2006.Environmental Microbiology. Narosa Publishers, New Delhi.

PAT 312 DISEASES OF FRUITS, PLANTATION, MEDICINAL AND 2+1 **AROMATIC CROPS**

Theory

Unit I: Tropical Fruit Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of mango, banana , grapes, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate and ber

Unit II: Temperate Fruit Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of apple, pear, peach, plum, almond, walnut and strawberry

Unit III: Plantation Crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of arecanut, coconut, oilpalm, coffee, tea, cocoa, cashew, rubber and betelvine

Unit IV: Medicinal and aromatic crops

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanm khasianum* and Tephrosia

Unit V: Post harvest diseases of fruits, plantation and medicinal and aromatic crops and their management

Post harvest diseases of fruits, plantation and medicinal and aromatic crops, factors influencing post harvest diseases - preharvest and post harvest factors - Management of post harvest diseases - physical, chemical, biological methods – Postharvest treatments for organic produces – Application methods - Integrated management of post harvest diseases - Emerging technologies for postharvest disease control

Practical

Study of symptoms and host parasite relationship of the following crops : Tropical fruits - mango, banana , grapes, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, and ber Temperate fruits - apple, pear, peach, plum, almond, walnut and strawberry; Plantation crops - arecanut, coconut, oilpalm, coffee, tea, cocoa, cashew, rubber and betelvine; Medicinal and Aromatic crops - senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanm khasianum* and Tephrosia and and Post harvest diseases of fruits, plantation and medicinal and aromatic crops and their management.

References

1. Agrios, G. N. 2008. Plant Pathology, 5th edition, Academic Press, New York.
2. Mehrotra, R.S. and Agarwal, A. 2006. Plant Pathology (6th edition), Tata McGraw Hill Publishing Company Ltd., New Delhi, India
3. Chaube, H.S and Pandhir. 2005. Crop diseases and their management. Prentice hall of India Pvt. Ltd. New Delhi
4. Das Gupta, M.K. and Mandel, W.C.1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Co. Pvt. Limited, New Delhi.
5. Neeta Sharma and Mashkoo Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Company, India
6. Parvatha Reddy, P. 2008. Diseases of Horticultural Crops, Scientific Publishers, India
7. Pathak V.N. 1980. Diseases of Fruit crops, Oxford and IBH publishing Co. Pvt. Limited, New Delhi
8. Rangaswami, G. and Mahadevan, A. 2004. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi
9. Naqvi S. A. M. H. 2004. Diseases of Fruits and Vegetables Volume I. Diagnosis and Management ISBN: 978-1-4020-1822-0.
10. Srikant Kulkarni and Yashoda, R. Hegde. 2002. Diseases of Plantation Crops and their management, Agrotech, Udaipur.
11. Alfred Steferud., 2005, Diseases of Plantation Crops. Delhi, Biotech Books, , x, 317p., ISBN 81-7622-136-8.

Theory**Unit I**

Concept of entrepreneurship; entrepreneurial and managerial characteristics; Assessing overall business environment in the Indian economy. Globalisation and the emerging business / entrepreneurial environment. Overview of Indian social, political and economic systems and their implications on agricultural entrepreneurs.

Unit II

Managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; SWOT analysis and Market Survey, Generation, incubation and commercialization of ideas and innovations.

Unit III

Entrepreneurship development initiatives of the Government – SSIB, SIDO, NSIC, KVIC, NISIET, NIESBUD, IIE, SSIDC, SDI, DIC, SIDBI, Commercial banks, SFC. Schemes and incentives for promotion of entrepreneurship - Agribusiness, Agri clinic, Agri Business Center, EXIM bank, Special Economic Zones, Food parks. Government policies related to horticulture and food processing sector. Export and Import policies of government of India.

Unit IV

Venture capital. Contract farming and joint ventures, public, private partnerships. Overview of horti inputs industry. Characteristics of Indian horticultural processing and export industries. Social Responsibility of Business.

Unit V

Communication skills for entrepreneurs – Meaning, definition, process and importance, types of communication skills. Leadership – Definition, styles, difference between leaders and Managers.

Practicals

Listening and note taking, writing skills, oral presentation skills; Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting, individual and group presentations. Analysing cases, Practicing SWOT analysis. Visiting Agri clinics/Agri based industries/Agri Financing Institutions. Sample Project formulation and report preparation.

References

1. Gupta, C.B. 2001. Management: Theory and Practice. Sultan Chand and Sons, New Delhi.
2. Khanka, S.S.1999. Entrepreneurial Development. S. Chand and Co., New Delhi.
3. Sagar Mondal and G.L. Ray. 2009. Text Book of Entrepreneurship and Rural Development, Kalyani Publishers, Ludhiana.
4. Vasant Desai.1997. Small Scale Industries and Entrepreneurship. Himalaya Publishing

House, New Delhi.

5. Vasant Desai. 2000. Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, New Delhi.
6. Smitha Diwase, 2014. Indian Agriculture and Agri-Business Management, Scientific Publishers, Rajasthan.
7. R.R.Choleet.et al.,2012.Entrepreneurship Development and Communication Skills, Scientific Publishers, Rajasthan.

PJN 302

SOFT SKILLS FOR EMPLOYABILITY

0+1

Practical

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

Attitude - Psychological and Sociological definitions – types of attitude (positive and negative) and consequences – suggestions to keep a good attitude. Emotional Intelligence - Introduction and Definitions – four branch model of EQ and its detailed explanation - five point scale to measure EI – suggestions to improve EI. Inter personal 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 SWOT 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.

Objectives of communication – Types of communication – Formal Vs informal communication – LSRW components of communication – Barriers to communication - 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 - 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 - 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 - 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 - The right environment – formal greetings - telephone courtesies – effective listening skills – interpersonal skills – concluding formality.

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

Corporate Skills - 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. Select definitions – functions of negotiation – two kinds of negotiation – phases of the process – rules – steps to improve negotiation skills. Basic skills of time management – relationship between stress management and time management – time management techniques for prudent time management – tips for time management. Definition of stress –kinds - stress at work – causes, effects and solution - stress and stroke –different kinds of stroke – stress in interview.

References

1. Hariharan,S. , S. N. Sundararajan, and S.P.Shanmugapriya.(2010). Soft Skills. MJP Publishers, Chennai.
2. Alex. (2009). Soft skills: Know yourself and know the world. S. Chand & Co. Publishing House, New Delhi.
3. Beverly Jaeger. (2004). Making Work Work for the Highly Sensitive Person. Tata McGraw – Hill, USA.
4. Dipali Biswas. (2009). Enhancing Soft Skills. Shoraff Publishers and Distributors.
5. Gloria. J. Galanes, Kathreine Adams, John. K. and Brilhart. (2004). Effective Group Discussion. Tata McGraw – Hill, New Delhi.
6. Jagadeesan. G. and Santhanakrishnan, R. (2007). Soft Skills Development.ICFAI University Press. New Delhi.
7. Martin Avis. (2010). Effective Time Management Skills for Everyone. Avis Consultancy, London, U.K.
8. Mayer, J.D., Salovey, P and Caruso, D.R. (2000). Models of Emotional Intelligence. R.J. Shernberg (Ed.). Handbook of Intelligence. Cambridge University Press, Cambridge.
9. Patsy McCarthy and Caroline Hatcher. (2002). Presentation Skill: The Essential Guide for Students. Sage Publications, CA.
10. Peggy Claus. (2007): The Hard Truth about Soft Skills. Harper Collins Publishers, New York, USA.
11. Peter. J. Gosling. (2002), Scientists Guide to Poster Presentations, Kluwar Academic Pub, N.Y, USA.
12. Richard Ellis. (2009). Communication Skills; Step ladders to success for professionals. Intellect Books, Chicago, USA.
13. Robert, A. Day. (2000). How to Write a Scientific Paper. ELBS, U.K.
14. Sarvesh Gulati. (2006). Corporate Soft Skills. Rupa Publishers, New Delhi.
15. Soleman. D. (1998). Working with Emotional Inteligence Bloomsbury Publishing, London.

VII SEMESTER COURSES

HOR 411 RURAL HORTICULTURAL WORK EXPERIENCE (RHWE) 0+10

The students will spend eight week working with State Department of Horticulture; Horticulture based industries, commercial horticulture farms, plantation industries etc., to gain first hand information and hands – on – training in the chosen area of interest.

The course will be jointly conducted by the faculties from the Departments of Horticulture and Agricultural Extension.

EXPERIENTIAL LEARNING COURSES – I

HEL 401 COMMERCIAL SEED PRODUCTION 0+8

Offering Department: Seed Science and Technology

Objective

To enable students to gain hands - on experience in commercial seed production and also to train the students to start a commercial seed production unit / farm.

Activities

Hands – on - experience in Seed Enhancement techniques-sowing-nursery management – Transplanting – Thinning – Maturing – Herbicide application – Mother crop nutrition - Plant protection – Hybrid seed production – Supplementary pollination – Roguing – Pre harvest sanitation sprayings – Seed certification – Harvesting – Threshing – Seed Extraction – Seed Drying – Seed processing – Seed treatment – Seed Marketing – Seed storage – Visit to seed production plots – Visit to seed industries – Visit to seed certification Agency – Working out of B:C Ratio-Project preparation – Target crops – Tomato – Brinjal – Chilli – Okra – Bittergourd – Riddegourd – Bottlegourd – Snakegourd - Pumpkin – Ashgourd - Muskmelon – Watermelon – Cucumber – Cluster bean – Vegetable Cowpea – Lab lab – Amaranthus – Onion - Coriander – any other commercially important crops.

Deliverables

Students who complete this course will gain enough confidence and technical skills to start a seed business.

References

1. Agrawal, R.L. 2003. Seed Technology. Oxford & IBH Publishing Co. Pvt. Ltd. NewDelhi.
2. Singhal, N.C. 2003. Hybrid seed production in field crops. Kalyani Publishers, Ludhiana.
3. Jag Paul,S 2011.Quality Seed Production of Vegetable Crops Technological Interventions, Kalyani Publishers, Ludhiana.
4. Singh I.P. 2002. Seed production of vegetable crops, Aman Publishing House, New Delhi
5. Sharangi and Amit Baran. 2014. Seed Production of Selected Horticultural Crops, DK Publishers and Distributors. Delhi.

HEL 402

COMPOSTING TECHNOLOGY

0+8

Offering Department: Soil Science and Agricultural Chemistry

Objective

To enable students to gain hands on experience in composting techniques and to train the students in establishing a commercial large scale composting unit.

Activities

Identification of raw materials, availability, types and segregation of wastes – Characterization – Preparation of Indore, Bangalore, Coimbatore method of composting – Windrow compost making – Vermicomposting – Acceleration of composting and enrichment of compost with bio-inoculants - Instrumentation techniques in compost analysis – Monitoring the changes during composting – Compost maturity analysis – Physical, Chemical and biological maturity tests – Quality standards – Economics of compost making and marketing – Field visit to small scale compost units – Agro-industrial composting sites and municipal waste composting – Preparation of large scale composting project.

Deliverables

The student who completes this course will gain enough skill and confidence to run a commercial composting unit

References

1. Rynk Robert, Maarten van de Kamp, George B Wilson, Mark E. Singley, Tom L. Richard, John J. Kolega, Francis R. Gouin, Lucien Laliberty, Jr. David Kay, Dennis W. Murphy, Harry A. J. Hoitink, William F. Brinton. 1992. *On-farm* composting Handbook. Natural Resources, Agriculture and Engineering Service (NRAES) Publication #NRAES-54
2. Hoitink Harry and Harold Keener (eds) 1993. Science and engineering of Composting Design. Environmental, Microbiological and utilization aspects. Proceedings of 1992 Composting research symposium, Worthington, OH Renaissance Publications.

HEL 403

PRODUCTION OF BIOCONTROL AGENTS

0+8

**Offering Departments: Agricultural Entomology
and Plant Pathology**

Objective

To develop biocontrol agent and biopesticides production skills for entrepreneurial activity

Activities

Requirements of a biocontrol unit - rearing of host insects for parasitoids and pathogens - rearing of prey insects for predators - rearing of egg parasitoid *Trichogramma*

Rearing of egg - larval parasitoid *Chelonus* - Larval parasitoids *Goniozus*, *Bracon* and *Eriborus* pupal parasitoids *Tetrastichus israeli*, *Thchospilus pupivora*, *Brachymeria*, *Acerophagous papaya* - rearing of predators - Coccinellids – *Cryptolaemus montrouzieri*, *Scymnus coccivora* - Rearing of *Chrysoperla carnea*- Mass production of entomopathogens - production of nuclear polyhedrosis virus of *Helicoverpa armigera* and *Spodoptera litura* granulosus virus of sugarcane early shoot borer *Chilo infuscatellus*, *Metarhizium anisopliae*, *Beauveria bassiana* and *Verticillium lecanii* - Standardization of insect pathogens - Field utilization techniques of biocontrol agents - Improving the efficacy of biocontrol agents. Isolation and mass multiplication of fungal biocontrol agents (*Trichoderma* and VAM) and PGPR (*Pseudomonas fluorescens* and *Bacillus subtilis*) - Delivery systems - Quality parameter studies- Cost analysis and Project preparation - Specifications for establishing biocontrol laboratory - Agricultural Finance - Preparation of botanical pesticides and antiviral principles – Delivery systems Cost analysis and project preparation : Principles of enterprise management - preparation of agricultural project reports – project analysis and financial management – agricultural finance – source of finance – acquisition – ratio analysis – principles of costing – economics of farm enterprise – Visit to biocontrol laboratory at KVK, Puducherry.

Deliverables

Students who complete this course will gain technical competence to start biocontrol agent production unit independently.

References

1. Burges, H D 1981 Microbial control of pests and plant diseases, Academic Press, New York, 949
2. Clausen.C. P 1940. Entomophagous insects Hafner Publishing Co. New York, 688p
3. De Bach P and E.T Schlinger (eds). 1964 Biological control of insect pests and weeds. Chapman and Hall, London, 844 p
4. Huffaker. C.B. (ed.) 1974. Biological control. Plenum Publishing Corporation, Unites States of America, 511 p
5. Aneja, K. R.1996. Experiments in Microbiology, Plant Pathology, Tissue culture and cultivation Mushroom (2nd Edition). Wishwa Prakashan, New Delhi, 451 pp.
6. Campbell, R. 1989. Biological control of Microbial plant pathogens, Cambridge Univ. Press,Cambridge.
7. Cook, R.J. and Baker, K.F. 1983. The Nature and Practice of Biological Control of Plant Pathogens. American Phytopathological society, St. Paul, Minnesota, USA, 539 pp.
8. Hall, F.R. and J.W. Barry (1995) Biorational Pest control agents – Formulation and Delivery, American Chemical Society, Washington, DC, USA.
9. Hornby, D. (1990) Biological control of soil-borne plant pathogens, CAB international, Wallingford, U.K

Objective

Understanding the principles of bioinoculants production technology; to update the knowledge on bioinoculants technology with current scenario and to impart entrepreneurship to the undergraduate students.

Activities

Production of various bioinoculants: nitrogenous bioinoculants - *Rhizobium*, *Azospirillum*, *Azotobacter*, *Glucanoacetobacter diazotrophicus*, *Azolla*, *Blue Green Algae*; phosphatic bioinoculants - phosphate solubilisers AM fungi; PGPR- PPFM, *Pseudomonas fluorescens*. BIS/FCO standards for commercial bioinoculant production and quality testing of various bioinoculants. Application of bioinoculants to crops. Evaluation of plant response to bioinoculant application. Establishment of bioinoculant production unit: facilities and equipments required for laboratory scale, pilot scale and large scale production and marketing of products and project preparation.

1. To understand and gain practical knowledge on various techniques related to bioinoculant production and application methods.
2. To build confidence on planning entrepreneurial tasks for bioinoculant production.

Deliverables

The student who completes this course will gain skill and technical knowledge to start bio-inoculants production unit.

References

1. Motsara, M.R., Bhattacharyya, P., and Beena Srivatsava. 2004. Biofertiliser Technology, Marketing and Usage – A source book- Cum - Glossary
2. Subba Rao, N.S. 2006. Soil Microbiology (4th Edition of Soil Microbiology and Plant Growth).Oxford&IBH,NewDelhi.
3. Deaker R, Kecskés ML, Rose MT, Khanok-on A, Ganisan K, Tran Thi Kim Cuc, Vu Thuy Nga, Phan Thi Cong, Nguyen Thanh Hien and Kennedy IR 2011. *Practical methods for the quality control of inoculant biofertilisers*. ACIAR Monograph No.147. Australian Centre for International Agricultural Research: Canberra. 101 pp. (ISBN 978 1 921738 838)
4. Deshmukh AM, Khobragade RM, Dixit Jaipur PP 2007. Handbook of Biofertilizers and Biopesticides /edited, Oxford Book Company, xviii, 308 p., tables, figs., ISBN 81-89473-15-0.
5. NIIR (2012) The Complete Technology Book on Biofertilizer and Organic Farming (2nd Revised Edition). NIIR Project Consultancy Services, New Delhi. P.608. (ISBN: 9789381039076)

6. Rai MK (2006) Handbook of Microbial Biofertilizers. Food Products Press. New York. P.543. (ISBN 13: 978-1-56022-269-9).
7. Trivedi PC (2008) Biofertilizers. Pointer Publications, New Delhi. P.374. (ISBN: 9788171325429)

PJN 401

ALL INDIA TOUR

0+2

The students will visit various National and International Institutions related to Agriculture, Horticulture, Forestry and other allied fields in various regions of the country. The students will gain first hand knowledge about different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities in different parts of the country. The duration of the tour will be 15 days (institutional visits and intermediate journey) exclusive of onward and return journey.

VIII SEMESTER COURSES

EXPERIENTIAL LEARNING COURSES – II

HEL 405

PROTECTED CULTIVATION AND PRECISION HORTICULTURE

0+20

Offering Department: Horticulture

Objectives

1. Understanding the principles and theoretical aspects of protected cultivation of high Value vegetable crops
2. Developing skills in erection of protected structures and cultivation of vegetable crops

Activities

Study of various protected structures, importance and function – Location, planning and various components of green house – Layout and erection of different types of structures – Green house heating, cooling, shading and ventilation system – CO₂ generation and monitoring – Lighting systems – Growing of vegetables crops i.e., Cucumber and Capsicum – Containers and substrates – Soil Sterilization – Drip and fertigation system – Water and nutrient management – Weed management – Special horticultural practices i.e. training and pruning – IPM & IDM – Harvest indices – Harvesting techniques, post harvest handling techniques – visit to commercial vegetables production units – Precision horticulture; principles and concepts; GPS, GIS, remote sensing, variability management in precision farming, GAP, precision equipments. Project preparation to establish a commercial green house.

Deliverables

Students who complete this course will gain confidence and technical skills to establish a commercial green house.

References

1. Nelson, P.V.1991. Green house operation and management, Bali Publication.
2. Chandra, S and So, V 2000. Cultivating vegetables in green house. India horticulture 45:17-18
3. Prasad, S and Kumar, U. 2003. Green house technology for controlled environment. Narosa Publication House

HEL 406

NURSERY PRODUCTION AND MANAGEMENT

0+20

Offering Department: Horticulture

Objective

To enhance the technical expertise related to propagation of commercial horticultural crops and to inculcate entrepreneurial capacity by providing hands on training and practical exposure for the students to effectively manage horticultural nurseries.

Activities

Types of nurseries and economical importance – Tools and implements – Different types of media – Practices in preparation of media for fruit plants – Flowering annuals, foliage and indoor plants – Containers for propagation – Seed propagation – Visit to community nurseries producing hybrid vegetable seedlings in pro trays – Visit to shade net houses to study cost of erection of net house – Calculating requirement and working out cost economics – Mother plant block or scion block establishment – Hands on training in preparation of various types of cuttings, layering, budding and grafting – Raising of root stocks - After care of propagated plants - Commercial propagation of horticultural crops – Mango, Sapota, Aonla, Guava, Jasmine, foliage ornamental plants, important flowering climbers, ornamental trees – Maintenance of records in nursery – Project preparation for the establishment of commercial nursery.

Deliverables

Students who complete this course will gain confidence and technical skills to establish a commercial nursery.

References

1. Hartmann, H.T. and Kester, D.E. 2010. Plant Propagation: Principles and Practices.
2. John Mason. 2004. Nursery Management.
3. Ray, P.K. 2012. Plant Nursery Management: How to Start and Operate a Plant Nursery.
4. Sharma, R.R. and Srivastav, M. 2004. Plant Propagation and Nursery Management.

HEL 407

**POST HARVEST TECHNOLOGY AND
VALUE-ADDITION**

0+20

Offering Department: Horticulture

Objective

To emphasize the importance in post harvest technology and value – addition in horticultural crops

Activities

Design and project formulation - Design and lay out of pilot plant, cold store, grading – packing line, cool chain - Pre harvest practices to extend shelf life - Quality standards of fruits and vegetables for processing - Procurement of raw material, inventory control - Post harvest handling; grading; packaging; cool chain transportation and storage of fresh produce - Processing (juice/pulp extraction, concentration, product preparation; dehydration; waste Management; In-plant quality control) - Packaging (bottling, corking, sealing, labeling, aseptic packaging, storage) - Quality laboratory exercises, quality assurance, analytical tools, hygiene, machinery Maintenance, HACCP, International standards, FPO Licence, PFA standards, codex Laws - Sales promotion of processed products, certification, distribution and marketing, pricing of the produce, banking, finance and Institutional management.

Deliverables

Students on completing the course will gain confidence to start a processing unit

References

1. Saraswathy, S., T.L.Preethi, S.Balasubramanyan, J.Suresh, N.Revathy and S.Natarajan. 2007. Postharvest management of Horticultural Crops. Agrobios Publishers, Jodhpur.
2. Jacob John, P.,2008.A Handbook on postharvest management of fruits and vegetables. Daya publishing House, Delhi.
3. Pandey, P. H. 1998. Principles and practices of post harvest technology.Kalyani Publishers, New Delhi.
4. Ranganna, S. 1997. Handbook of analysis and quality control for fruits and vegetables products, Tata, Mc Graw – Hill Publishers Co. Ltd., New Delhi.
5. Srivastava, R.P and Sanjeev Kumar, Fruit and Vegetable preservation, 3rd edition International Book distributing Co. 2002.
6. Rathore, N.S., Mathur, G.K. and Chasta, S.S. Post harvest management and processing of fruits and vegetable ICAR. New Delhi 2012
7. Shaifur Rehman, M.2007 Hand book of food preservation. Second edition CRC. Press London journals
8. Journal of food science and Technology. Indian food Industry beverage and food world

HEL 408**FLORICULTURE AND LANDSCAPE GARDENING****0+20****Offering Department: Horticulture****Objective**

To equip students in identifying various landscape elements and application in landscape designing

Activities

Production and management of commercial flowers – Harvesting and Post harvest handling of produce – Marketing of produce, cost analysis, Institutional management – Visit to flower growing areas and export house - Study of garden components – (Annuals, Shrubs, Trees, Climbers, Ferns, Bulbous plants, Cacti and Succulents, Palms, Lawn Making) – Management of plant components – Visits to Institutional, Industrial and public garden – Bio aesthetic planning – Landscaping places of public importance – Flower arrangement – Bonsai making.

Deliverables

Students on completing the course will become professionals in landscaping home and other gardens of public importance

References

1. Arora, J.S.Introductory Ornamental Horticulture
2. Nambisan, K.M.P.1992. Design and elements of landscape gardening. Oxford and IBH Publications, New Delhi.
3. Pal, B.P.1960. Beautiful climbers of India. ICAR, New Delhi
4. Randhava, G.S. 1973. Ornamental Horticulture in India. Today and Tomorrow's Printers and Publishers. Karol Bagh, New Delhi
5. Randhava, G.S and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi