

# **B. Sc. (Hons.) Horticulture**

## **Curriculum and Syllabus 2017**



**SCHOOL OF AGRICULTURAL SCIENCES  
KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION  
(To be a Kalasalingam University)  
Krishnankoil - 626126, Virudhunagar District**

## SEMESTER WISE COURSES

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester - I</b>					
1	HSS17R153	English for Technical Communication	1	1	2
2	MAT17R140	Mathematics for Agriculture	2	0	2
3	CHY17R155	Primer on Analytical Chemistry	2	1	3
4	HOR17R151	Primer on Horticulture	2	1	3
5	HOR17R152	Botany of Horticultural crops	2	1	3
6	HOR17R153	Agricultural Microbiology	2	1	3
7	CSE17R151	Primer on ICT	2	1	3
<b>Total</b>			<b>13</b>	<b>6</b>	<b>19</b>

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester - II</b>					
1	HOR17R154	Macro Propagation	2	1	3
2	HOR17R155	Crop Production: Tropical Fruits	2	1	3
3	HOR17R156	Crop Production: Tropical Vegetables	2	1	3
4	HOR17R157	Primer on Agricultural Meteorology	2	1	3
5	HOR17R158	Basic of Genetics and Cytogenetics	2	1	3
6	HOR17R159	Physiology of Plants	2	1	3
7	HOR17R160	Basic of Biochemistry	1	1	2
8	HOR17R161	Principles of Agricultural Economics	2	1	3
<b>Total</b>			<b>15</b>	<b>8</b>	<b>23</b>

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester – III</b>					
1	HOR17R251	Production Technology of Temperate Vegetables	2	1	3
2	HOR17R252	Weed and Irrigation Management	2	1	3
3	HOR17R253	Fundamentals of Soil Science	2	1	3
4	HOR17R254	Agriculture Entomology	2	1	3
5	HOR17R255	Principles of Quality Seed Production	2	1	3
6	HOR17R256	Plant Pathology	2	1	3
7	HOR17R257	Livestock and Poultry: Production and Management	1	1	2
8	HOR17R258	Farm Machinery and Power	1	1	2
9	HOR17R259	Commercial Microbiology	1	1	2
10	HOR17R260	Fundamentals of Food Science and Nutrition	1	1	2
<b>Total</b>			<b>16</b>	<b>10</b>	<b>26</b>

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester – IV</b>					
1	HOR17R261	Production Technology of Temperate and Sub Tropical Fruit crops	2	1	3
2	HOR17R262	Production Technology of Spices and Plantation crops	2	1	3
3	HOR17R263	Introduction to Agricultural Bio Technology	1	1	2
4	HOR17R264	Commercial Horticultural Seed Production	2	1	3
5	HOR17R265	Enterprenership development in Horticulture	2	0	2
6	HOR17R266	Horti Business Management	1	1	2
7	MAT17R440	Principles of Agricultural Statistics	1	1	2
8	HOR17R267	Soil and Water Conservation Engineering	2	1	3
9	HOR17R268	Agro Forestry & Social Management	1	1	2
10	HOR17R281	Practical Crop Production - Vegetables	0	2	2
<b>Total</b>			<b>14</b>	<b>10</b>	<b>24</b>

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester – V</b>					
1	HOR17R351	Precision and Protected Hi Tech Horticulture	1	1	2
2	HOR17R352	Floriculture	2	1	3
3	HOR17R353	Production Technology of Medicinal and Aromatic Crops	2	1	3
4	HOR17R354	Applied Plant Bio Technology	1	1	2
5	HOR17R355	Pest management in Horticultural crops - I	2	1	3
6	HOR17R356	Economics and Farm management	2	1	3
7	HOR17R357	Basics and methods of plant breeding	2	1	3
8	HOR17R358	Disease Management in Horticultural crops - I	1	1	2
9	HOR17R381	Practical Crop Production : Flower crops	0	1	1
10	HOR17R359	Fundamentals of Extension Education	2	1	3
11	HOR17R382	Study Tour	0	2	2
<b>Total</b>			<b>15</b>	<b>12</b>	<b>27</b>

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester – VI</b>					
1	HOR17R360	Crop Improvement in Horticultural Crops	2	1	3
2	HOR17R361	Garden and Landscape Horticulture	2	1	3
3	HOR17R362	Insect Pests of Vegetable, Ornamental and Spice Crops	2	1	3
4	HOR17R363	Postharvest Management of Horticultural Crops	1	1	2
5	HOR17R364	Extension approaches in rural development perspectives	2	1	3
6	HOR17R365	Diseases of fruit, Plantation, Medicinal and Aromatic Crops	2	1	3
7	HOR17R366	Processing of Horticultural Crops	1	1	2
8	HOR17R367	Dry Land Horticulture	1	1	2
9	HOR17R368	Apiculture, Sericulture and Lac culture	1	1	2
10	HOR17R369	Information and Communication Technology	1	1	2
<b>Total</b>			<b>15</b>	<b>10</b>	<b>25</b>

Sl. No.	Course Code	Course Title	Days	L	P	C
<b>Semester – VII</b>						
1	HOR17R481	STUDENT READY- Placement in Villages 1. General Orientation and on campus Training by different faculties. 2. Village attachment	1 60	0	10	10
2	HOR17R482	STUDENT READY - Placement in Industries 1. Agro Industrial tie up 2. Plantation Internship	7 15	0	10	10
3	HOR17R483	Educational tour		0	2	2
<b>Total</b>				<b>0</b>	<b>22</b>	<b>22</b>

Sl. No.	Course Code	Course Title	L	P	C
<b>Semester – VIII</b>			<b>0</b>	<b>20</b>	<b>20</b>
<b>STUDENT READY:</b>					
<b>The student undergoing ELP may be allowed to register for a maximum two courses in which they have failed but completed requisite percentage of attendance.</b>					
<b>Experimental Learning programme</b>			<b>20 (0+20)</b>		
<b>HOR17R484</b>		<b>ELP- I</b>	<b>(0+10)</b>		
1.		Commercial Horticulture	0	10	10
2.		Processing of Fruits and Vegetables for Value Addition	0	10	10
3.		Floriculture and Landscape Architecture	0	10	10
4.		Bio-inputs: Bio-fertilizers and Bio-pesticides.	0	10	10
5.		Mushroom culture	0	10	10
6.		Bee keeping	0	10	10
<b>HOR17R485</b>		<b>ELP-II</b>	<b>(0+10)</b>		
1.		Protective Cultivation of High Value Horticulture Crops	0	10	10
2.		Mass Multiplication of Plant And Molecules through Tissue Culture	0	10	10
3.		Commercial Ornamental/Medicinal Plant Production.	0	10	10
4.		Seed Production in Vegetable Crops	0	10	10
5.		Commercial Production of Bio Control Agent	0	10	10
6.		Farm advisory on Soil Health Quality and Plant Nutrition.	0	10	10
7.		Production and Marketting Organic Media for Kitchen and Roof garden.	0	10	10
<b>Total</b>			<b>0</b>	<b>20</b>	<b>20</b>

<b>S. No.</b>	<b>SEMESTER</b>	<b>L</b>	<b>P</b>	<b>C</b>
1.	SEMESTER I	13	6	19
2.	SEMESTER II	15	8	23
3.	SEMESTER III	16	10	26
4.	SEMESTER IV	14	10	24
5.	SEMESTER V	15	12	27
6.	SEMESTER VI	15	10	25
7.	SEMESTER VII	0	22	22
8.	SEMESTER VIII	0	20	20
	<b>TOTAL</b>	<b>88</b>	<b>98</b>	<b>186</b>

<b>HSS17R153</b>	<b>ENGLISH FOR TECHNICAL COMMUNICATION</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

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

### **UNIT II**

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

### **UNIT III**

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

### **UNIT IV**

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

### **UNIT V**

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

### **Practical schedule**

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

### **TEXT BOOKS**

1. Peter Roach (2009): English phonetics and phonology, a practical Course: (Fourth edition).CUP. U.K

2. Steven Brown&Dorokyn Smith (2006)-Active Listening: CUP U.K
3. Christian Evans Carter (2010) Mindsapes: Critical Reading Skills: Wadsworth publishing company. Belmont, Calif. USA
4. Kory Floid (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. Leasrning to Communicate. TOEFL Books published by Orient Longman and Cambridge Univceristy Press



<b>MAT17R140</b>	<b>MATHEMATICS FOR AGRICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>

### **UNIT I**

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

### **UNIT II**

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

### **UNIT III**

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

### **UNIT IV**

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

### **UNIT V**

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

### **TEXT BOOKS**

1. Manickavasagam Pillai, T. K and Natarajan, T. 2003. Calculus, Viswanathan Publications, Madras.
2. James Stewart and Barbara Frank, Calculus, 2008, International Thomson Publishers, Singapore

### **REFERENCE BOOKS**

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

<b>CHY17R155</b>	<b>PRIMER ON ANALYTICAL CHEMISTRY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

General principles of analytical chemistry – common analytical methods – qualitative and quantitative analysis – accuracy and precision of analytical results-Preparation of laboratory reagents

### **UNIT II**

Volumetric analysis – preparation of primary and secondary standards – standardization. Theory of indicators and buffers – acidimetry, alkalimetry, oxidimetry, complexometry and thio-cyanometry

### **UNIT III**

Gravimetric analysis – principles of precipitation reactions– solubility product – common ion effect – conditions of precipitation – – choice of filters -washing solutions

### **UNIT IV**

Instrumental analysis – principles and practices of potentiometry, conductometry, colorimetry, spectrophotometry, absorption and emission spectroscopy and chromatography – choice of analytical methods

### **UNIT V**

Radiation chemistry – radio activity – radiation decay, detection and measurements - radiological safety – stable isotopes – mass spectroscopy- use of radio active and stable isotopes in agriculture

### **Practical schedule**

1. Principles of Gravimetry and Moisture estimation.
2. Volumetric analysis – Preparation of primary, secondary standards and indicators
3. Acidimetry – Standardization of bases
4. Alkalimetry – Standardization of acids
5. Permanganimetry – Standardization of  $KMnO_4$
6. Dichrometry – Standardization of Ferrous Sulphate
7. Iodimetry – Estimation of Copper
8. Complexometry – Estimation of Calcium and Magnesium
9. Potentiometry and Conductometry – Determination of pH and EC
10. Spectrophotometry – Determination of phosphorus in matrices
11. Turbidimetry -Estimation of Sulphur
12. Flame Photometry - Estimation of Potassium
13. Absorption spectrophotometry –Estimation of Fe / Zn / Mn / Cu
14. Detection and measurement of radioactivity using Geiger Muller (GM) Counter

### **TEXT BOOKS**

1. Hesse, P.R. 1971.A Text book of Soil Chemical Analysis. John Murray (Publishers) Ltd. London.

2. Jackson, M.L. 1973. Soil Chemical Analysis. Prentice Hall Pvt.Ltd
3. Piper, C.S 1942. Soil and plant analysis: Interscience *Publishers*, New York.
4. Gupta A.K. and Varshney M.L., 1989. Practical manual for Agricultural Chemistry – Kalyani Publishers, New Delhi.

#### **REFERENCE BOOKS**

1. Hamilton I.F. and Simpson G.S.G., 1964. Quantitative Chemical Analysis – The Mc Millan Co., New York.
2. Keith A. Smith, 1983. Soil Analysis – Instrumental Techniques and Related Procedures, New York.
3. Kreshkov A.P. and Yaroslavtsev, 1977. Course of Analytical Chemistry Vol.II. Quantitative Analysis – Mir Publishers, Moscow.
4. Sankaram, A. 1966. A Laboratory Manual for Agricultural Chemistry – Asia Publishing House, Bombay.

<b>HOR17R151</b>	<b>PRIMER ON HORTICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Scope and importance – Global scenario of horticultural crops- Divisions of horticulture - area and production – export and import - classification of horticultural crops – Nutritive value of horticultural crops – horticultural therapy – Horticulture Zones of India and Tamil Nadu – Horticultural developmental agencies

### **UNIT II**

Influence of soil – physical and chemical properties and climatic factors – light, temperature, photoperiod, relative humidity, rainfall, micro climate, and pollution – influence of biotic and abiotic stresses on crop production

### **UNIT III**

Nursery techniques – vegetable garden – Nutrition garden, kitchen garden and other types of gardens - planting systems – planning, layout and management of an orchard- wind breaks - after-cultural practices – clonal orchards- use of growth regulators – water management – drip and fertigation - weed management - nutrient management - soil fertility management - cropping systems - intercropping - multi-tier cropping

### **UNIT IV**

Important phases of growth and development - bearing habits - Principles and methods of pruning and training of horticultural crops– rejuvenation of old and senile orchards- factors influencing fruitfulness and unfruitfulness – special horticultural practices

### **UNIT V**

Protected cultivation – principles of organic horticulture – hydroponics - harvesting and post harvest handling – processing, value addition, storage and marketing of horticultural produce

### **Practical schedule**

1. Study of different features of an orchard
2. Planning and layout of orchard
3. Planning and layout of orchard – Advanced
4. Tools and implements used in cultivation
5. Layout of nutrition garden
6. Preparation of nursery bed and sowing of vegetable seeds
7. Preparation of pits and planting of fruit plants
8. Layout of different irrigation systems and irrigation methods
9. Preparation of fertilizer mixtures and method of application
10. Preparation and application of growth regulators
11. Identification and correction of nutritional and physiological disorders
12. Study of bearing habits in horticultural crops
13. Methods of training and pruning in horticultural crops
14. Observation of structures used in protected cultivation and storage structures
15. Study of maturity standards, harvesting, grading, packing and storage of horticultural crops
16. Visit to private orchards and cold storage unit

### **TEXT BOOKS**

1. Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth Heinemann, Oxford University Press.
2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi
3. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

### **REFERENCE BOOKS**

1. Bhattacharjee.S.K. 2006. Amenity Horticulture, Biotechnology and Post harvest technology. Pointer publishers. Jaipur
2. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
3. Chattopadhyaya, P.K.2001. A text book on Pomology (Fundamentals of fruit growing) Kalyani Publication, New Delhi
4. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi
5. Edmond, J.B. T.L.Senn, F.S. Andrews and P.G.Halfacre, 1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co.New Delhi.
6. George Acquaaah, 2002, Horticulture-principles and practices. Prentice-Hall of India pvt. Ltd., New Delhi.
7. Hartman, H.T. and Kester, D.E. 1986. Plant propagation – Principles and Practices – Prentice Hall of India Ltd., New Delhi.

<b>HOR17R152</b>	<b>BOTANY OF HORTICULTURAL CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Systematic botany– terminology, morphological description and classification – root, stem, leaf, inflorescence, flower and fruit – flowering mechanism – modes of pollination – asexual/vegetative reproduction – floral biology – fertilization and fruit set. Principles involved in nomenclature, ICBN rules and recommendations with special reference to names of hybrids and names of cultivated plants.

### **UNIT II**

Botany, floral biology, pollination, fruit set and economic part in the families Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin), Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove), Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

### **UNIT III**

Botany, floral biology, pollination, fruit set and economic part in the families Solanaceae (tomato, brinjal, chilli, potato), Malvaceae, Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber), Moringaceae, Fabaceae (peas, French beans), Alliaceae (onion, garlic), Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae, Amaranthaceae, Convolvulaceae (sweetpotato), Araceae (elephant foot yam, colocasia), Dioscoreaceae (yam, medicinal dioscorea).

### **UNIT IV**

Botany, floral biology, pollination, fruit set and economic part in the families Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (Vanilla, Dendrobium orchid), Apiaceae (Umbelliferae) (coriander), Myristicaceae, Lauraceae, Leguminosae, Caesalpiniaceae, Camelliaceae, Rubiaceae, Arecaceae(Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaceae(Cocoa).

### **UNIT V**

Botany, floral biology, pollination, fruit set and economic part in the families Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae, Acanthaceae, Caryophyllaceae, Iridaceae, Apocynaceae, Poaceae (Graminae), (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Lamiaceae (Labiatae) (coleus, patchouli, mint, maruvu), Scrophulariaceae.

### **Practical schedule**

1. Observation and description of the taxonomy and morphological characters of the crops in the families
2. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.
3. Moraceae, Vitaceae and Caricaceae.
4. Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.
5. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

6. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.
7. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber).
8. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).
9. Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae and Amaranthaceae.
10. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal dioscorea).
11. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).
12. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
13. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm) and Sterculiaceae.
14. Oleaceae (malligai, mullai, jathimalli), Amaryllidaceae and Acanthaceae.
15. Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum)
16. Caryophyllaceae, Iradiaceae, Apocynaceae and Geraniaceae
17. Graminae (lemongrass, citrononella, palmarosa, vetiver), Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae

### **TEXT BOOKS**

1. Mauseth, J.D. 2009. Botany: an introduction to plant biology. Jones and Bartlett Publishers, MA.
2. Spichiger, R., Savolainen, V., Figeat, M., Jeanmond, D. 2004. Systematic Botany of flowering plants. Science Publishers Inc., USA.
3. Jansi Rani, P. Subramanian, S., Veeraragavathatham and S. Thamburaj, 1997. Botany of vegetable crops. KRS Screen Printers, Lawley Road, Coimbatore.
4. Gangulee, Das and Datta. 1997. College Botany Vol. I. New Central Book Agency (P) Ltd., 8/1, Chintamani Daslane, Calcutta – 700 009.
5. Subhash Chandra Datt, 1989. Systematic Botany – Willey Eastern Ltd., New Delhi.

### **REFERENCE BOOKS**

1. Genin, A. 1994. Application of Botany in Horticulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Kochhar, S.L. 1992. Economic Botany in the tropics. Macmillan India Ltd., Madras, 600 041.
3. Madhu Arora, 1991. Dictionary of Botany. Anmol Publications Pvt. Ltd., New Delhi.
4. Joseph Y. Bergen, 1990. Fundamentals of Botany. Arihant Publishers, Jaipur (India)

<b>HOR17R153</b>	<b>AGRICULTURAL MICROBIOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Definition and scope -Spontaneous generation theory, 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; Prokaryotes Vs Eukaryotes; Groups of microorganisms; Bacterial size, shape and arrangement and morphology; functional anatomy of bacteria; structure and organization of a bacterial cell: Invariant and variant components structure and organization of microbial cell. Morphology of fungi and algae- economic importance

### **UNIT II**

Microscopy – principles and types; staining of microorganisms-principles; sterilization and disinfection techniques; principles and methods of sterilization - physical methods – heat, filters, and radiation; chemical methods; isolation of pure culture techniques - enrichment culturing, dilution-plating, streak plate, spread plate methods; preservation of microbial cultures.

### **UNIT III**

Bacterial growth, reproduction and factors influencing bacterial growth – Growth curve: environmental condition for growth- nutritional types and metabolic diversity of bacteria; principles of energy generation and carbon metabolism; fermentation–respiration in bacteria- Metabolic diversity in bacteria-overview, outline classification of bacteria – bergey’s manual of systematic bacteriology Edn-II

### **UNIT IV**

Overview of soil microbiology, definitions- Concepts and scope, discovery, distribution and importance of soil microorganisms in soil fertility - factors affecting the activities of soil microorganisms; Rhizosphere, Microorganisms and importance; Phyllosphere microorganisms - plant-microbe and microbe-microbe interactions in soil.

### **UNIT V**

Microbial transformation of nutrients in soil - carbon, phosphorous and sulphur cycle; nitrogen cycle, biological nitrogen fixation - symbiotic and non-symbiotic microorganisms, Process of nodulation and nitrogen fixation; Silicate and zinc solubilising bacteria - types and importance of biofertilizers in agriculture; mass production and quality control of biofertilizers.

### **Practical schedule**

1. Microscopes- handling light microscope.
2. Staining techniques-Simple and Differential staining
3. Sterilization-equipment and apparatus used for sterilization
4. Media preparation for bacteria, fungi and actinomycetes
5. Enumeration of soil microorganisms- serial dilution plate technique (bacteria, fungi, and actinomycetes)
6. Purification and preservation of bacteria & fungi
7. Growth of bacteria - turbidimetric method.



8. Morphological and biochemical characters of bacteria.
9. Conn's direct microscopic count and Burried slide technique.
10. Organic matter decomposition - measurement of CO<sub>2</sub> evolution.
11. Demostration of antibiosis – crowded plate assay
12. Isolation of symbiotic N<sub>2</sub> fixing microorganism – Rhizobium
13. Isolation of associative and non symbiotic N<sub>2</sub> fixer: *Azospirillum* and *Azotobacter*
14. Isolation of phosphate solubilizing microorganisms and demonstration of Winogradsky column.
15. Assessment of AM fungi colonization in crop plants
16. Mass production of biofertilizers

#### **TEXT BOOKS**

1. Black, J.G. 2005. Microbiology: Principles and Explorations, John Wiley, USA.
2. Michael Madigan, John Martinko and Jack Parker. 2006. Brock Biology of Microorganisms. 11<sup>th</sup> Edition. Benjamin Cummings. England.

#### **REFERENCE BOOKS**

1. Prescott, M.J., Harley, J.P. and Klein, D.A. 2002. Microbiology. 5th Edition, WCB Mc GrawHill, New York.
2. Singh, T. Purohit, S. S. and Parihar, P. Soil Microbiology. 2010. Mrs. Saraswati Purohit. India.
3. Subba Rao, N.S. 2006. Soil Microbiology (4th Edition of Soil Microbiology and Plant Growth). Oxford & IBH, New Delhi.

<b>CSE17R151</b>	<b>PRIMER ON ICT</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Computer system – hardware: input devices, output devices – Software: system software - application Software - utility Software - Virus: types of virus – virus preventive and corrective measures - operating system: Building blocks of a generic operating system – Types of operating system – disk operating System (MS-DOS 8.0) - Windows 7 operating system.

### **UNIT II**

Introduction to computer network – Types of Network – LAN, MAN, WAN, WLAN - Basic networking devices: hub, switch, router, Wi-Fi Hotspot - IP Address: Class A, B, C and D – Protocols: TCP/IP, HTTP, FTP – Network port: 80.

### **UNIT III**

Internet Vs Intranet – Browser – Universal Resource Locator (URL) - World Wide Web (WWW) – Search Engine - e-Mail Servers – e-Mail services: Create, Forward, Reply, Attachment, Carbon Copy (CC), Blind Carbon Copy (BCC) - Introduction to Agricultural websites.

### **UNIT IV**

Introduction to office automation - Microsoft Office Suite 2010 - Word processor software - Microsoft Word 2010: create, edit, format, print a document – Document conversion : PDF to Word - Word to PDF - Spreadsheet software - Microsoft Excel 2010 - Worksheet manipulation: insert, delete, copy and hide worksheet – cell manipulation: copy, edit and format cell data – charts - create bar and pie charts - Presentation software - Microsoft PowerPoint 2010 - views - slide layout - slide design – create presentation – slide show – animation – database management system (DBMS) – table – row - Column – structured query language (SQL) – ANSI SQL vs MS Access SQL – CREATE, INSERT, SELECT, UPDATE and DELETE statements – Microsoft Access 2010 - Query Wizard – Query Design - Open Source office automation software – Introduction to Open Office 3.x.

### **UNIT V**

Programming in C - C Compiler - compilation and execution - structure of a C program - data types – constants and variables – Operators: arithmetic operators, relational operators, logical operators, increment and decrement operators – input and output statements - decision making and branching statements: If, If...else and switch - looping statements: While, do...while and for.

### **Practical schedule**

1. Keying practice using online/offline keyboard tutor software
2. Familiarizing working environment of MS DOS 8.0
3. Familiarizing working environment of Windows 7 Operating System
4. Troubleshooting computer viruses by using an Anti-virus software
5. Creating a document using Microsoft Word 2010.
6. Document conversion using Word to PDF and PDF to Word softwares
7. Spreadsheet creation and manipulation using Microsoft Excel 2010.
8. Creating Bar and Pie charts using Microsoft Excel 2010
9. Creating presentation using Microsoft PowerPoint 2010.

10. Working with animation and slideshow using Microsoft PowerPoint 2010
11. Creation and manipulation databases and tables in Microsoft Access 2010
12. Updating and Deleting a row in a Table using Microsoft Access 2010
13. Simple and Advanced searching of web and retrieving articles from open access agricultural journals
14. Creating e-Mails : Create, Reply, Forward, Attachment, CC and BCC and Download options
15. Write a C program to print a formatted text.
16. Write a C program to perform basic arithmetic operations.

### **TEXT BOOKS**

1. Sanjay Saxena, A First Course in Computers, 2004 Edition, Vikas Publishing House Private Limited. Wallace Wang, Office 2010 for Dummies, 2010, Wiley Publishing Inc.,
2. Balagurusamy, E., Programming in ANSI C, Fourth Edition, 2008, Tata McGraw Hill.

### **REFERENCE BOOKS**

1. Guy, Hart-Davis, Beginning Microsoft Office 2010, 2010, APress
2. Brian W. Kerighan and Dennis M. Ritchie, C Programming Language, Prentice Hall of India, New Delhi.
3. Rajaraman, V, Computer Programming In C, PHI Learning, Easter Economy Editions

<b>HOR17R154</b>	<b>MACRO PROPAGATION</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Scope and importance - different methods - definitions - sexual propagation - importance, advantages and disadvantages - asexual propagation - importance, advantages and disadvantages - agencies involved in the nursery development - government schemes for development of nurseries - establishment of nursery - site selection - tools and implements - mist chamber - phytotron - humidifiers - greenhouse - glasshouse - polyhouse - shade net - cold frames - hot beds - pit nursery - ball and bur lapped culture - media and containers - soil sterilization - manures and manuring - liquid manures.

### **UNIT II**

Micro and megasporogenesis - apomixis - mono and polyembryony - seeds - quality - nursery bed - prostrate culture - sowing - seed viability - longevity - germination - dormancy - types of dormancy - seed treatments - seed invigoration - seedling vigour.

### **UNIT III**

Genetic variations - chimeras and types - methods of vegetative propagation - identification of plus trees – mother block – raising clonal nursery - types of cuttings - factors influencing rooting of cuttings - use of growth regulators - layering - advantages and disadvantages - methods of layering - anatomical and physiological basis of rooting

### **UNIT IV**

Grafting and budding - methods - advantages and disadvantages - rootstocks - scion bank - factors for successful graft union - selection, pre-curing and collection of scion - bud wood selection - bud wood certification - anatomical and physiological basis of graft / bud union - stock-scion relationship - root stock influences - after care and hardening – techniques of propagation through specialized organs - tubers - bulbs - corms - runners - suckers - crown - slips - rhizome - offshoots - top working – quality management and nursery certification – display, packing, transport and marketing.

### **UNIT V**

Micro propagation – definitions - different methods - protocol of micropropagation - Stage I establishment and sterilization - Stage II shoot multiplication - Stage III root formation - Stage IV acclimatization and hardening – specific protocol for aseptic culture - explants - sterilization techniques - types of media - composition - media preparations - meristem tip culture - micro grafting - *in vitro* clonal propagation of important horticultural crops - constraints and problems in micropropagation - after care - packing, transport and marketing - infrastructure requirements - establishment of commercial tissue culture units - visit to commercial TC units- status of micropropagation in India.

### **Practical schedule**

1. Media and containers for macro propagation, tools and implements -
2. Propagation structures *viz.*, mist chamber, poly house, shade net house, cold frames and hot beds and their maintenance
3. Sexual propagation of acid lime, papaya and raising rootstocks in mango - Preparation of nursery beds and sowing
4. Potting, repotting, handling and maintenance of seedling and rootstocks

5. Preparation of growth regulators and standardization of formulations for seed and vegetative propagation.
6. Techniques of propagation through leaf cuttings
7. Techniques of propagation through stem cutting
8. Techniques and methods of air layering
9. Techniques and methods of ground layering
10. Techniques and methods of propagation through inarching grafting
11. Techniques and methods of propagation through epicotyl grafting
12. Propagation techniques through T budding
13. Propagation techniques through patch budding
14. Propagation through specialized organs
15. Project preparation for commercial nurseries
16. Visit to private nurseries and commercial tissue culture units

### **TEXT BOOKS**

1. Adams, C.R., K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS Publishers and Distributors 4596/1-A, Daryaganj, New Delhi. 110 002.
2. 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. IndiaEdmond, J.B., T.L. Senna, F.S. Andrews and R.G. Halfacre. 1990. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd.
3. 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.

### **REFERENCE BOOKS**

1. Ramswat, K. G. and J.M. Merillan 1999. Biotechnology – secondary Metabolites Oxford & IBH Publishers, Co (P) Ltd., New Delhi.
2. Purohit, S. S. 1998. Biotechnology: Fundamentals and Applications II Edition; Agro Botanica Bikaner, India.
3. Kains, M. G. 2008. Plant Propagation: Greenhouse and Nursery Practice. Singh, B.D. 1999. Biotechnology, Kessinger Publishing, New York.

<b>HOR17R155</b>	<b>CROP PRODUCTION: TROPICAL FRUITS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Scope and importance of tropical fruits cultivation – overview: global, national and regional levels – area, production and export potential– horticultural zones of India and Tamil Nadu with emphasis on tropical fruits- GAP. organic production - composition and uses – origin and distribution – species and cultivars - climate and soil requirements - species and varieties - cropping systems- propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management - special horticultural techniques - use of plant growth regulators - production constraints - physiological disorders – post harvest handling - economics of production.

### **UNIT II**

Composition and uses – origin and distribution – species and cultivars - climate and soil requirements, cropping systems- varieties - propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management – GAP - organic production - special horticultural techniques – sex forms and pollination - use of plant growth regulators - production constraints - physiological disorders - pre and post harvest handling - economics of production.

### **UNIT III**

Composition and uses – origin and distribution – species and cultivars - climate and soil requirements, cropping systems- varieties - production constraints - propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management - GAP - organic production - special horticultural techniques - use of plant growth regulators - physiological disorders - pre and post harvest handling - economics of production.

### **UNIT IV**

Dryland horticulture – importance and scope in India and Tamil Nadu-distribution of arid and semi-arid zones in India and Tamil Nadu. Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns for rainfed horticultural crops- *in situ* grafting and budding techniques – alternative land use systems – mulching - soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – regulation of cropping – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production.

### **UNIT V**

Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties - cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns for rain fed horticultural crops- *in situ* grafting and budding techniques – alternative land use systems – mulching - soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering –

crop regulation – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production.

### **Practical Schedule**

1. Study of mango varieties
2. Practices in propagation, planting and growth regulation in mango.
3. Study of banana varieties and their genome classification and scoring techniques.
4. Practices in propagation, planting, growth regulation treatments and special practices in banana.
5. Study of grapes varieties, training and pruning practices
6. Visit to mango, banana and grapes orchards in Cumbum valley
7. Study of sapota varieties, propagation and planting
8. Study of papaya varieties, propagation and thinning of plants
9. Papain extraction and its cost economics
10. Study of guava propagation techniques and varieties.
11. Acid lime, lemon and sweet orange varieties, suitable root stocks and their propagation
12. Aonla, pomegranate custard apple, Jamun, bael and manila tamarind propagation and varieties
13. Visit to RRS, Aruppukottai
14. Assessment of maturity standards for tropical and arid zone fruits.
15. Practices in harvesting and postharvest handling
16. Working out the economics of production of tropical fruits and project preparation.

### **TEXT BOOKS**

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 1-3). 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.

### **REFERENCE BOOKS**

1. Bose T.K., S. K. Mitra and M. K. Sadhu. 2003 Mineral Nutrition of Fruit Crops. Naya Prakash, Calcutta.
2. Pal, J.S. 1997. Fruit Growing, Kalyani Publishers, New Delhi.
3. Singh, S. S. Krishanmurthi and S. L Katyal. 1967. Fruit culture in India, ICAR, New Delhi.

<b>HOR17R156</b>	<b>CROP PRODUCTION: TROPICAL VEGETABLES</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Area, production, world scenario, industrial importance, export potential of tropical vegetable crops – institutions involved in vegetable crops research - Classification of vegetable crops - Effect of climate, soil, water and nutrients on vegetable crop production and their management– cropping systems.

Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden – types of vegetable farming and contract farming- rice fallow cultivation, river bed cultivation, rain fed cultivation, organic farming – GAP in vegetable production – export standards of vegetables.

### **UNIT II**

Composition and uses – area and production- climate and soil requirements – season-varieties and hybrids – seed rate- nursery practices-containerized transplant production and transplanting –preparation of field-spacing-planting systems-planting- water and weed management-nutrient requirement-fertigation-nutrient deficiencies- physiological disorders- use of chemicals and growth regulators-cropping systems-constraints in production-harvest-yield

Crops: Tomato, brinjal, chilli and bhendi.

### **UNIT III**

Composition and uses- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems – planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders – sex expression - use of chemicalS and growth regulators - cropping systems – constraints in production - harvest – yield

Onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, coccinia, cucumber and gherkin.

### **UNIT IV**

Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids - seed rate –preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders- use of chemicals and growth regulators - cropping systems – constraints in production-harvest – yield.

Cluster beans, cowpea, lab-lab, moringa, chekurmanis, palak, basella and amaranth.

### **UNIT V**

Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids - seed rate –preparation of field - nursery practices and transplanting – spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders- use of chemicals and growth regulators - cropping systems – - constraints in production –virus elimination in cassava- harvest – yield

Cassava, sweetpotato, colocasia, vegetable coleus, amorphophallus, edible dioscorea, and yam bean

### **Practical schedule**



1. Preparation of nursery, containerized transplant production and sowing of seeds for solanaceous vegetable crops.
2. Preparation of field and sowing of direct sown vegetable crops.
3. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable crops and tuber crops.
4. Identification and description of species and varieties of tomato, brinjal and chilli. Working out cost- benefit ratio.
5. Identification and description of species and varieties of bhendi, amaranth, cluster beans, vegetable cowpea and lab-lab. Working out cost- benefit ratio.
6. Identification and description of species and varieties of cucurbits, onion, moringa, chekkurmanis and determination of sex ratio in cucurbits. Working out cost- benefit ratio.
7. Identification and description of cultivars and wild relatives of tuber crops. Working out cost –benefit ratio.
8. Planning and lay out of kitchen/ nutrition garden.
9. Study of rainfed cultivation practices in vegetable crops
10. Study of drip and fertigation, basal dressing, top dressing and foliar spray of fertilizers for vegetable crops.
11. Identification of weeds, preparation of herbicide spray fluids and their usage in the field. Working with the economics of weed management
12. Preparation of growth regulator spray solution- their usage in tropical vegetable crops
13. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
14. Maturity indices, harvesting and seed extraction
15. Visit to commercial vegetable growing area / markets
16. Project preparation for commercial cultivation of tropical vegetable crops.

### **TEXT BOOKS**

1. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. “Modern technology in vegetable production” New India Publishing Agency, New Delhi.
2. Uma Shankar Singh, 2008. “Indian vegetables”, Anmol publications Pvt., Ltd., New Delhi.
3. Gopalakrishnan, T.R., 2007. “Vegetable Crops” New India publishing agency, New Delhi.
4. James S. Shoemaker and Thomas Smith., 2006. “Culture of Veg., Growing” Asiatic.

### **REFERENCE BOOKS**

1. Vishnu Swarup, 2006. Vegetable science and technology in India. Kalyani publishers, New Delhi.
2. Neeraj Pratap Singh. 2005. “Basic concepts of vegetable science”, International Book distributing co., New Delhi.
3. Rai, N. and D.S. Yadav, 2005. Advances in Vegetable Production: Research co Book Centre, New Delhi.
4. Nem Pal Sing. A.K. Bhardwaj, K.M. Sing and Abnish Kumar .2004. Modern technology on vegetable production, International book distributing Co., Lucknow.

<b>HOR17R157</b>	<b>PRIMER ON AGRICULTURAL METEOROLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Meteorology - agricultural meteorology - scope in crop production. Coordinates of India and Tamil Nadu - atmosphere - composition and vertical layers of atmosphere (stratification) - climate - weather - factors affecting climate and weather - climatic types

### **UNIT II**

Solar radiation - light intensity, quality, direction and duration - air and soil temperature - Diurnal variation - importance in crop production. Heat unit and its importance in agriculture. Relative humidity and its importance - wind and its effect on crops.

### **UNIT III**

Atmospheric pressure - pressure systems - cyclones, anticyclones, tornado, hurricane and storms - wind systems of the world - inter tropical convergence zone. Clouds - types and their classification. Precipitation - forms - monsoon - - Seasons of India- rainfall variability- drought, flood and their effect - cloud seeding – Evapotranspiration

### **UNIT IV**

Agroclimatic zones - agroclimatic normals - weather forecasting - synoptic chart - crop weather calendar - remote sensing and crop weather modeling - Impact of climate and weather on crop production and pest and diseases.

### **UNIT V**

Climate change- climate variability – definition and causes of climate change - Impact of climate change on agriculture, forestry, hydrology, marine and coastal ecosystem

### **Practical schedule**

1. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements - Reviewing agromet registers.
2. Measurements of solar radiation (pyranometers), sunshine hours (sunshine recorder) – working out weekly and monthly mean for graphical representation
3. Measurement of air and soil temperature and grass minimum thermometers and thermographs – drawing isolines
4. Humidity measurements – use of wet and dry bulb thermometers - Psychrometers – Hygrograph - Measurement of wind direction and wind speed and conversion (KMPH, KNOT, and M/Sec.) – Beaufort’s scale.
5. Measurement of atmospheric pressure - barograph - Fortein-s barometer - Isobars based on past data for different seasons.
6. Measurement of rainfall - Ordinary and self-recording rain gauges - Measurement of Dew - dew gauge- study of Automatic weather station.
7. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data-Measurement of Evapotranspiration- Lysimeter.
8. Heat Unit concept- GDD, HTU, PTU for fixing time of sowing.
9. Probability analysis of rainfall for crop planning
10. Drawing Synoptic charts for understanding weather.
11. Preparation of crop weather calendars and forecast based agro advisories
12. Preparation pest weather calendar and pest forewarning
13. Estimation of length of growing periods using weekly rainfall data.

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

#### **TEXT BOOKS**

1. Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
2. Yellamanda Reddy, T. and G.H. Sankara Reddi, 2004. Principles of Agronomy, Kalyani Publishers, Ludhiana.

#### **REFERENCE BOOKS**

1. Gopaldaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.
2. IPCC Fourth Assessment report, 2007 (<http://www.ipcc.ch>)
3. Kakde, J.R., 1985. Agricultural climatology, Metropolitan Book Co. Pvt. Ltd., New Delhi.
4. Lenka, D. 2000. Climate, Weather and Crops in India, Kalyani Publishers, Ludhiana.
5. Mavi, H.S., 1996. Introduction to Agrometeorology, oxford and IBH Publishing Co., New Delhi.
6. Murthy, V.R.K. 1995. Practical manual on Agricultural Meteorology, Kalyani Publishers, Ludhiana.

<b>HOR17R158</b>	<b>BASIC OF GENETICS AND CYTOGENETICS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Cell and cell organelles- differences between prokaryotes and eukaryotes, Cell theory - cell cycle – cell division - mitosis, meiosis and their significance, Chromosome structure – types of chromosomes- karyotype, ideogram -special chromosomes. Chromosomal aberration: variation in chromosome structure – deletion, duplication, inversion and translocation – genetic and cytological implications. Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin. Polyploid - auto and allopolyploids, their characters; evolution of wheat, triticale, cotton, tobacco, brassicas

### **UNIT II**

Earlier concepts of heredity - vapour and fluid theory, magnetic power theory, preformation theory, Lamarck's theory, Darwin's theory, germplasm theory and mutation theory, Mendel's work- laws of heredity, Chromosomal theory of inheritance, Allelic interactions – dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance, Gene interactions – Non-allelic interactions, Lethal genes, pleiotrophy, penetrance and expressivity, phenocopy, Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters.

### **UNIT III**

Linkage - coupling and repulsion; experiment on 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 - Stern's experiment; factors controlling crossing over. Strength of linkage and recombination; Two point and three point test cross, Double cross over, interference and coincidence; genetic map, physical map.

### **UNIT IV**

Sex determination - chromosomal mechanism of sex determination and its types - autosomes and sex chromosomes – homogametic and heterogametic sexes; genic balance theory of sex determination of bridges. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance. Sex determination in plants – Melandrium, papaya, maize. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial, plasmid and episomic inheritance.

### **UNIT V**

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. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication. RNA types - mRNA, tRNA, rRNA; genetic code. Transcription – central dogma of life. Gene expression – translation – protein synthesis. Regulation of gene expression – operon model of Jacob and Monad; Structural genes and regulator genes. -exons and introns.

Modern concept of gene- cistron, muton and recon; complementation test; mobile genetic elements. Mutation –characteristics of mutation micro and macro mutation – CLB technique - molecular basis of mutation; major physical and chemical mutagens.

### **Practical schedule**

1. Use of microscopes and study of cell shapes and cell organelles of active mitotic and meiotic tissues.
2. Principles of killing and fixing; preparation of stains and preservatives.
3. Study of the mitotic phases in root tips of onion / *Aloe sp.*
4. Study of behaviour of chromosomes in mitosis.
5. Procedure for fixing and observing different meiotic phases in the inflorescence of maize.
6. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/sorghum.
7. Induction of polyploidy using colchicine
8. Repetition of meiotic studies in maize/sorghum/pearl millet and making temporary and permanent slides.
9. Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross;.
10. Dihybrid ratio with dominance, with incomplete dominance and test cross
11. Simple interaction of genes-comb character in fowls; Dominant epistasis.
12. Recessive epistasis, Duplicate and additive epistasis.
13. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
14. Multiple alleles and polygenic inheritance
15. Estimation of linkage with F<sub>2</sub> and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; working out interference, coincidence and drawing genetic maps.

### **TEXT BOOKS**

1. Gupta P.K., 1997. Cytogenetics, Rastogi Publications, Meerut
2. Strickberger. M.W., 1996. Genetics, Prentice-Hall of India Pvt. Ltd. New Delhi.
3. Singh, B.D. 2004. Fundamentals of genetics, Kalyani Publishers, Chennai.

### **REFERENCE BOOKS**

1. Daniel Sundararaj, G. Thulasidas and M.Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai –15.
2. Benjamin Lewin 2005 Genes IX Oxford University Press, Oxford.

<b>HOR17R159</b>	<b>PHYSIOLOGY OF PLANTS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Importance of crop physiology in agriculture, role of water –water potential and components -Definitions - field capacity, water holding capacity of soil and permanent wilting point, absorption and translocation of water and solutes, transpiration - significance- antitranspirants.

### **UNIT II**

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

### **UNIT III**

Photosynthesis - light reaction and photosynthetic pathways - C3, C4 and CAM, differences between C3, C4 and CAM pathways - Factors affecting photosynthesis, photorespiration and significance phloem and xylem loading- source sink relationship.

### **UNIT IV**

Growth - growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity,- - Photoperiodism - role of phytochrome in flowering and regulation of flowering. Vernalisation – devernalisation- plant growth regulators and commercial applications - physiological role of auxins and GA, physiological role of cytokinin, ethylene and ABA - novel growth regulators and retardants - their uses in crop productivity, post harvest physiology - physiology of seed germination, seed and bud dormancy and breaking methods, parthenocarpy - physiology of fruit ripening - climacteric and non-climacteric fruits- - factors affecting ripening and storage, abscission – senescence, shelf life and quality changes – use of PGRs and nutrients.

### **UNIT V**

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

### **Practical schedule**

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

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

#### **TEXT BOOKS**

1. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
2. Pandey, S. N. and B. K.Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
3. Purohit, S.S, 2005. Plant physiology, Student edition, Jodhpur.

#### **REFERENCE BOOKS**

1. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
2. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

<b>HOR17R160</b>	<b>BASIC OF BIOCHEMISTRY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

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 alkalies. Industrial uses.

### **UNIT II**

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**

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**

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

### **Practical schedule**

1. Qualitative tests for carbohydrates.
2. Estimation of total sugars.
3. Determination of reducing sugars
4. Amylose estimation.
5. Estimation of starch
6. Colour reactions of amino acid and proteins.
7. Estimation of proteins. by Biuret method
8. Sorenson's formal titration of amino acids.
9. Estimation of total free amino acids by Ninhydrin method.
10. Estimation of free fatty acids of an oil.
11. Determination of iodine number of an oil.



12. Estimation of ascorbic acid.
13. Estimation of total phenol.
14. Assay of amylase
15. Separation of amino acids through PC.
16. Separation of sugars through TLC.

#### **TEXT BOOKS**

1. Rastogi S.D., 2010, Biochemistry, 3<sup>rd</sup> edn, Tata McGraw-Hill, Delhi
2. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W., 2003. 26<sup>th</sup> edn, Tata McGraw-Hill, New Delhi
3. Nelson DL, Cox MM. 2004. Lehninger Principles of Biochemistry Fourth (Indian edition) Macmillian, Worth Publishers.
4. Voet D, Voet JG and CW Pratt. 2002. Biochemistry. John Wiley & Sons, Inc, Singapore
5. Thayumanavan, B, Krishnaveni, S and Parvathi, K. 2004. Biochemistry for Agricultural Science, Galgotia Publications Pvt Ltd., New Delhi

#### **REFERENCE BOOKS**

1. Conn, E.E. and Stumpf, P.K. 1996. Outlines of Biochemistry – Wiley Eastern Ltd., Fifth Edition.
2. Stryer L, Berg T, Tymoczko, J, Biochemistry. 2009 5<sup>th</sup> Ed. Wiley Eastern Ltd, New Delhi
3. Chesworth, JM., Stuchbury, T. and Scaife, JR. 1998. An Introduction to Agricultural Biochemistry. Chapman and Hall
4. Goodwin, T.W. and Mercer, E.I. 1991. Introduction to Plant Biochemistry. Pergamon Press.

<b>HOR17R161</b>	<b>PRINCIPLES OF AGRICULTURAL ECONOMICS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Nature and scope of economics: Importance – subject matter, science vs. art, positive vs. normative science - deductive and inductive methods - Different economic systems: merits and demerits - definitions of economics: wealth, welfare, scarcity and growth definitions - divisions of economics – micro and macro economics - agricultural economics: definition and scope - basic concepts: goods, service, value, cost, price, wealth, welfare - wants: characteristics and classification.

### **UNIT II**

Utility: definition, measurement - cardinal and ordinal utility - marginal utility - Law of diminishing marginal utility and Law of equi-marginal utility: definition – assumptions - limitations and applications - Demand: definition - kinds of demand, demand schedule, demand curve, law of demand, determinants of demand - extension and contraction vs increase and decrease in demand - Elasticity of demand: types, degrees of price, elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand - importance of elasticity of demand - Engel's law of family expenditure - Consumers surplus: definition – importance.

### **UNIT III**

Concept of production – factors of production – land and its characteristics - Labour – division of labour - Malthusian theory and modern theory of population - Capital – characteristics of capital - capital formation – entrepreneur, characteristics and functions of entrepreneur - supply definition – law of supply – factors influencing supply - elasticity of supply.

### **UNIT IV**

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

### **UNIT V**

National income: Concepts – GNP, GDP, NNP, disposable income and per capita income- measurement of national income - public finance: meaning, principles. Public revenue: meaning, classification of taxes - service tax - canons of taxation, public expenditure: principles - Inflation: meaning, definition, kinds of inflation - welfare economics: meaning, Pareto's optimality – millennium development goals (MDG).

### **Practical schedule**

1. Exercise on Law of Diminishing Marginal Utility.
2. Exercise on Law of Equi Marginal Utility.
3. Demand schedule - graphical derivation of individual and market demand.
4. Indifference curve analysis – properties, budget line and consumer equilibrium.
5. Measurement of arc elasticity and point elasticity of demand - Estimation of own price elasticity, income and cross elasticity of demand.
6. Estimation of consumer surplus.

7. Exercise on law of diminishing marginal returns – relationship between TPP, APP and MPP.
8. Cost concepts and graphical derivation of cost curves.
9. Analysis of growth in population and food grain production in India.
10. Estimation of supply elasticity.
11. Market Structure – Price determination.
12. Analysis of causes of inflation and control measures. Measurement of inflation – Consumer price index and wholesale price index.
13. Types and functions of money.
14. Approaches to computation of National Income.
15. Analysis of trends in National Income and study of structural changes in the economy
16. Exercise on welfare indicators – HDI, PQLI, PPP, Poverty Line, etc

### **TEXT BOOKS**

1. Dewett, K.K. 2002. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Samuelson, P. 2004. Economics, (18/e), Tata Mcgraw-Hill, New Delhi
3. Koutsoyiannis, A. 1983. Modern Microeconomics, The Macmillan Press Ltd., Hongkong

### **REFERENCE BOOKS**

1. Varian, H. R. 1987. Intermediate Microeconomics, WW Norton & Company, New Delhi
2. Seth, M.L. 2000. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi

<b>HOR17R251</b>	<b>PRODUCTION TECHNOLOGY OF TEMPERATE VEGETABLES</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Area, production, world scenario, industrial importance, export potential of tropical vegetable crops – Classification of vegetable crops - Effect of climate, soil, water and nutrients on vegetable crop production and their management– Cropping systems – Seed production techniques and constraints in temperate vegetable crops.

### **UNIT II**

Composition and uses- origin and distribution- area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production – harvest – Yield

Crops: cabbage, cauliflower, Brussels sprouts, sprouting broccoli and Chinese cabbage.

### **UNIT III**

Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production – harvest – Yield – use of TPS in potato

Crops: potato, peas, beans, and chow chow.

### **UNIT IV**

Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest– Yield

Crops: carrot, beet root, radish and turnip.

### **UNIT V**

Composition and uses - area and production- climate and soil requirements – season - varieties and hybrids -seed rate – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield

Crops: Kale, cress, celery, rhubarb, asparagus, artichoke, leek, lettuce and spinach.

### **Practical Schedule**

1. Nursery preparation and sowing transplanted temperate vegetables
2. Nursery preparation, seed rate, spacing for direct sown temperate vegetables
3. Soil water conservation, contour planting, crop geometry
4. Use of herbicides, preparation of solution, application

5. Water management practices
6. Nutritional requirement, including major and micro nutrients
7. Scheduling of nutrients for temperate vegetables through drip fertigation
8. Use of growth regulators, preparation of solution and application in temperate vegetables
9. Identification of physiological disorders and nutritional disorders
10. Maturity indices and harvesting
11. Protected cultivation of temperate vegetables
12. Organic practices, GAP, precision farming in temperate vegetables
13. Visit to commercial farms in plains
14. Visit to commercial farms in hills
15. Visit to cold storage / markets / processing centres
16. Project preparation and working out economics

### **TEXT BOOKS**

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

### **REFERENCE BOOKS**

1. S. P. Singh, 1997. Principles of vegetable production Agrotech publishing Academy, Udaipur
2. Hazra, P. and M. G. Som. 1999. Technology of vegetable production and improvement Naya Prakash, Calcutta
3. Veeraraghavathatham, A, Jawaharlal and Seemanthini Ramdoss. 1991. A guide on vegetable culture, Suri Associates, Coimbatore – 2.
4. Prem Singh Arya, 1999. Vegetable seed production in Hills, M.D. Publications Pvt. Ltd., New Delhi.
5. Bailey, L. H. 1999. Principles of vegetable cultivation, Discovery publishing House, New Delhi.

<b>HOR17R252</b>	<b>WEED AND IRRIGATION MANAGEMENT</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Weeds – Definition, classification and characteristics of weeds – Weed ecology - Principles and methods of weed management: preventive, cultural, mechanical, chemical, biological and alternate methods – IWM for horticultural crops - management of problematic, parasitic and aquatic weeds.

### **UNIT II**

Chemical, weed management - classification herbicide formulations - adjuvants, herbicide protectants and antidotes - Mode and mechanism of action of herbicides - Herbicide selectivity - Principles of herbicide selectivity

### **UNIT III**

Herbicide resistant weeds and crops – Principles and concepts - development of transgenic herbicide resistant crops – Success of herbicide resistant crops (HRC) in World and Indian agriculture.

### **UNIT IV**

Water resources of India and Tamil Nadu, Importance of irrigation water – soil-water-plant relationship – soil moisture constant – soil water movement – soil moisture extraction pattern – evapotranspiration – water requirement of horticultural crops – critical stages for irrigation.

### **UNIT V**

Irrigation methods – surface, sub-surface and advance methods – drip, sprinkler and green house and landscape irrigations – Fertigation - Water use efficiency – Quality of irrigation water - Management of problem waters – Drainage

### **Practical schedule**

1. Identification and classification of wet land and garden land weeds
2. Identification and classification of dry land and hilly weeds
3. Practising Skill development on mechanical weed management
4. Identification and classification of herbicides
5. Practising Skill development on herbicide application techniques
6. Practising Skill development on spray equipments and spray fluid calibration
7. Calculation of herbicide quantity and recommendation
8. Economic evaluation of weed control methods in horticultural crops and cropping systems.
9. Estimation of soil moisture content by gravimetric method and instrumentation technique
10. Estimation of field capacity and permanent wilting point
11. Methods of irrigation and acquiring skill in landscaping for different surface irrigation methods.
12. Measurement of irrigation water, estimation of evapo transpiration, estimation of crop water requirement and calculation of irrigation efficiency
13. Design and layout of micro irrigation systems for different horticultural crops
14. Working out economics of drip and sprinkler irrigation systems
15. Developing fertigation schedule for horticultural crops

## 16. Estimation of water quality and drainage

### **TEXT BOOKS**

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

### **REFERENCE BOOKS**

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

<b>HOR17R253</b>	<b>FUNDAMENTALS OF SOIL SCIENCE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

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

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

### **UNIT II**

Phases of soil. Soil physical properties and their significance – Soil texture and textural classes - Soil structure and classification – Soil consistency

### **UNIT III**

Bulk density, particle density and porosity - Soil colour – significance - causes and measurement. Soil temperature – Soil air – Soil water- Soil water potentials – Soil moisture constants – Movement of soil water – saturated and unsaturated flow – Infiltration, hydraulic conductivity, percolation, permeability and drainage

### **UNIT IV**

Soil colloids – Properties, types and significance – Layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange - significance. Soil reaction, Buffering capacity and EC

### **UNIT V**

Soil organic matter – Composition – decomposition and mineralization, C : N ratio, Carbon cycle – Fractions of soil organic matter – Humus formation. Soil organisms - Beneficial and harmful effects.

### **Practical schedule**

1. Identification of common rocks and minerals
2. Soil sample collection
3. Visit to soils of different terrains and study of soil profiles
4. Determination of bulk density, particle density and porosity – cylinder, wax coating and core methods.
5. Soil textural analysis – feel method, International pipette method (part 1)
6. International pipette method (part 2)
7. International pipette method (part 3)
8. Determination of soil colour and temperature.
9. Determination of soil moisture– Gravimetric and gypsum block method
10. Determination of soil moisture–Tensiometer, TDR and neutron probe
11. Determination of Infiltration rate
12. Determination of hydraulic conductivity
13. Determination of soil pH and EC
14. Estimation of soil organic carbon
15. Colloquium 1. – Chemical constituents of soil – water soluble elements, total elemental composition – relevance in soil properties and behaviour
16. Colloquium 2. – Preparation of interpretative reports of soil analysis and assignments



**TEXT BOOKS**

1. Brady, N.C., 2002 the Nature and Properties of Soils (13<sup>th</sup> 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, NewDelhi
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.

**REFERENCE BOOKS**

1. Biswas T.D. and Mukherjee S.K., 1987. Text Book of Soil Science–Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Jenny, H. 1941. Factors of Soil Formation - A System of Quantitative Pedology. McGraw-Hill Book Company INC. NewYork.
3. Joffe, J.S. 1936. The ABC of Soils. Pedology Publication, New Jersey.

<b>HOR17R254</b>	<b>AGRICULTURE ENTOMOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

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**

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**

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, 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**

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

### **Practical schedule**

1. Observations on external features of grasshopper / cockroach
2. Methods of insect collection, preservation, pinning, labelling, display and storage
3. Types of insect head and antenna
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, housefly, moths and butterflies
5. Structure of thorax and abdomen and their appendages —modifications in insect legs and wings — wing venation, regions and angles — wing coupling.
6. Types of immature stages of insects.
7. Study of digestive system.
8. Study of male and female reproductive systems.
9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota -Odonata and Ephemeroptera and Phasmida
10. Dictyoptera, Dermaptera, Embioptera, Orthoptera (Acrididae, Tettigonidae, Gryllidae and Gryllotalpidae), Mallophaga and Siphunculata
11. Exopterygota —Isoptera and Hemiptera — **Homoptera** (Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae and Psyllidae); **Heteroptera** (Reduviidae, Pentatomidae, Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae),

12. Observing the characters of orders Thysanoptera and Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)
13. Observing the characters of Hymenoptera (Tenthredinidae, Apidae, Sphecidae
14. Vespidae, Formicidae, Xylocopidae, Chalcididae Megachilidae Ichneumonidae, Bethyidae, Braconidae, Agaonidae, Evaniidae, Encyrtidae,
15. Eulophidae and Trichogrammitidae).
16. Observing the characters of Coleoptera (Curculionidae, Apionidae, Cicindellidae, Carabidae, Staphylinidae, Dytiscidae, Coccinellidae, Gyrinidae, Lampyriidae, Hydrophilidae, Scarabaeidae Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae).
17. Observing the characters of Lepidoptera (Nymphalidae, Lycaenidae, Pieridae,
18. Papilionidae, Satyriidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae and Hesperidae)
19. Observing the characters of Neuroptera (Chrysopidae, Myrmeleonidae, Mantispidae, Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family

#### **TEXT BOOKS**

1. Borror, D.J., D.M. DeLong and C.A. Triple Horn. 1976. An introduction to the study of insects (IV Edition). Holt, Rinehart and Winston, New York, London and Sydney.
2. Cedric Gillott. 2005. Entomology (Third Edition). Springer, Netherlands.
3. Nayar. K.K., T.N. Ananthakrishnan and B.V. David 1976. General and Applied Entomology. Tata Mc-Graw Hill publishing Company Ltd, New Delhi.
4. Richards O.W. and R.G. Davies 1977. Imm's General Text Book of Entomology Vol.I and II. Chapman and Hall Publication, London.

#### **REFERENCE BOOKS**

1. Chapman, R.F. 1981. The Insects: Structure Function. Edward Arnold (publishers) Ltd, London.
2. Chapman R.F.1974. Insect Structure and Function, ELBS publishers, New Delhi.
3. Paulson, G.S. 2005. Hand book to the Construction and Use of Insect Collection and Rearing Devious Springer Dordrechse, New York.
4. Snodgrass. R.E. 1993. Principles of Insect Morphology, Cornell University Press, New York.

<b>HOR17R255</b>	<b>PRINCIPLES OF QUALITY SEED PRODUCTION</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Seed - definition – importance – quality characteristics – history of seed industry - classes of seed - generation system - multiplication ratio - seed replacement rate – varietal deterioration - causes – maintenance.

### **UNIT II**

Methods and tools of seed production in variety and hybrid – seed crop management - land requirement-isolation – pre-sowing seed treatment – dormancy - spacing – nutrient-irrigation - contaminants - roguing – plant protection – physiological maturation – pre-harvest sanitation spray - harvest and postharvest techniques-extraction – methods - drying – processing - seed treatment - pre-storage – packing – storage – mid- storage treatment.

### **UNIT III**

Seed certification – phases – procedures - general and specific standards – field inspection – field counts –contaminants - post harvest inspection – seed standards - bagging – tagging – blending of seed lots – grow out test.

### **UNIT IV**

Seed testing - importance – seed lot – seed sample - sampling methods – purity analysis – moisture estimation – germination tests – viability test – seed vigour tests - seed health test .

### **UNIT V**

Seed Act and Rules –Central Seed Committee - Central Seed Certification Board, State Seed Certification Agency - Central and State Seed Testing Laboratories - Seed Inspector - duties and responsibilities – offences and penalties - Seed Control Order 1983 – New policy on seed development / New Seed Policy 1988– National Seed Policy 2002 - Seed Bill 2004.

### **Practical Schedule**

1. Seed structure in horticultural crops
2. SMR and SRR - calculation - factors influencing – variety /hybrid - comparison
3. Practicing varietal and hybrid seed production plots and pre sowing seed management techniques (dormancy)
4. Practising pre sowing seed management techniques (priming, coating and pelleting)
5. Identification of contaminants and practising roguing
6. Studies on physiological and harvestable maturity and seed extraction
7. Practicing field counting
8. Visit to seed processing unit
9. Visit to Directorate of Seed Certification
10. Visit to grow out test plots
11. Seed sampling, mixing and dividing
12. Analysis of physical purity and estimation of seed moisture
13. Conducting germination tests
14. Seedling evaluation and seed health test
15. Practising quick viability test

16. Visit to seed retail shop for observing the methods of taking official sample

**TEXT BOOKS**

1. P.S.Arya. 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.
2. S.P.Singh. 1999. Seed production of commercial vegetables. Kalyani Publishers. New Delhi.
3. Raymond A.T. George. 1985. Vegetable seed production. Longman and London, New York.

**REFERENCE BOOKS**

1. K.Vanangamudi *et al.*, 2006. Advances in Seed Science and Technology. Vol. 2. Quality seed production in vegetables. Agrobios (India), Jodhpur. Agrobiosindia.com
2. R.Umarani, R.Jerlin, N.Natarajan, P.Masilamani and A.S.Ponnuswamy (2006) Experimental Seed Science and Technology, Agrobios, Jodhpur.
3. T.S.Verma and S.C.Sharma (2000) Producing Seeds of Biennial Vegetables in Temperate Regions. ICAR, New Delhi.
4. P.S.Arya. 1999. Vegetable seed production in hills. M.D. Publication Pvt. Ltd

<b>HOR17R256</b>	<b>PLANT PATHOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### UNIT I

Plant Pathology : definition, history – Pathogens : fungi, bacteria, virus, viroid, phytoplasma, Fastidious vascular bacteria, spiroplasma , algae and phanerogamic parasites – Koch's postulates - Types of parasitism - General characters of fungi – Major symptoms of fungal diseases

### UNIT II

Classification of Kingdom – Protozoa - important taxonomic characters and symptoms and life cycle of Plasmodiophora brassicae -Classification of Kingdom – Chromista- General Characters - Classification of Oomycetes .Symptoms and life cycle of Pythium, Phytophthora and Albugo peronosclerospora, Sclerospora, Perenospora, Pseudoperenospora and Plasmopora-Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of Rhizopus Classification of Kingdom– Ascomycota- important characters

Symptoms and life cycles of Erysiphe, Leveillula, Phyllactinia, Uncinula and Podosphaera pyricularia, Helminthosporium, Alternaria, Cercospora and Curvularia, Fusarium, Verticillium, Colletotrichum, Gloeosporium, Pestalotia, Macrophomina and Botryodiplodia,-Classification of Kingdom - Basidiomycota - important characters Symptoms and life cycles of Puccinia ,Uromyces, Ustilago and Hemileia, Ganoderma, Agaricus, Pleurotus , Volvariella and Calocybe Symptoms and important characters of Corticium, Rhizoctonia and Sclerotium

### UNIT III

Classification, general characteristics and symptoms of bacterial diseases, mode of entry and spread - General characteristics and symptoms of viral, viroid and phytoplasma diseases - General characters of algal parasite *Cephaleuros* and phanerogamic parasites.

### UNIT IV

Epidemiology of crop diseases - role of weather factors in disease development. Survival and spread of plant pathogens - Disease surveillance and forecasting.Principles of Crop disease management – Prophylaxis : Exclusion, Eradication and direct protection and immunization : Cross protection and host plant resistance. Fungicides – classification – characteristics of an ideal fungicide – group of fungicides – Non systemic and systemic. Formulations – methods of application of fungicides. Precautions and safety measures in handling of fungicides. Special methods of application

### UNIT V

Biological control of crop diseases and their scope – biocontrol agents – Fungi, bacteria, – use of plant products and anti viral principles in plant disease management. Biotechnological approaches in plant disease management

#### Practical schedule

1. General characters of fungi – types of mycelium, asexual, sexual and vegetative spores – types of sexual and asexual fruiting bodies.
2. Study of symptoms, fungal characters and host parasite relationships of
3. *Plasmodiophora brassicae* (club root), *Pythium* (damping off), *Phytophthora* (late blight)
4. Study of symptoms, fungal characters and host parasite relationships of

5. *Plasmopara*, *Peronospora*, *Pseudoperonospora* and *Rhizopus* (Jack fruit rot)
6. Study of symptoms, fungal characters and host parasite relationships of *Taphrina* (leaf curl), *Protomyces* (stem gall), *Capnodium* (sooty mould), *venturia* (scab) and *Mycosphaerella* (leaf spot)
7. Study of symptoms, fungal characters and host parasite relationships of *Erysiphe*, *Podosphaeria*, *Sphaerthea*, *Leveillula* (powdery mildew), *Puccinia*, *Uromyces*, *hemileia*
8. (Rust) and *Ganoderma* (basal stem rot)
9. Study of symptoms, fungal characters and host parasite relationships of
10. *Helminthosporium*, *Cercospora* (leaf spot), *Alternaria* ((leaf blight), *Colletotrichum*
11. (Anthracnose) and *Gloeosporium* (fruit rot)
12. Symptoms of bacterial diseases – leaf spot, blight, canker, scab, crown gall, wilt and soft rot.
13. Symptoms and vectors of viral diseases – chlorosis, mosaic, vein clearing, vein banding, leaf crinkle and leaf curl, enation, necrosis, dwarfing, rosette, bunchy top and bract mosaic.
14. Symptoms of phytoplasma (little leaf and phyllody) algal diseases – *Cephaleuros*. and phanerogamic parasites
15. Study of various groups of fungicides.
16. Preparation of Bordeaux mixture and Bordeaux paste.
17. Methods of application of fungicides – seed treatment, dry, wet – foliar spraying and soil drenching, Root feeding, corm injection, and capsule application, Acid delinting, pairing and prolinage and post harvest treatment.
18. Cross protection – demonstration of production of immunized seedling against citrus tristeza.
19. Biocontrol agents – mass production of *Trichoderma viride* and *Pseudomonas fluorescens*.
20. Preparation of leaf extracts, oil emulsion of neem and other botanicals and antiviral principles.
21. Survey and assessment of foliar crop diseases, post harvest diseases, soil borne and viral diseases

#### **TEXT BOOKS**

1. Agrios, G.N. Plant Pathology, 2008 5<sup>th</sup> Edition Academic Press, New York
2. Alexopolus, C. J. and Mims, 2010. Introductory Mycology, Willey Eastern Ltd., New Delhi
3. Chattopadhyay, S.G. 1998. Principles and procedure of plant protection – Oxford and IBH publication, New Delhi.
4. Maramorach, K. 1998. Plant diseases of viral, viroid, Mycoplasma and uncertain etiology, Oxford and IBM publications, New Delhi
5. Mehrotra, R.S. 1990. An introduction to mycology, Willey Eastern Ltd., New Delhi.

#### **REFERENCE BOOKS**

1. Narayanasamy, P 1997. Plant Pathogens and detection and disease diagnosis, CRC Publication, USA.
2. Nene, Y.L. and Thapliyal, P. N. 1998. Fungicides in plant disease control. Oxford and IBH Publishing Co. Ltd., New Delhi.
3. Prakasam, V., T. Raguchander, and K. Prabakar, 1998. Plant Disease Management, A.E. Publication, Coimbatore.
4. Vidyasekaran, P. 1993. Principles of Plant Pathology, CBS Publishers and Distributors, New Delhi.

<b>HOR17R257</b>	<b>LIVESTOCK AND POULTRY: PRODUCTION AND MANAGEMENT</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Prelusion – Significance of livestock and poultry in Indian economy – Livestock and poultry census – Different livestock development programmes of Government of India - Various systems of livestock production-extensive – semi intensive - intensive-mixed-Integrated and specialized farms.

### **UNIT II**

White and black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - cross breeding- upgrading - economic traits of cattle - Estrus Cycle – artificial insemination – Introduction to embryo transfer – Housing – space requirement calf and adult stock – System and types of housing - Feeding and management of calf, heifer, pregnant, milch animal and working animals – Nutrition – ration – Balanced Ration - Characteristics of ration and classification of feed and fodder – Composition of concentrate mixture for different stages - Milking methods - Clean milk production - Factors affecting milk composition – Diseases of cattle – classification – Symptoms - preventing and control measures.

### **UNIT III**

Breeds - sheep and goat classification — economic traits - system of rearing - Housing management – floor space requirement - care and management of young and adult stock – Nutrition – feed and fodders of small ruminants – flushing - common diseases – prevention and control.

### **UNIT IV**

Classification of breeds – Economic traits - housing - nutrition – creep feeding - care and management of adult and young stock - common disease- prevention and control.

### **UNIT V**

Classification of breeds - commercial strains of broilers and layers – housing – brooding – deep litter and cage system – care and management of broilers and layers - nutrition of chick, grower, layer and broiler – Incubation and Hatching of eggs - common diseases - control and prevention.

### **Practical schedule**

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, dehorning, castration and dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock
7. Determination of specific gravity, fat percentage and total solids of milk.
8. Common adulterants and preservatives of milk
9. Demonstration of cream separation, butter, ice cream and ghee making
10. Identification of feeds and fodder
11. Economics dairy, goat and swine farming
12. Study of external parts of fowl. Preparation of brooder house
13. Identification of layer and non layer



14. Debeaking, delousing and deworming of poultry-vaccination schedule for broiler and layer
15. Demonstration of dressing of broiler chicken. economics of broiler and layer farming
16. Visit to a modern dairy plant and commercial layer and broiler farms
17. Demonstration of incubator and setter.

### **TEXT BOOKS**

1. Banerjee, G.C. 2010. The Text Book of Animal Husbandry. Oxford Book Company, Calcutta.
2. Dairy India Year Book 2007. A-25, Priyadarshini Vihar, Delhi
3. Gopalakrishnan, C.A., and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publications Private Limited, GHAZIABAD, Uttar Pradesh.
4. ICAR, 2007. A Hand Book of Animal Husbandry
5. Jull, M.A. (2003) Successful Poultry Management
6. Kadirvel, R., and Balakrishnan, V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary College, TANUVAS. Chennai.

### **REFERENCE BOOKS**

1. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai
2. Radostitis, O.M. Gray, C.C., Blood, D.C. and Hinchcliff, K.W. (2000). A text book of the diseases of Cattle, Sheep, Pigs, Goats and Horses. IX edition, Book Power-WB Saunders, London.
3. Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 1982. Farm Animal Management and Poultry Production. Vikas Publishing House Private Limited, Ghaziabad, UP
4. Sastry, N.S.R., Thomas, C.K. 2005. Livestock Production Management. Kalyani Publishers, Ludhiana

<b>HOR17R258</b>	<b>FARM MACHINERY AND POWER</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

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

### **UNIT II**

Tractors-types, selection of tractors and cost of tractor power - Tractor and implement selection for different agricultural operations

### **UNIT III**

Fuels – types and properties-higher and lower heating values, their determination -properties of gas mixtures, ideal and real gases – Gibb’s function, Classification-engine components-Four stroke cycle- principle-valve timing diagram-P-V diagram- two stroke cycle- principle-valve timing diagram.

### **UNIT IV**

Tillage implements- primary and secondary tillage implements - Sowing methods - seed drills, seed cum fertilizer drills - implements for intercultural operations Wet land equipment - Paddy transplanters - field and nursery requirements

### **UNIT V**

Plant protection equipment - 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 schedule**

1. Study of working of two and four stroke petrol IC engine
2. Study of MB plough and disc plough, measurement of plough size, different parts, horizontal and vertical suction,
3. Study of disc harrows, bund former, leveller and rotavator
4. Study of seed-cum-fertiliser drills- furrow opener, metering mechanism and calibration
5. Study of tractors – their operation and maintenance
6. Learning to drive tractor
7. Learning to operate tractor with mounted implement
8. Study of power tillers - their operation and maintenance
9. Study of different inter-cultivation equipments in terms of efficiency, field capacity
10. Study of plant protection equipments – power sprayers, knapsack sprayers, dusters – minor repairs and adjustment of sprayers
11. Study of paddy transplanters – allied machinery for raising mat nursery
12. Study of paddy reaper and paddy combine – registration and alignment of cutter bars
13. Study of sugarcane, turmeric and groundnut harvesters.
14. Tools for horticultural crops – propagation tools, planters and harveting tools and machinery
15. Study of land development and soil conservation machinery - dozers, levelers, chisel plough, blade harrow, bund former and trenchers
16. Problems on field capacity and cost of operation of farm machinery

**TEXT BOOKS**

1. Jagadishwar Sahay, 1992. Elements of agricultural engineering. Agro book agency, Patna–20.
2. Michael and T.P.Ojha, 1996. Principles of agricultural engineering. Jain brothers, New Delhi.

**REFERENCE BOOKS**

1. Nakra C.P 1970. Farm Machinery and equipment,; Dhanpat Rai & Son
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., NewDelhi.

<b>HOR17R259</b>	<b>COMMERCIAL MICROBIOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Introduction to industrial processes for microbial products - Development and range of fermentation processes – component parts of a process; commercially important fermentations – organisms – strain improvement, process, applications; Microbial biomass production – Baker’s yeast; SCP.

### **UNIT II**

Alcohol fermentations – Microbial production processes for beer, wine, ethanol; Production of organic acid - citric acid, acetic acid, lactic acid.

### **UNIT III**

Commercial microbial enzymes – amylase, protease, cellulase - production processes and their application; Immobilization techniques; Amino acid - glutamic acid, lysine; Vitamins – B2 and B12.

### **UNIT IV**

Antibiotics- penicillin, streptomycin; Microbial production of solvents; microbial fuels – methane, hydrogen, ethanol and algal biodiesel; Biopolymers: bioplastics, xanthan and dextran; microbial pigments.

### **UNIT V**

Microbiological production of fermented foods – bread; traditional fermented food products; Fermented dairy products - cheese, yogurt, kefir and other fermented foods - sauerkraut, pickles, green olives and sausages, tea; probiotics; Good manufacturing practices – containment of contaminants in industries – standard tests for assessment of microbial quality.

### **Practical schedule**

1. Isolation of industrially important microbes – yeast/ actinomycetes.
2. Fermentor – components and functions.
3. Primary metabolite: Alcohol fermentation.
4. Solid state fermentation – cellulose.
5. Production and assay of amylase.
6. Secondary metabolite: Antibiotic production by *Streptomyces*.
7. Extraction and down streaming.
8. Microbial production of GA3.
9. Microbial production of food colourants.
10. Production of Single Cell Protein.
11. Dairy fermentation: Cheese making.
12. Cereal fermentation: Bread making.
13. Soy sauce fermentation.
14. Probiotics: yogurt preparation.
15. Detection of food-borne pathogens (*Salmonella*, *E.coli*).
16. Industrial visit.

### **TEXT BOOKS**

1. Adams, M. R. 2008. Food Microbiology (3rd edition), Panima Publishing Corporation, New Delhi
2. Casida, L.E. 2006. Industrial Microbiology, New Age International Publishers, New Delhi.
3. Cruger, W and A. Cruger. 2004. Biotechnology-A Textbook of Industrial Microbiology, 2nd Ed. Panima.

### **REFERENCE BOOKS**

1. El-Mansi and Bryce. 2002. Fermentation Microbiology and Biotechnology, S.Chand and Co., New Delhi.
2. Demain, A.L and Davies, J.E. 1999. Manual of Industrial Microbiology and Biotechnology, II<sup>nd</sup> Edition, ASM press, Washington, D.C.
3. Frazier, W.C., Westhoff, D. C. 2003. Food Microbiology, 4<sup>th</sup> Edition. Mc Graw – Hill, Inc, USA.

<b>HOR17R260</b>	<b>FUNDAMENTALS OF FOOD SCIENCE AND NUTRITION</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

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

### **UNIT II**

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

### **UNIT III**

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

### **UNIT IV**

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

### **UNIT IV**

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

### **Practical schedule**

1. Cooking tests for cereals and pulses
2. Determination of energy value of food
3. Estimation of moisture
4. Estimation of protein
5. Estimation of fat
6. Estimation of ascorbic acid
7. Estimation of iron
8. Estimation of crude fibre
9. Processing of jam and jelly
10. Processing of squash and RTS

11. Puffing of pulses
12. Extrusion of cereals and millets
13. Canning of fruits and vegetables
14. Processing of dehydrated fruits and vegetables
15. Identification of common food adulterants
16. Visit to food processing unit and quality control lab

**TEXT BOOKS**

1. Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.
2. Srivastava, R.P., and Sanjeevkumar. S. 2013. Fruit and Vegetable preservation. International Book Distributing Co. Lucknow.
3. Srilakshmi .B. 2015. Nutrition Science. New Age International Pvt. Ltd. New Delhi

<b>HOR17R261</b>	<b>PRODUCTION TECHNOLOGY OF TEMPERATE AND SUB TROPICAL FRUIT CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Subtropical, temperate and humid zones of India and Tamil Nadu – Classification of subtropical and temperate fruits – Area, production, scope and importance, role on national economy of temperate and subtropical fruit crops.

### **UNIT II**

Composition and uses – origin and distribution – species and cultivars, soil and climatic requirements - propagation - main field preparation – spacing, planting density and cropping systems. Planting and 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 hill banana, mandarin, grapefruit, pummelo, grapes and avocado.

### **UNIT III**

Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements - propagation - main field preparation – spacing, planting density and cropping systems. Planting and 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 pine apple, mangosteen, litchi, loquat, rambutan, carambola, durian, passion fruit and rose apple.

### **UNIT IV**

Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements - propagation - main field preparation – spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management

Training and pruning – problems in flowering, pollination and fruit set – planting of pollinizers - use of plant growth regulators – Physiological disorders and remedies - maturity indices and harvest - post harvest handling and storage - production constraints of apple, pear, peach, plum, strawberry, sweet and sour cherry, black and raspberry, currants, apricot, kiwi, persimmon.

### **UNIT V**

Composition and uses – origin and distribution – species and cultivars. Soil and climatic requirements - propagation - main field preparation – spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management

Training and pruning – flowering, pollination and fruit set – planting of pollinizers - use of plant growth regulators – Physiological disorders and remedies - maturity indices and harvest - post harvest handling and storage - production constraints of pistachio nut, macadamia nut, almond, walnut, pecan nut, chest nut and hazel nut.



### **Practical schedule**

1. Hill banana - description, pre treatment of suckers – intercultural operations viz., de suckering and clump management
2. Description of mandarin, pummelo and grape fruit, budding and training practices
3. Visit to sub-tropical fruit zones and identification of sub-tropical varieties
4. Grape varieties, propagation methods and use of growth regulators
5. Training and pruning practices in grapes
6. Identification of physiological disorders and remedies in grapes, mandarin, pummelo and grape fruit
7. Identification and description of varieties of avocado, litchi and passion fruit
8. Study of varieties, propagation, propagation, planting systems and growth regulation in pine apple
9. Description of varieties and propagation methods of mangosteen, loquat and carambola
10. Visit to temperate orchards and identification of temperate fruit varieties
11. Description of apple and pear varieties
12. Study of propagation and growth regulation of apple and pear
13. Description of plum and peach varieties
14. Study of propagation and growth regulation of plum and peach
15. Identification and description of temperate nut crops
16. Study of maturity indices in major sub tropical and temperate fruit crops

### **TEXT BOOKS**

1. Bose, T. K. S. K. Mitra, and D. S. Rathore. 1998. Temperate Fruits - Nayaprakash, Calcutta
2. Bose, T. K. 1996. Fruits of India – Tropical and sub – tropical. Nayaprakash, Calcutta
3. Bose, T.K., S.K. Mitra and D. Sanyal 2001, Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
4. Bose, T.K., S.K.Mitra, A.A. Farooqi and M.K. Sadhu (Eds) 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
5. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
6. Chattopadhyay, T.K., 2001. A Text Book on Pomology (4 volumes) Kalyani Publishers, Ludhiana.

### **REFERENCE BOOKS**

1. T. K. Bose & S. K. Mitra, 1990. Fruits : Tropical and subtropical Nayaprakash, Bidhan Saranai, Calcutta – 700 116, India
2. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
3. Sadhu, M.K. and P.K. Chattopadhyay.2001. Introductory Fruit Crops. Naya Prokash, Calcutta.
4. Singh, S.P. 1995. Commercial Fruits. Kalyani Publishers, Ludhiana

<b>HOR17R262</b>	<b>PRODUCTION TECHNOLOGY OF SPICES AND PLANTATION CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### UNIT I

Scope and Importance – History – Indian and world scenario – Classification – Institutions involved in research and development – Export potential.

Origin and distribution – Area and production – Composition and uses – soil and climate – varieties – propagation – planting – nutrient management – irrigation – weed control – mulching – intercropping – training and pruning practices – role of growth regulators – shade regulation – harvest and yield – GAP- Organic production -post harvest technologies – storage – value added products – methods of extraction of essential oil – oleoresin – precision farming – constraints. **Crops: Black pepper, Cardamom, Turmeric, Ginger, Coriander, Fenugreek and Fennel,**

### UNIT II

Origin and distribution – Area and production – Composition and uses – Soil and climate – varieties – propagation – planting – irrigation - nutrition management - weed control – mulching - mixed cropping, intercropping, multi-tier cropping - cover cropping - training and pruning practices - role of growth regulators- harvest and yield-GAP –Organic production of Tree Spices- post harvest technologies – processing - storage – value added products – organic production – constraints **Crops: Clove, Nutmeg, Cinnamon and Tamarind**

### UNIT III

Origin and distribution –cultivars- area and production- composition and uses – soil and climate – varieties – propagation– seed and vegetative propagation – planting systems and method – multi-tier cropping systems - gap filling – systems of cultivation – mulching – cover cropping - shade regulation - flowering physiology - – weed and water management – training, pruning and handling – Nutrition management – foliar feeding – role of plant growth regulators – soil management – liming– tipping– top working and other agricultural practices – physiological disorders

– Harvest and yield -GAP-Organic production -post harvest handling, processing – value addition and by-products utilization – packing and marketing and constraints. **Crops: Coffee, Tea, Rubber, Cashew**

### UNIT IV

Origin and distribution – cultivars - composition and uses – soil and climate – varieties – propagation — planting systems and method – Multi tier cropping systems - gap filling – systems of cultivation mulching – weed and water management – Nutrition – harvest and yield- GAP- Organic production - post harvest handling, processing – value addition and by-products utilization – packaging and marketing and constraints. **Crops: Coconut, Arecanut, Oil palm, Cocoa and Palmyrah**

### UNIT V

Origin and distribution - Area and production – Composition and uses – Soil and climate – varieties – seed/vegetative propagation – planting systems and methods – irrigation - nutrition management- harvesting and yield- GAP-Organic production - post harvest technologies – processing – value addition - storage **Crops: Cumin, Ajowan, All Spice, Kokum, Paprika, Vanilla, Curry leaf, Thyme, Celery, Parsley, Betel vine**

## **Practical schedule**

1. Identification of major spices and plantation crops varieties.
2. Rapid multiplication technique and nursery management in black pepper.
3. Seed spices – main field preparation – manuring - use of herbicides- seed treatment – sowing and irrigation.
4. Turmeric and Ginger - main field preparation – rhizome selection - treatment and planting - nutrient, water and weed management – use of PGR - maturity indices, harvesting and curing.
5. Tamarind, Curry leaf - practices in propagation - nursery preparation and maintenance - planting - nutrient, water and weed management – use of PGR - maturity indices and harvest .
6. Tree spices – Practices in propagation – cropping – harvest. Visit to Spices Gardens
7. Coffee – study of varieties - nursery management- training and pruning – intercropping – harvesting and processing in coffee. Visit to Coffee board, Thandikudi.
8. Coconut and Arecanut - mother palm and seed nut selection - preparation of nursery - sowing of seed nuts and nursery management.
9. Coconut – practice in manuring- study of nutritional disorders and correction - root feeding of coconut tonic and implements used for harvesting.
10. Harvesting, curing and cleaning of seed spices. Working out cost economics of spice crops.
11. Cashew - raising nursery and practicing grafting techniques
12. Visit to cashew, cocoa farmers field and cashew processing unit
13. Visit to spices processing, essential oil and oleoresin extraction units
14. Extraction of essential oil and oleoresin in spices
15. Visit to spices board and e- auction center for cardamom.
16. Working out cost economics of major spice crops

## **TEXT BOOKS**

1. Jitendra Singh. 2008. Spices and Plantation Crops. Aavishkar Publishers, Distributors, Jaipur.
2. Nybe, E.V., N. Miniraj and K.V. Peter. 2007. Spices – Horticulture Science Series Vol. 5. New India Publishing Agency, New Delhi.
3. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. Ed. by K.V. Peter, New India Publishing Agency, New Delhi.
4. Parthasarathy, V.A., P.K.Chattopadhyay and T.K. Bose 2006.Plantation Crops. Vol I and II. Parthasankar basu Naya Udyog, Kolkata.
5. Ravindran, P.N., K.N. Shiva, Johny. A. Kallapurackal and K. Nirmalbabu. 2006. Advances in Spices Research. Agrobios, India.

## **REFERENCE BOOKS**

1. Shanmugavelu, K.G., N. Kumar and K.V. Peter 2005. Production Technology of Spices and Plantation Crops. Agrobios (India), Jodhpur.
2. Tiwari, R.S and Ankur Agarwal 2004. Production technology of spices. International book distributing Co., Lucknow.
3. Chadha, K. L. (ed.) 2001. Handbook of Horticulture. ICAR Publication, New Delhi
4. Pruthi, J.S, 2001.Minor Spices and Condiments. Crop management and Postharvest technology. ICAR publication, New Delhi.
5. Sanjeev Agarwal, E.V. Divakara Sastry and R.K. Sahrama. 2001. Seed Spices: Production, quality and export. Pointer Publishers, Jaipur.

<b>HOR17R263</b>	<b>INTRODUCTION TO AGRICULTURAL BIO TECHNOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

History and concepts, Nutritional requirements, morphogenesis-organogenesis and embryogenesis, tissue culture techniques-callus and suspension cultures, shoot tip and meristem tip culture, anther and pollen culture, ovule and embryo culture, endosperm culture and protoplast culture.

### **UNIT II**

Structure of nucleic acids-an overview, central dogma of life - DNA replication, transcription and translation, fine structure of a gene, regulation of gene expression, polymerase chain reaction, blotting techniques, DNA sequencing methods.

### **UNIT III**

Recombinant DNA, vectors: plasmids, phagemids, cosmids, BAC and YAC, DNA manipulation enzymes - polymerase, restriction endonucleases and ligases - construction of recombinant DNA molecules - bacterial transformation.

### **UNIT IV**

Design of plant transformation vectors-selectable markers, reporter genes, promoters. Methods of gene transfer-direct: microinjection, electroporation, particle bombardment, indirect: *Agrobacterium* mediated gene transfer.

### **UNIT V**

Antigens, antibodies and their structure, antigen-antibody interaction, monoclonal and polyclonal antibodies.

### **Practical schedule**

1. Laboratory organization and sterilization techniques
2. Preparation of MS medium
3. Inoculation of explant -shoot tip
4. Embryo culture
5. Preparation of reagents for plasmid and DNA isolation
6. Isolation of plasmid DNA from bacteria
7. Extraction of genomic DNA from leaf tissue
8. Quantification of DNA by spectrophotometer
9. Genomic DNA visualization using agarose gel electrophoresis
10. Restriction digestion and ligation
11. Competent cell preparation
12. Bacterial transformation and blue white colony screening
13. Demonstration of *Agrobacterium* mediated transformation method
14. Amplification of DNA using thermocycler
15. Analysis of PCR products in agarose gel electrophoresis
16. Ouchterlony double immunodiffusion

### **TEXT BOOKS**

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
4. Singh, B.D. 2004. Frontier areas in Biotechnology. Kalyani Publications, New Delhi.

#### **REFERENCE BOOKS**

1. Chawla, H.S. 2005. Introduction to plant biotechnooogy, India.
2. Lehninger. 2004. Principles of Biochemistry. CBS Publications, New Delhi.
3. Brown, T.A. 2006. Gene cloning - An introduction. V Ed. Chapman Hill, U.K.

<b>HOR17R264</b>	<b>COMMERCIAL HORTICULTURAL SEED PRODUCTION</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Seed production – importance – seed and crop production – variety and hybrid seed production - factors influencing seed production. - seed production planning

### **UNIT II**

Seed production in tomato, brinjal and chilli (solanaceae) - bhendi – malvaceae) and cowpea, lablab and cluster bean (fabaceae) – ash gourd, bitter gourd, ribbed gourd, snake gourd and bottle gourd (cucurbitaceae) - onion (alliaceae), amaranthus (amaranthaceae) moringa (oleiferae) and yam (amaryllidaceae)

### **UNIT III**

Seed production in cabbage, cauliflower (cruciferae) - carrot (umbelliferae) and beetroot (chenopodiaceae) - peas and french beans (fabaceae) - potato (solanaceae)

### **UNIT IV**

Seed production - flower crops – marigold, petunia and cock’s comb – medicinal plants -ashwagandha, periwinkle, senna and phyllanthus -Seed production - coriander and fenugreek

### **UNIT V**

Seed handling in plantation crops-cocoa, cashew, coffee and coconut –fruit crops-aonla and jamun, difference between Orthodox and recalcitrant seeds

### **Practical schedule**

1. Planning seed production
2. Identification of off types in vegetables seed production plot
3. Practising emasculation and dusting techniques (tomato/ brinjal /okra)
4. Practising different seed extraction methods
5. Study on pre germinated seed and ethrel spray in cucurbits
6. Visit to vegetable seed industry
7. Practising dormancy breaking treatments
8. Visit to seed production plots of temperate vegetables (ICHS, Ooty)
9. Practicing seed grading techniques
10. Study on seed production standards for vegetative propagules
11. Visit to seed potato production plots
12. Germination enhancement techniques in tropical and temperate vegetables
13. Germination enhancement techniques in flower and medicinal crops
14. Practising pre storage seed treatment and packing materials
15. Study on seed storage structures and maintenance
16. Study on recalcitrant seed storage

### **TEXT BOOKS**

1. P.S.Arya. 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.
2. S.P.Singh. 1999. Seed production of commercial vegetables. Kalyani Publishers. New Delhi.
3. Raymond A.T. George. 1985. Vegetable seed production. Longman and Londen, New York.

## **REFERENCE BOOKS**

1. K.Vanangamudi *et al.*, 2006. Advances in Seed Science and Technology. Vol. 2. Quality seed production in vegetables. Agrobios (India), Jodhpur. [Agrobiosindia.com](http://Agrobiosindia.com)
2. R.Umarani, R.Jerlin, N.Natarajan, P.Masilamani and A.S.Ponnuswamy (2006) Experimental Seed Science and Technology, Agrobios, Jodhpur.
3. T.S.Verma and S.C.Sharma (2000) Producing Seeds of Biennial Vegetables in Temperate Regions. ICAR, New Delhi.
4. P.S.Arya. 1999. Vegetable seed production in hills. M.D. Publication Pvt. Ltd

<b>HOR17R265</b>	<b>ENTREPRENEURSHIP DEVELOPMENT IN HORTICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>

### **UNIT I**

Market and marketing: definitions, components and dimensions of a market. Agricultural/horticultural Marketing: Concepts and definitions, scope and subject matter. Classification of markets. Role of market functionaries - market forces and price determination. Marketing of agricultural/horticultural vs manufactured goods. Producer surplus of agricultural/horticultural commodities: Definition, producer surplus. Marketable and marketed surplus: Definition, importance and factors affecting marketable surplus.

### **UNIT II**

Marketing functions: buying and selling- packaging and transportation –grading and standardization--storage and warehousing -- processing and value addition. Market structure--conduct--performance paradigm (SCP) – market structure meaning, components, dynamics of conduct and performance.

### **UNIT III**

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. Concepts of supply chain management and value enhancement. Marketing of agricultural/horticultural inputs. Role and objectives of marketing institutions: State and central-objectives -Cooperatives, commodity groups, state trading, warehousing, FCI, PDS, - quality control, AGMARK.

### **UNIT IV**

Theories of trade: absolute and comparative advantage - Status of agricultural/horticultural exports / imports from India and their share. Barriers to trade – tariff and non-tariff measures. Role of institutions like UNCTAD and WTO in promoting trade in agricultural/horticultural products. Free trade agreements - implications of AoA-market access, domestic support and export subsidies. New EXIM policy of India – advantages of AEZs. – export promotion organization: APEDA, MPEDA, NHB, commodity boards .

### **UNIT V**

Price characteristics of agricultural/horticultural products. Objectives of price policy – Role of CACP – concept of MSP, FRP (SMP) and SAP. Risk in marketing - meaning and importance-types of risk- speculation and hedging - futures trading – Role of contract farming in risk mitigation.

### **REFERENCE BOOKS**

1. Acharya S.S. and N.L.Agarwal, 2002. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Acharya S.S. and N.L.Agarwal,1994 Agricultural Prices -analysis and policy, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.



3. Kahlon A.S. and S.D.Tyagi, 2000. Agricultural Price Policy in India -Allied Publishers Pvt. Ltd., Bombay.
4. Sak Onkvisit. John J.Shaw.1999 International Marketing Analysis and Strategy, Prentice Hall of India, New Delhi.

<b>HOR17R266</b>	<b>HORTI BUSINESS MANAGEMENT</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Agribusiness – definition – structure of agribusiness (input, farm and product sectors), Agribusiness management - special features of agribusiness - importance of agribusiness in Indian economy.

### **UNIT II**

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, MNCs

### **UNIT III**

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 IV**

Staffing – concept – human resource planning – process, Directing – concept – principles – techniques, supervision, Motivation – concept - Maslow’s “Need Hierarchy Theory – types – techniques, Communication – definition and process – models – types – barriers, Leadership – definition – styles – difference between leadership and management

### **UNIT V**

Controlling – concept - steps – types – importance – process, Project- definition- project cycle- identification- sources of projects, Formulation- issues and budgeting the project, appraisal

### **Practical schedule**

1. Exercise on operations management in agribusiness firms
2. Logistics management
3. Inventory management - inventory types, costs and economic order quantity
4. Procurement systems and vendor rating methods
5. ABC analysis
6. Exercise on supply chain management
7. Market research and segmentation
8. Demand forecasting methods
9. Visit to agri hi-tech bank branch / commercial banks/RRB/ NABARD
10. Exercises on human resource planning and management
11. Farmers survey – buying behaviour of agricultural inputs
12. Market promotion measures
13. Pricing methods
14. Assessing and acquiring finance for agribusiness firms
15. Procedure and constraints in establishing agro based industries
16. New agribusiness venture proposal preparation

### **TEXT BOOKS**

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

### **REFERENCE BOOKS**

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

<b>MAT17R440</b>	<b>PRINCIPLES OF AGRICULTURAL STATISTICS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode – properties – Measures of dispersion: range, standard deviation, variance and coefficient of variation – properties. Computation of the above measures for raw data.

### **UNIT II**

Distributions – theoretical distribution – binomial, poisson and normal distributions – definitions and properties, Sampling theory – population – sample – parameter and statistic – sampling vs complete enumeration – deliberate sampling – simple random sampling – selection using random numbers.

### **UNIT III**

Tests of significance – large sample test – single mean and difference between two means – single proportion and difference between two proportions. Small sample tests – t-test for testing the significance of single mean – independent t-test (equal variances only) and paired t test – chi square test for testing the association of a 2 x 2 contingency table.

### **UNIT IV**

Correlation – Karl Pearson’s correlation coefficient – computation – properties of correlation coefficient, Regression – simple linear regression – fitting of simple linear regression equation of y on x – properties of regression coefficient.

### **UNIT V**

Analysis of variance (ANOVA) – assumptions – one way ANOVA – two way ANOVA, Experimental designs – randomization, replication and local control – completely randomised design (CRD) (for equal replications) – randomised block design (RBD) – Latin square design (LSD).

### **Practical schedule**

1. Computation of arithmetic mean, geometric mean, harmonic mean, median and mode for raw data
2. Computation of range, standard deviation, variance, coefficient of variance for raw data – calculation of the above measures using MS Excel functions
3. Simple problems in Binomial distribution and Poisson distribution
4. Simple problems in Normal distribution
5. Selection of sample using simple random sampling method
6. Large sample test – test for single proportion and difference between two proportions
7. Large sample test – test for single mean and difference between two means.
8. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only)
9. Paired t-test
10. Chi square test for testing the association of a 2 x 2 contingency table
11. Computation of Karl Pearson’s correlation coefficient
12. Fitting of simple linear regression equation y on x – correlation and regression using MS Excel functions
13. Analysis of Completely Randomised Design (CRD) – for equal replications only
14. Analysis of Randomised Block Design (RBD)

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

### **TEXT BOOKS**

1. G. Nageshwara Rao, 2007, Statistics for Agricultural Sciences, BS Publications, Andhra Pradesh.
2. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi.

### **REFERENCE BOOKS**

1. S.C. Gupta & V.K. Kapoor, Fundamentals of Applied Statistics, 2006, Sultan Chand & Sons, New Delhi.
2. Chandel, S.R.S., 1999, a hand book of Agricultural Statistics, Achal Prakashan Mandhir, Kanpur.
3. Gomez, K.A. and Gomez, A.A., 1984, Statistical Procedures for Agricultural Research, John Wiley and Sons, New York.
4. Sahu P.K, 2009, Agriculture and Applied Statistics-I and II, Kalyani Publishers, Ludhiana.
5. K.P. Dhamu and K. Ramamoorthy, 2007, Statistical Methods, Agrobios (India), Jodhpur.

<b>HOR17R267</b>	<b>SOIL AND WATER CONSERVATION ENGINEERING</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Surveying and levelling – chain, compass and plane table survey – levelling – land measurement and computation of area – Simpson’s rule and Trapezoidal rule.

### **UNIT II**

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

### **UNIT III**

Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping – cropping systems – vegetative barriers - windbreaks and shelterbelts - shifting cultivation - mechanical measures – contour bund – graded bund – Broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – gully control structures – permanent and temporary structures. Farm ponds – percolation ponds-watershed management.

### **UNIT IV**

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

### **UNIT V**

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

### **Practical schedule**

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

15. Problems on duty of water, irrigation efficiencies.

**TEXT BOOK**

1. Michael, A.M. and Ojha, T.P. 2006. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.

**REFERENCE BOOKS**

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

<b>HOR17R268</b>	<b>AGRO FORESTRY &amp; SOCIAL MANAGEMENT</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Indian forest – forestry — role of forests – classification of forests -silvics – silviculture locality factors – regeneration of forests – natural and artificial regeneration

### **UNIT II**

Site selection - choice of species - modern silvicultural techniques in site preparation – planting and tending operations – mechanization in silviculture - silvicultural packages for timber species (teak, sal, sandal wood and rosewood), pulpwood species (eucalyptus, casuarina, bamboo), Fuel wood species (acacias, prosopis), match wood species (ailanthus, melia), tree borne oilseeds (neem, pungam, bassia), fodder trees (subabul, white babul). .

### **UNIT III**

Forest utilization – wood and non-wood forest products – solid wood- timber-wood composites- plywood, fibre board and particle boards – non wood forest products

### **UNIT IV**

Social forestry concepts and applications –JFM concepts - agroforestry-agroforestry classification -agroforestry systems for different agro climatic zones of Tamil Nadu – distinction between social forestry and agroforestry

### **UNIT V**

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

### **Practical schedule**

1. Nursery layout and other nursery techniques.
2. Nursery technology for teak and sandal,dalbergia,neem
3. Nursery technology for rose wood
4. Nursery technology for eucalyptus
5. Nursery technology for casuarina.
6. Nursery technology for bamboo and acacia
7. Nursery technology for TBO's.
8. Visit to a forest nursery to study the nursery techniques
9. Visit to a agro forestry model unit.
10. Clonal propagation techniques for forest trees.
11. Practicing tree planting techniques.
12. Practicing tending and cultural operations in forest plantations.
13. Visit to pulp and paper manufacturing industry
14. Study of plywood production technology – visit to plywood industry.
15. Study of match manufacturing process – visit to matchwood industry.
16. Visit to a NWFP value addition unit

### **TEXT BOOKS**

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



## **REFERENCE BOOKS**

1. Heygreen, G. and J.L.Bowyer. 1982. Forest products and wood science. The Ohio State University Press, Ames.
2. Lal, J.B. 1992. India's forest – Myth and reality. Natraj Publishers, Dehra Dun.**Journals**
3. Indian Journal of Forestry
4. Indian Journal of Agroforestry

<b>HOR17R281</b>	<b>PRACTICAL CROP PRODUCTION - VEGETABLES</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>2</b>	<b>2</b>

1. Practice in raising nursery for transplanted vegetables.
2. Seed treatment, sowing and after care.
3. Practicing application of FYM and main field preparation.
4. Formation of beds, ridges and furrows.
5. Application of basal dressing of fertilizers.
6. Practising transplanting of vegetables.
7. Practising herbicide application.
8. Practising scheduling of irrigation.
9. Practising gap filling operation.
10. Practising top dressing and earthing up operation.
11. Practising PGR preparation and application.
12. Practising pesticide, fungicide application and other inter cultural operations.
13. Practising harvest and assessing maturity index
14. Practising seed extraction, processing, cleaning, grading, packaging and marketing.
15. Practising grading, packaging and marketing
16. Cost economics of production

#### **REFERENCE BOOKS**

1. Azhar Ali Farooqi, B.S. Sreeramu, K.N. Srinivasappa - 2005 Cultivation of spice crops. Universities press India Pvt., Ltd., Hyderabad.
2. Battacharjee, S.K., & L.C. De, 2003. Advanced commercial floriculture (Vol. I&II), Aavishkar publishers and distributors, Jaipur.
3. Arun. K. Sharma. 2002. A Hand book of Organic Farming. Agrobios (India)
4. Bose, T.K., J.Kabir and V.A. Parthasarathy. 2002. Vegetable crops (Vol.I,II&III). Naya Prokash, Kolkatta.
5. Bailey, L. H 1999. Principles of Vegetable cultivation. Discovery Publishing House, New Delhi.
6. Bose, T.K., LP. Yadav, P. Pal, P. Das. V.A. Parthasarathy. 2002. Commercial flowers (Vol. I&II), Naya Prokash, Kolkatta.
7. Lourie, A., V.H. Ries, 2004. Floriculture fundamental and practices, Agro bios (India) Jodhpur.
8. Hazra, P. and M. G., Som. 1999. Technology for vegetable production and improvement, Naya Prakash, Kolkatta.
9. Nem Pal Singh, A.K. Bharadwaj, Abnish Kumar and K.M.Singh.2004. Modern technology on vegetable production. International Book Distributing company, Lucknow.
10. Pal, A.K., A.B. Sarangi and U. Thapa. 2006. Varieties of horticultural Crops. Agro-tech Publishing Academy, New Delhi.
11. Prem Singh Arya. 2002. A text book of vegetable culture, Kalyani Publishers,New Delhi.

<b>HOR17R351</b>	<b>PRECISION AND PROTECTED HI TECH HORTICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house - study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture – growing media and nutrients – canopy management – micro irrigation and fertigation systems.

### **UNIT II**

Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – postharvest handling.

### **UNIT III**

Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliage and fillers – integrated pest and disease management – postharvest handling.

### **UNIT IV**

Importance of precision horticulture – definition, principles and concepts – Role of geographic information systems (GIS) – global positioning systems (GPS) - Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation in horticultural crops - role of computers in developing comprehensive systems needed in site specific management (SSM) –georeferencing and photometric correction – Sensors for information gathering – geostatistics – robotics in horticulture - postharvest process management (PPM) – remote sensing - information and data management and crop growth models – GIS based modeling.

### **UNIT V**

Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

### **Practical schedule**

1. Study of different protected structures – designs, components, orientation and construction of greenhouse.
2. Types and structures of auto control system in green house.
3. Study of heating and cooling systems in green house.
4. Study of different media, solarization and fumigation for green house cultivation.
5. Study of special cultural practices for production of vegetable crops under protected cultivation.
6. Study of special cultural practices for flower crops under protected cultivation.

7. Visit to protected culture units.
8. Project preparation of protected cultivation of important horticultural crops.
9. Positioning systems understanding of GPS, positioning accuracy specifications and utilization of GIS software.
10. Study of soil salinity, soil compaction, soil test crop response (STCR) and grid soil sampling.
11. Practicing design and layout of precision farming system
12. Canopy management in precision farming
13. Water use efficiency in annual, perennials and landscape horticulture
14. Visit to commercial computerized irrigation control unit.
15. Project preparation of precision cultivation in important horticultural crops
16. Searching internet resources for precision horticulture

### **REFERENCE BOOKS**

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

### **Further reading**

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

<b>HOR17R352</b>	<b>FLORICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

History- importance and scope – distribution – area and production – export potential – international and national floral industry. Institutions and developmental agencies involved in promotion of floriculture. 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 – intercultivation – 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, alstromeria and flowering fillers viz., limonium, asparagus, ivy, gypsophila and baby eucalyptus.

### **UNIT V**

Postharvest handling – principles and methods of extension of shelf life – methods of extraction of floral concrete from rose, jasmine and tuberose – natural dye extraction from flowers crops - uses - grading - export standards – packaging - marketing - constraints in flower production - future thrust.

### **Practical schedule**

1. Rose–identification and description of species/varieties – propagation and planting – pruning management.
2. Jasmine sp.-identification and description of species/varieties – propagation and planting pruning management.
3. Tuberose and crossandra – identification, description of species/varieties, propagation and planting

4. Chrysanthemum and marigold- identification and description of species/varieties - propagation and planting
5. Nerium and gomphrena - identification, description of species/varieties, nursery raising and planting
6. Celosia and china aster - identification, description of species/varieties, nursery raising and planting
7. Visit – Flower market and flower growing areas – loose flowers.
8. Preparation of project – loose flower production – open condition
9. Cut rose - identification and description of species/varieties – media – planting
10. Carnation and gerbera - identification and description of species/varieties – media – planting
11. Cut chrysanthemum and gladiolus - identification and description of species/varieties – media – planting
12. Anthurium and orchids – identification and description of species/varieties – media preparation - planting
13. Bird of paradise and heliconia - identification and description of species/varieties – propagation - media preparation – planting
14. Asiatic lily, alstromeria, flowering and foliage fillers - identification and description of species/varieties – propagation - media preparation – planting
15. Visit to flower growing areas – Cut flowers
16. Rose, jasmine and tuberose-extraction of floral concrete – lecture / Field visit
17. Preparation of project – Cut flower production – controlled condition

#### **REFERENCE BOOKS**

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.
3. Bhattacharjee, S.K., 2004 – Landscape gardening and design with plants.
4. Bhattacharjee, S.K., 2004 – Post harvest technology of flowers and ornamental plants.
5. Bose, T. K. and P. Yadav. 1989. Commercial flowers. Naya Prakash, Calcutta.

<b>HOR17R353</b>	<b>PRODUCTION TECHNOLOGY OF MEDICINAL AND AROMATIC CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Importance and scope - medicinal plant wealth of India and states - area and production - exports and imports - Demand of medicinal plants in phytochemicals and AYUSH - Conservation strategies, exsitu and insitu - Classification of medicinal plants based on family, habit, climate, soil and ecological factors- Organized production- GAP, GMP guidelines, contract farming- Institutions for promotion of medicinal plants- Constraints and challenges in production.

### **UNIT II**

Soil and climate - varieties – propagation – nursery practices - planting methods - nutrient management- irrigation- intercropping - harvest Crops: senna, periwinkle, glory lily, ashwagandha, medicinal coleus, aloe, long pepper, *Phyllanthus amarus* and stevia.

### **UNIT III**

Soil and climate - varieties – propagation - nursery practices - planting methods – nutrient management- irrigation- intercropping - harvest Crops: isabgol, opium poppy, medicinal solanum - medicinal dioscorea, rauwolfia, vasambu, vallarai and noni.

### **UNIT IV**

Importance and scope- aromatic plant wealth of India- area and production - exports and imports of essential oil – Demand of aromatic crops in perfumery and cosmetic industries – International standards for perfumes – Classification of essential oils-Methods of distillation of essential oil – Fractional distillation-Aromatherapy.

### **UNIT V**

Soil and climate - varieties – propagation – nursery practices - planting methods - nutrient management- irrigation- intercropping - harvest Crops: ocimum, davana, mint, lemon grass, citronella, palmarosa, vetiver, geranium, patchouli and rosemary.

### **Practical Schedule**

1. Identification of major medicinal crops – parts used and their products
2. Identification of major aromatic crops- essential oil content
3. Study of varieties, propagation techniques of Senna and Periwinkle
4. Study of varieties, propagation techniques of ashwagandha
5. Study on propagation, pollination, standards in glory lily
6. Study of propagation techniques of medicinal coleus and aloe
7. Study of varieties, propagation techniques of vallarai and vasambu
8. Study of propagation techniques, use of media, growth regulators for rooting of long pepper.
9. Study of seed treatment techniques for enhancing germination of noni
10. Study of species, propagation techniques of Mint and Rosemary
11. Study of species, propagation techniques of ocimum and davana
12. Working out the benefit cost ratio for medicinal Coleus and Glory lily
13. Working out the benefit cost ratio for Ocimum and davana

14. Extraction of medicinal products using Soxhlet apparatus
15. Distillation of essential oil from aromatic crops using Clevenger apparatus
16. Visit to commercial medicinal and aromatic plantation

#### **TEXT BOOKS**

1. Atal. C. K. and B. M. Kapur. 1992. Cultivation and utilisation of medicinal plants RRL. CSIR, Jammu Tawi.
2. Kumar, N. Md. Abdul Khader, JBM, Rangasamy, P. and I. Irulappan. 1998. Introduction to Spices, Plantation crops, Medicinal and Aromatic Plants. Oxford IBH Publishers, New Delhi.



<b>HOR17R354</b>	<b>APPLIED PLANT BIO TECHNOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Micropropagation and successful examples- meristem culture and production of virus free plants - protoplast isolation and fusion - somatic hybrids. Somaclonal variation, synthetic seeds - Doubled haploids - National certification system for TC plants- *in vitro* germplasm conservation

### **UNIT II**

DNA markers -different kinds -hybridization based RFLP -PCR based markers - AFLP, RAPD, SSR and SNPs - DNA fingerprinting of varieties -gene tagging - marker assisted selection and its application in crop improvement.

### **UNIT III**

Transgenic plants for biotic and abiotic stress resistance and quality improvement-current status at national and international level- detection of GMOs - biosafety and bioethics

### **UNIT IV**

Plants as biofactories – production of vaccines, therapeutic proteins, industrial enzymes and bioplastics

### **UNIT V**

Discovery of novel compounds from plants - secondary metabolites – callus and cell suspension culture, bioreactors for plant cell culture.

#### **Practical schedule**

1. Micropropagation of banana
2. Micropropagation of rose
3. Meristem culture of tapioca
4. Virus indexing in banana and tapioca
5. Transformation of tobacco and analysis of transgenic plants - PCR
6. Visit to Bt cotton field and strip assay for detecting Cry protein
7. ELISA for Cry protein expression analysis
8. DNA isolation
9. DNA fingerprinting using RAPD primers
10. NTsys analysis
11. Hybrid identification using SSR marker
12. Callus culture
13. Cell suspension culture
14. Extraction of secondary metabolites
15. Antimicrobial assay using food poisoning technique
16. Visit to commercial tissue culture lab / biotech lab/GC-MS, HPLC lab
17. Practical Examination

#### **TEXT BOOKS**

1. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice.

Elsevier Publication.

2. Gupta, P.K. 2005. Molecular Biology and genetic engineering. Rastogi Publication, India.
3. Singh, B.D. 2004. Frontier areas in Biotechnology. Kalyani Publications, New Delhi.

<b>HOR17R355</b>	<b>PEST MANAGEMENT IN HORTICULTURAL CROPS- I</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

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**

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

### **UNIT III**

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Crucifers, Cucurbits, Moringa, Amaranthus, Potato, Sweet potato and Tapioca

### **UNIT IV**

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Guava, Sapota, Citrus, Banana, Grapevine, Jack and Jamun

### **UNIT V**

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Aonla, Pomegranate, Papaya, Ber, Apple, Pear, Peach and Plum

### **Practical schedule**

#### **Identification of symptoms of damage and life stages of important**

1. Pests of Brinjal and bhendi
2. Pests of Tomato and chillies,
3. Pests of Amaranthus and moringa,
3. Pests of Coriander
4. Pests of Mango and citrus
5. Pests of Sapota and papaya
6. Pests of Pomegranate and amla
7. Pests of Potato
8. Pests of Crucifers and cucurbits
9. Pests of Ber and apple
10. Pests of Banana and grapevine
11. Pests of Guava and jamun
12. Pests of Sweet potato and tapioca
13. Pests of Peach and plum

14. Pests of Pear
15. Pests of Citrus
16. Pests of Jack

**TEXT BOOKS**

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. Srivastava, K.P. and D.K. Butani, 1998. Pest Management in Vegetables (Part I & II) Research Periodicals and Book Publishing House, India.

<b>HOR17R356</b>	<b>ECONOMICS AND FARM MANAGEMENT</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Production economics: Meaning - definition – nature and scope – Farm Management : Definition - objectives of farm management - production economics vs farm management – farm management decisions - decision making process - scope of farm management. Types and systems of farming: types - specialized and diversified mixed systems of farming – peasant farming – state farming – capitalistic – collective co- operative farming.

### **UNIT II**

Factor - product relationship: Meaning Agricultural/horticultural production function: Meaning – definition- Laws of returns: increasing, constant and decreasing returns- Classical production function and three stages of production – Elasticity of production – Types/forms of production functions- Linear, Cobb-Douglas and Quadratic – Cost concepts and cost curves: total, average and marginal cost – Economics of scale - determination of optimum input and output - physical and economic optimum.

### **UNIT III**

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

### **UNIT IV**

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

### **UNIT V**

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

### **Practical schedule**

1. Estimation of Optimum input – output combination.
2. Determination of least-cost combination
3. Determination of optimum product combination
4. Computation of cost concepts- cost of cultivation and cost of production of aricultural / horticultural crops
5. Cost of cultivation and production of perennial crops/ horticultural crops.
6. Cost of production of livestock products
7. Depreciation: methods of calculating depreciation

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

### **REFERENCE BOOKS**

1. Sankayan, P.L. Introduction to Farm Management, (New Delhi:Tata Mc Graw Hill Publishing Company Ltd) 1983
2. Johl SS & Kapoor TR. (1973). Fundamentals of Farm Business Management.Kalyani Publ.India
3. Kahlon AS & Singh K. (1992). Economics of Farm Management in India. Allied Publ.New Delhi

<b>HOR17R357</b>	<b>BASICS AND METHODS OF PLANT BREEDING</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Introduction to plant breeding - objectives and role - historical perspective centres of origin – germplasm – conservation -plant introduction - reproduction in plants- systems of mating - self incompatibility – sterility- apomixes.

### **UNIT II**

Breeding methods: self pollinated crops- genetic basis – pureline selection – mass selection – hybridization and selection - pedigree breeding – bulk breeding - single seed descent - backcross breeding – multiline.

### **UNIT III**

Breeding methods: cross pollinated crops - genetic structure – Hardy Weinberg law - mass selection – modified mass selection; Heterosis breeding – use of malesterility systems – types of hybrids; recurrent selection - synthetics - composites; asexual breeding system: genetic structure – breeding methods

### **UNIT IV**

In vitro selection techniques; mutation breeding - polyploidy breeding and distant hybridization – Introduction to markers – morphological – biochemical- DNA markers – Use of markers for crop improvement.

### **UNIT V**

Maintenance breeding - procedure for release of new varieties – stages in multiplication – certification – Nucleus and breeder seed production techniques – Current trends in plant breeding

### **Practical schedule**

1. Pollination and reproduction in plants - Alternation of generation and life cycle.
2. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops.
3. Pollen morphology - Exine structure of different crops. Fertility and sterility in A, B, R and TGMS lines.
4. Breeder kit and its components – uses; Principles of selfing and crossing techniques
5. Emasculation, and pollination techniques in horticultural crops.
6. Emasculation, and pollination techniques in horticultural crops.
7. Layout of different yield trials - Observing the experimental plots.
8. Calculation of PCV, GCV, heritability, genetic advance
9. Estimation of heterosis.
10. Maintenance of A, B and R line and TGMS lines. Hybrid seed production techniques
11. Studies on segregating generations and maintenance of records.
12. Irradiation - dosimetry - half life period - procedure for irradiation. Chemical mutagenesis – molar solution preparation - procedure for chemical mutagenesis.
13. Studies on different wild species in crop plants and wide hybridization.

14. Screening methods – laboratory and field – for biotic and abiotic stresses.
15. Observation on germplasm preservation – evaluation - records maintained in research stations
16. Procedure for marker assisted selection

**TEXT BOOKS**

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

<b>HOR17R358</b>	<b>DISEASE MANAGEMENT IN HORTICULTURAL CROPS -I</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Fruit crops- Etiology, symptoms, mode of spread, survival and integrated management important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non -parasitic causes of the following

**Crops- Mango, banana, citrus, grapes, guava and sapota**

### **UNIT II**

- Etiology, symptoms, mode of spread, survival and integrated management important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non - parasitic causes of the following

**Crops- Pomegranate, annona, papaya, jack, pineapple, ber, aonla, apple, pear, peach and plum.**

### **UNIT III**

Vegetable crops-- Etiology, symptoms, mode of spread, survival and integrated management important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non -parasitic causes of the following

**Crops- Brinjal, tomato and bhendi**

### **UNIT IV**

Etiology, symptoms, mode of spread, survival and integrated management important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non - parasitic causes of the following

**Crops-Cucurbits, crucifers, beans, peas and potato**

### **UNIT V**

Etiology, symptoms, mode of spread, survival and integrated management important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non - parasitic causes of the following

**Crops- Sweetpotato, beetroot, radish ,yam , colocasia and cassava.**

### **Practical schedule**

Study of symptoms and host parasite relationship of

1. Diseases of mango and banana.
2. Diseases of citrus and grapes.
3. Diseases of guava and sapota
4. Diseases of pomegranate and annona
5. Diseases of jack and papaya
6. Diseases of pineapple, ber and aonla.
7. Diseases of apple and pear,
8. Diseases of plum and peach.
9. Diseases of tomato and brinjal.
10. Diseases of cucurbits and crucifers.



11. Diseases of beans, peas and potato.
12. Diseases of cassava and sweetpotato.
13. Diseases of yam and colocasia
14. Diseases of onion, garlic and chilli
15. Diseases of pepper and betelvine
16. Field visit

Note: Students should submit 50 well-preserved diseased specimen

### **REFERENCE BOOKS**

1. Arjunan.G. Karthikeyan, G, Dinakaran ,D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
2. Rangaswamy C.2005, Diseases of crop plants in India –. Prentice Hall of India, Pvt. Limited, New Delhi
3. Pathak V.N. 1980. Diseases of Fruit crops –. Oxford and IBH publishing Co.Pvt.Limited
4. Das Gupta M.K. and Mandel W.C.1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Company ,New Delhi.
5. Neeta Sharma and Mashkoor Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Co. UP.
6. Parvatha Reddy P. 2008 Diseases of Horticultural Crops Author ISBN8172335431 Scientific Publishers

<b>HOR17R381</b>	<b>PRACTICAL CROP PRODUCTION: FLOWER CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>1</b>	<b>1</b>

### **Practical schedule**

1. Practising raising nursery for transplanted flower and spice crops
2. Seed treatment, sowing, after care and collection of stubbles
3. Practising application of FYM .
4. Formation of beds, ridges and furrows.
5. Application of basal dressing of fertilizers.
6. Practising transplanting and direct sowing of spice crops .
7. Practising herbicide application.
8. Practising scheduling of irrigation.
9. Practising gap filling operation.
10. Practising top dressing and earthing up operation.
11. Practising PGR preparation and application.
12. Practising pesticide, fungicide application and other inter cultural operations.
13. Practising harvest and assessing maturity index
14. Practising seed extraction, processing, cleaning, grading, packaging and marketing.
15. Practising grading, packaging and marketing.
16. Cost economics of production

### **REFERENCE BOOKS**

1. Battacharjee, S.K., & L.C. De, 2003. Advanced commercial floriculture (Vol. I&II), Aavishkar publishers and distributors, Jaipur.
2. Arun. K. Sharma. 2002. A Hand book of Organic Farming. Agrobios (India)
3. Bose, T.K., LP. Yadav, P. Pal, P. Das. V.A. Parthasarathy. 2002. Commercial flowers (Vol. I&II), Naya Prokash, Kolkatta.
4. Lourie, A., V.H. Ries, 2004. Floriculture fundamental and practices, Agro bios (India) Jodhpur.
5. Pal, A.K., A.B. Sarangi and U. Thapa. 2006. Varieties of horticultural Crops. Agro-tech Publishing Academy, New Delhi.

<b>HOR17R359</b>	<b>FUNDAMENTALS OF EXTENSION EDUCATION</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Extension Education – meaning, definition, scope, objectives, philosophy, principles; Extension Education Process; Differences among formal, informal and non-formal education; Extension education as a science – relationship with other social sciences.

### **UNIT II**

Historical development of extension in India – Famine Commission, Royal Commission, Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon Experiment, Sriniketan, Sevagram, Marthandam project, India Village Service, Firka development scheme, Etawah pilot project, Nilokheri Experiment; Extension in USA – origin, Cooperative Extension Service, organization of extension work, 4-H club; Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Farming System Research Extension (FSRE), Agricultural Technology Management Agency (ATMA); Firstline Extension System – KVK, IVLP, ATIC, Frontline demonstrations.

### **UNIT III**

Rural Development – meaning, definition, concept, importance; Rural Development in India - Democratic Decentralization – Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup – Community Development Programme (CDP), National Extension Service (NES), IADP, IAAP, HYVP, IVLP, WDP, NATP, ITDP, IRDP, SFDA, MFAL, NREP, RLEGP, DPAP, CADP, FFW, JRY, EAS, IAY, SGSY, PMEY, SJSRY, PMGSY, SGRY, MGNREGA, PURA, NAIP, NADP (RKVY) - the strengths and weaknesses of the above programmes.

### **UNIT IV**

Women Development Programmes – DWCRA, RMK, ICDS, MSY, TANWA; Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), ARYA - the strengths and weaknesses of the above programmes.

### **UNIT V**

Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.

### **Practical schedule**

1. Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes
2. Visit to a Panchayat Union Office to learn about its functions.
3. Exposure to the activities of a Grama Panchayat
4. Study of the functions of JDA / ADA and to understand the reorganized extension system, organizational setup, functions, ATMA scheme and other schemes
5. Interaction with a SHG to study its activities.
6. Exposure to an NGO to study their role in rural development activities
7. Study of the extension activities of the State Department of Horticulture

8. Visit to a nearby KVK to study its role and activities.
9. Visit to the Social Welfare Department to study the social welfare and women development programmes
- 10&11. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise)
- 12&13. Visit to a village to collect data (Group exercise).
- 14&15. Preparation of report
16. Presentation of report.

### **TEXT BOOKS**

1. Sagar Mondal and Ray, G.L. 2007. Text book of Rural Development, Kalyani Publishers, New Delhi.
2. Sanjay Prakash Sharma. 2006. Panchayat Raj, Vista International Publishing House, New Delhi.
3. Singh, A.K. 2012. Agricultural Extension, Agrobios, New Delhi.
4. Van den Ban, A.W and H.S. Hawkins. 2002. Agricultural Extension, CBS Publishers & Distributors, New Delhi.
5. Viswanathan Maithili. 1994. Women in Agriculture and Rural Development, Printwell, Jaipur.

<b>HOR17R382</b>	<b>STUDY TOUR</b>	<b>L</b>	<b>P</b>	<b>C</b>
		0	2	2

Visit to places of commercial cultivation of fruits and vegetables in tropical temperate and sub-tropical zones of Tamil Nadu–study of Cropping systems-varieties –constraints in production –marketing –economic analysis –case studies.

### **Practical schedule**

1. Visit to SHF, Srivilliputhur.
2. Visit to SHF, Courtalam for sub-tropical fruits.
3. Visit to HRS, Pechiparai for high rainfall zone crops.
4. Visit to AC&RI, Killikulam for tropical fruits and vegetables.
5. Visit to ARS, Paramakudi and Ramnad for tropical fruits and vegetables.
6. Visit to RRS, Aruppukottai and AC&RI, Madurai for arid zone fruits.
7. Visit to HRS, Kodaikanal and Thadiyankudisai for sub-tropical and temperate fruits and vegetables.
8. Visit to Agricultural Research Station, Aliyarnagar –Coconut and coconut based intercrop systems.
9. Tamil Nadu Agricultural University, Coimbatore campus.
10. Visit to Thudiyalur-arecanut area-Forest Research Station, Mettupalayam –Eence Aromatics.
11. Visit to Ooty, Coonoor and Bhavanisagar.
12. Visit to mango orchards, Regional Research Station, Paiyur
13. Processing unit.
14. Visit to Giant Orchards, Melchengam
15. Visit to Regional Research Station, Vridhachalam –Cashew.
16. Visit to Tamil Nadu Rice Research Institute, Aduthurai.-oilpalm
17. Visit to Sugarcane Research Station, Sirugamani –Betelvine

<b>HOR17R360</b>	<b>CROP IMPROVEMENT IN HORTICULTURAL CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Methods of breeding and achievements in crop improvement of self and cross pollinated and asexually propagated crops

### **UNIT II**

Floral biology, methods of breeding and achievements in crop improvement of fruit crops : mango, banana, acid lime, mandarin orange, sweet orange, grapes, sapota, papaya, aonla, guava, pomegranate and custard apple.

### **UNIT III**

Floral biology, methods of breeding and achievements in crop improvement of vegetable crops : tomato, brinjal, chilli, bhendi, bitter gourd, cucumber, watermelon, bottle gourd, peas, beans, potato, onion, amaranth, moringa, carrot, cabbage and cauliflower.

### **UNIT IV**

Floral biology, methods of breeding and achievements in crop improvement of spice crops: black pepper, cardamom, clove, nutmeg, coriander, garlic, turmeric and ginger and plantation crops : tea, coffee, cocoa ,cashew, coconut, arecanut and palmyrah.

### **UNIT V**

Floral biology, methods of breeding and achievements in crop improvement of flower crops: rose, jasmine, chrysanthemum, marigold, tuberose, crossandra, carnation and tropical orchids, medicinal crops : senna, gloriosa and coleus and aromatic crops: mint and cymbopogon.

### **Practical schedule**

- 1.Study of floral biology and pollination mechanism, practices in selfing and crossing in mango and banana.
- 2.Study of floral biology and pollination mechanism, practices in selfing and crossing in citrus, sapota and pomegranate.
- 3.Study of floral biology and pollination mechanism, practices in selfing and crossing in papaya, guava and aonla.
- 4.Study of floral biology and pollination mechanism, practices in selfing and crossing in tomato and chillies
- 5.Study of floral biology and pollination mechanism, practices in selfing and crossing in brinjal and bhendi
- 6.Study of floral biology and pollination mechanism, practices in selfing and crossing in tapioca and sweet potato

7. Study of floral biology and pollination mechanism, practices in selfing and crossing in peas and beans
8. Study of floral biology and pollination mechanism, practices in selfing and crossing in bitter gourd, watermelon and cucumber.
9. Study of floral biology and pollination mechanism, practices in selfing and crossing in onion, amaranth and annual moringa
10. Study of floral biology and pollination mechanism, practices in selfing and crossing in coriander, coconut and gloriosa.
11. Study of mutagenic treatments and various methods of mutation
12. Study of polyploidy and methods of development of polyploids.
13. Exploitation of heterosis and techniques of F1 hybrid production in self-pollinated crops.
14. Exploitation of heterosis and techniques of F1 hybrid production in cross-pollinated crops.
15. Identification of elite or plus trees in major fruit crops.
16. Variety release, procedures involved and DUS testing.

#### **TEXT BOOKS**

1. Chahal, G. S. and S. S. Gosal. 2002. Principles and procedures of plant breeding. Biotechnological and conventional approaches. CRC Press, U.K.
2. Kalloo, 1990. Vegetable Breeding, Vol. I II and III CRC Press, Florida.
3. Kumar, N. 2006. Breeding of Horticultural Crops Principles and Practices. New India Publishing Agency, Pitam Pura, New Delhi.

<b>HOR17R361</b>	<b>GARDEN AND LANDSCAPE HORTICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Importance and scope of gardening – historical background - gardens in India – definition, principles and concepts of landscape gardening - styles and types of gardens - Hindu, Moghul, English, Italian, Persian and Japanese gardens – bioaesthetic 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, trellies, ornamental vases, ornamental urns and window boxes. Special types of gardens - principles and design – dish, terrarium, water and bog garden, traffic islands - terrace 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) – Geographical Information system (GIS) – 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 – astroturf and management.

### **Practical schedule**

1. Identification and description of annuals shrubs and herbaceous perennials
2. Identification and description of trees, climbers and ground covers
3. Identification and description of cacti, succulents, palms, ferns and ornamental grasses.
4. Description and designing of garden components – arches, bowers, pergolas, paths, walks, bridges, fountains and statues
5. Designing of garden components – edges, hedges, rosary, flower borders.
6. Designing and layout of rockery and terrace garden
7. Designing and layout of water garden and bog garden
8. Designing and practicing bonsai, flower arrangements and bouquet preparation



9. Dry flower technology – practice, preparation of floral crafts and cards
10. Practice of handling software tools in landscape architecture
11. Practice of landscape with CAD (Computer Aided Design)
12. Practicing landscape design and plan – home and industrial garden
13. Project preparation and estimate preparation for landscaping
14. Practicing landscape design for urban and rural locations
15. Lawn and turfs – preparation of land, planting, after care and turf economics
16. Visit to large scale gardens, dam sites, lawns and turf nurseries

### **TEXT BOOKS**

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

### **REFERENCE BOOKS**

1. Randhawa, G.S. and A. Mukhopadyay. 1998. Floriculture in India. Allied publishers Limited,  
New Delhi
2. K.M.P. Nambisan 1992 – Design elements of landscape gardening – Oxford and IBH publishing  
Co, New Delhi.
3. Lancaster, P. 1991. Gardening in India. Oxford and IBH publishers Pvt. Ltd., Calcutta.
4. Gopaldasamy Iyengar. 1990. Complete gardening in India. IBH. Bangalore.

<b>HOR17R362</b>	<b>INSECT PESTS OF VEGETABLE, ORNAMENTAL AND SPICE CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

## **THEORY**

### **UNIT I**

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**

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**

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

### **UNIT IV**

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, papirika, Cocoa, Cardamom, black Pepper.

### **UNIT V**

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

## **Practical schedule**

### **Identification of symptoms of damage and life stages of important**

1. Pests of tomato, brinjal and bhendi.
2. Pests of tomato, brinjal and bhendi.
3. Pests of chilli and onion.
4. Pests of garlic and curry leaf.
5. Pests of crucifers and cucurbits.
6. Peast of potato and sweet potato.
7. Pest of tapioca.
8. Pests of garlic and turmeric.
9. Pests of rose and jasmine.
10. Pests of rose and jasmine.
11. Pests of crossandra, chrysanthemum and tuberose.
12. Pests of gloriosa, coleus.
13. Pests of lawn, turf, and cut flowers
14. Storage pests of vegetables.
15. Storage pests of ornamentals and spice crops.
16. Field visit.

**TEXT BOOKS**

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. Srivastava, K.P. and D.K. Butani, 1998. Pest Management in Vegetables (Part I & II) Research Periodicals and Book Publishing House, India.

**REFERENCE BOOKS**

1. Reddy, P. P., 2010, Plant Protection in Horticulture Vol. 1, 2 & 3, Scientific Publishers, Jodhpur.
2. Ranjit, P., 2012, Entomological Techniques in Horticultural Crops, New India Publishing Agency.

<b>HOR17R363</b>	<b>POST HARVEST MANAGEMENT OF HORTICULTURAL CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

## **THEORY**

### **UNIT I**

Importance of Postharvest Technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, spices, medicinal and aromatic plants.

### **UNIT II**

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

### **UNIT III**

Quality parameters and specifications. Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Preservation by low temperature: definition, principle, method, suitability – refrigeration, freezing - preparation of frozen foods.

### **UNIT IV**

Preservation by controlled atmosphere, modified atmosphere: definition, principle, method, suitability – processing by irradiation: definition, principle, method, suitability – application of irradiation in food industry.

### **UNIT V**

Methods of storage for local market and export. Pre-harvest treatment and pre-cooling, pre-storage treatments. Different systems of storage, 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. Modes of transport.

### **Practical schedule**

1. Practice in judging the maturity of various horticultural produce.
2. Determination of physiological loss in weight and quality.
3. Grading of horticultural produce.
4. Post-harvest treatment of horticultural crops, physical and chemical methods.
5. Post-harvest treatment of horticultural crops, physical and chemical methods.
6. Packaging and evaluation of the shelf life of fruits at different temperatures.
7. Packaging and evaluation of the shelf life of vegetables at different temperatures.
8. Packaging and evaluation of the shelf life of fruits and vegetables under CAP and MAP.
9. Packaging studies in plantation crops, spices and cut flowers.
10. Packaging studies in plantation crops, spices and cut flowers.
11. Methods of storage.
12. Post-harvest disorders in horticultural produce.
13. Identification of storage pests and diseases in spices.
14. Identification of storage pests and diseases in spices.
15. Visit to markets.
16. Visit to packing houses and cold storage units.

### **TEXT BOOKS**

1. Saraswathy, S. et. al. 2008. Post harvest Management of Horticultural Crops. Agribios (India).81-7754-322-9.
2. Jacob John, P. 2008. A Handbook on Post Harvest management of Fruits and vegetables. Daya Publishing House, Delhi-1081-7035-532-X.

### **REFERENCE BOOKS**

1. Kader, A.A. (Ed.). 2002. Postharvest Technology of Horticultural Crops. Third Edition. Publication 3311.University of California, Division of Agriculture and Natural Resources. Oakland CA.
2. Postharvest Management of Fruit and Vegetables in the Asia-Pacific Region. 2006. Asian Productivity Organization and Food and Agriculture Organisation, UN,
3. Crop Management and Postharvest Handling of Horticultural Products - Fruits and Vegetables.2003. Eds. Dr. Ramdane Dris and Raina iskanen:World Food Ltd., Meri-astilantie, Helsinki, Finland.
4. Kitinoja, L. and Kader, A. A. 2003. Small-Scale Postharvest Handling practice: A Manual for Horticulture crops (4th ed.). US Davis, PHT Research and information Center.

<b>HOR17R364</b>	<b>EXTENSION APPROACHES IN RURAL DEVELOPMENT PERSPECTIVES</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

### **UNIT I**

Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.

### **UNIT II**

Extension teaching methods - audio-visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.

### **UNIT III**

Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone

### **UNIT IV**

Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, innovation decision process and attributes of innovation consequences of adoption.

### **UNIT V**

Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC and KVK.

### **Practical schedule**

1. Understanding the communication pattern in State Department of Agriculture/Horticulture.
2. Study on communication pattern in University TOT Centres.
3. Study of on going agricultural development programmes.
4. Preparation and practicing of posters, charts, graphs, circular letter, folders and leaflets
5. Visit to the State Department of Agricultural Engineering to study the transfer of technology efforts in farm mechanization.
6. Visit to village and fixing the priorities and selecting a most important problem for preparation of a project.
7. Visit to ATMA implemented village.
8. Studying the role of print media communication in publishing the activities of agriculture and allied fields.
9. Visit to Educational Media Centre.
10. Practicing skill on photo journalism
11. Studying the distance learning efforts of Directorate of ODL/Educational Media Centre
12. Studying the role of Community Radio Centre in TOT
13. Script writing for Radio and Television
14. Preparation of interview schedule to study the spread and acceptance of farm technologies at village level.
15. Data collection and tabulation

16. Presentation of reports.

**TEXT BOOKS**

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, Newyork
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.

<b>HOR17R365</b>	<b>DISEASES OF FRUIT, PLANTATION, MEDICINAL AND AROMATIC CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>3</b>

## **THEORY**

### **UNIT I**

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**

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**

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**

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, 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 schedule**

### **Study of symptoms and host parasite relationship of**

1. Diseases of mango and banana.
2. Diseases of mango and banana.
3. Diseases of citrus and grapes.
4. Diseases of guava and sapota
5. Diseases of pomegranate and annona
6. Diseases of jack and papaya
7. Diseases of pineapple, ber and aonla.
8. Diseases of apple and pear,
9. Diseases of plum and peach.
10. Diseases of pepper and betelvine
11. Diseases of turmeric and ginger



12. Diseases of cardamom and fenugreek
13. Diseases of aromatic plants
14. Diseases of plantation crops.
15. Diseases of plantation crops.
16. Field visit

Note: Students should submit 50 well-pressed diseased specimens

### **REFERENCE BOOKS**

1. Arjunan.G. Karthikeyan, G, Dinakaran ,D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
2. Rangaswamy C.2005, Diseases of crop plants in India –. Prentice Hall of India, Pvt. Limited, New Delhi.
3. Pathak V.N. 1980. Diseases of Fruit crops –. Oxford and IBH publishing Co.Pvt.Limited.
4. Das Gupta M.K. and Mandel W.C.1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Company ,New Delhi.
5. Neeta Sharma and Mashkoo Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Co. UP.
6. Parvatha Reddy P. 2008 Diseases of Horticultural Crops Author ISBN8172335431 Scientific Publishers.

<b>HOR17R366</b>	<b>PROCESSING OF HORTICULTURAL CROPS</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

## **THEORY**

### **UNIT I**

Introduction: Scenario of fruit and vegetable production and processing at national and international level - contribution of horticulture produces to human nutrition: nutritive value, nutraceutical properties – concept, principles and scope of processing and value addition of horticultural produces.

### **UNIT II**

Importance and scope of fruit and vegetable preservation industry in India, food pipe line, losses in post-harvest operations, unit operations in food processing. Principles and guidelines for the location of processing units.

### **UNIT III**

Principles and methods of preservation by heat - pasteurization, canning, bottling. Methods of preparation of juices, squashes, syrups, cordials and fermented beverages. Jam, jelly and marmalade. Preservation by sugar and chemicals, candies, crystallized fruits, preserves chemical preservatives, preservation with salt and vinegar, pickling, chutneys and sauces, tomato and mushrooms, freezing preservation.

### **UNIT IV**

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

### **UNIT V**

Processing of plantation crops, products, spoilage in processed foods, quality control of processed products, Govt. policy on import and export of processed fruits. Food laws.

### **Practical schedule**

1. Market survey of processed foods
2. Tools, equipments, lay out and other requirements of a small scale food processing unit.
3. Tools, equipments, lay out and other requirements of a small scale food processing unit.
4. Processing of jam and jelly
5. Processing of squash and RTS
6. Processing of fruit bar and candies
7. Processing of pickles and sauces
8. Steeping preservation of fruits and vegetables
9. Processing of osmo dried fruit slices
10. Processing of dehydrated vegetables
11. Processing of dehydrated spices

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

#### **REFERENCE BOOKS**

1. Verma, L. R. and Joshi, V. K. 2000. Post Harvest Technology of Fruits and Vegetables. Vol. I & II. Indus Publishing Co., New Delhi.
2. Dauthy, M. E. 1995. Fruits and Vegetables Processing- FAO Bulletin 119. International Book Distributing Co., Lucknow.
3. Fellows, P. J. 1998. Food Processing Technology – principles and Practices. Ellis Horwood.
4. Manoranjan, K and Sangita, S. 1996. Food Preservation & Processing. Kalyani Publishers, India.

<b>HOR17R367</b>	<b>DRY LAND HORTICULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

### **UNIT I**

Dry land Horticulture -overview: Area, production, and export potential, past and present status of dry land fruits in India and Tamil Nadu -General appraisal of dry land horticulture regions / zones in India and Tamil Nadu –special features of arid and semi arid zone fruits. Cropping systems and intercropping –crops suitable for dry land system –spacing and planting patterns for dry land horticultural crops.

### **UNIT II**

Aonla -climate and soil requirements –varieties -production constraints –propagation –planting method –planting density –pollination -nutrient, weed and water management -raining and pruning -use of growth regulators –harvest -grading –postharvest handling. Ber -climate and soil requirements –varieties–production constraints, propagation –planting density –nutrient, weed and water management -training and pruning -use of growth regulators -and harvest–grading –postharvest handling.

### **UNIT III**

Pomegranate -climate and soil requirements –varieties –propagation –planting density –nutrient, weed and water management, training and pruning -Growth regulation by chemical regulators and harvest -grading –postharvest handling. Custard apple climate and soil requirements –varieties –propagation –planting density –nutrient, weed and water management -training and pruning –crop regulation -use of growth regulators –harvest -grading –postharvest handling & processing Jamun -climate and soil requirements -varieties -propagation -planting density -nutrient, weed and water management -use of growth regulators -harvest -grading –postharvest handling

### **UNI IV**

Bael -climate and soil requirements -production constraints -propagation -planting density -nutrient, weed and water management -harvest -grading -postharvest handling Wood apple -climate and soil requirements –varieties –propagation –planting density –nutrient, weed and water management–use of growth regulators –harvest -grading –postharvest handling Manila tamarind -climate and soil requirements –varieties –propagation –planting density –nutrient, weed and water management—harvest -grading –postharvest handling

### **UNIT V**

Cluster beans -climate and soil requirements –varieties –propagation –Spacing –nutrient, weed and water management–use of growth regulators –harvest -grading –postharvest handling Senna, Periwinkle -climate and soil requirements –varieties –propagation –Spacing –nutrient, weed and water management –use of growth regulators –harvest -grading –postharvest handling Vetiver and Palmarosa-climate and soil requirements –varieties –propagation planting density –nutrient, weed and water management–use of growth regulators –harvest -grading –postharvest handling.

### **Practical Schedule**

1. Study of soil conservation practices for dry land horticulture
2. Study of moisture conservation practices for dry land horticulture
3. Study of water and nutrient management strategies for dry land horticulture
4. Study of Aonla varieties, crop regulation and Propagation methods
5. Study of Ber varieties, Propagation methods
6. Study of Pomegranate varieties, Propagation methods
7. Crop regulation and post harvest technology of Pomegranate
8. Study of Custard apple varieties, Propagation methods
9. Propagation and Crop regulation of Custard apple
10. Study of Jamun varieties, propagation and planting
11. Study of Bael and Wood apple varieties, propagation and planting
12. Study of Manila tamarind varieties, propagation and planting
13. Study of Cluster bean varieties, propagation and cultural practices
14. Study of Senna varieties, propagation and cultural practices
15. Study of Periwinkle varieties, propagation and cultural practices
16. Study of Vetiver and Palmarosa varieties, propagation and cultural practices

### **REFERENCES BOOKS**

1. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
2. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 2004. Scientific Fruit culture, Suri Associates, Coimbatore.

<b>HOR17R368</b>	<b>APICULTURE, SERICULTURE AND LAC CULTURE</b>	<b>L</b>	<b>P</b>	<b>C</b>
		1	1	2

## **THEORY**

### **UNIT I**

Introduction to beneficial insects. Importance and History of apiculture. Species of honey bees, Rock bee, Little bee, Indian bee, European bee, Italian bee and Dammar bee, lifecycle and caste determination. Bee colony maintenance, bee colony activities, starting of new colony, location site, transferring colony, replacement of queen, combining colonies, swarm prevention.

### **UNIT II**

Colony management in different seasons, Equipment for apiary, types of bee hives and their description. Bee pasturage. Honey extraction, honey composition and value, bee wax and tissues. Importance, History and development in India.

### **UNIT III**

Silkworms kinds and their hosts, systematic position, distribution, lifecycles in brief, Silk glands. Mulberry silkworm-morphological features, races, rearing house and equipments, disinfection and hygiene. Grainage acid treatment, packing and transportation of eggs, Incubation, black boxing, hatching of eggs. Silkworm rearing young age /chawki rearing and old age rearing of silkworms. Feeding, spacing, environmental conditions and sanitation.

### **UNIT IV**

Cocoon characters colour, shape, hardness and shell ratio. Defective cocoons and stifling of cocoons. Uses of silk and by-products. Economics of silk production. Moriculture- Mulberry varieties, package of practices, Pests and diseases and their management.

### **UNIT V**

Lac growing areas in India, Lac insects, biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac-insects.

### **Practical Schedule**

1. Honey bee colony, different bee hives.
2. Apiculture equipment.
3. Summer and winter management of colony.
4. Honey extraction and bottling.
5. Study of pests and diseases of honeybees.
6. Establishment of mulberry garden.
7. Preparation of mulberry cuttings, planting methods under irrigated and rainfed conditions. Maintenance of mulberry garden-pruning, fertilization, irrigation and leaf harvest.
8. Mulberry pests and diseases and their management and nutritional disorders.
9. Study of different kinds of silkworms and mulberry silkworm morphology and silk glands.
10. Sericulture equipments for silkworm rearing.
11. Mulberry silkworm rearing room requirements.
12. Rearing of silkworms-chalky rearing. Rearing of silkworms late age silkworm rearing
13. Study of mountages.
14. Study of silkworm diseases and its management.
15. Lac insects-biology, behavior.

16. Lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac and enemies of lac insects.

### **TEXT BOOKS**

1. Singh, S., 1975. Bee keeping in India – ICAR, New Delhi., 214p.
2. Sunita, N.D, Guled ,M.B, Mulla S.R and Jagginavar,2003, Beekeeping, UAS Dharwad.
3. Paul DeBach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 edition (27 June 1991).
4. YA Shinde and BR Patel. Sericulture in India.
5. Tribhuwan Singh. Principles and Techniques of Silkworm Seed Production, Discovery publishing House Pvt. Ltd.
6. Jolly, M.S. 1987. “Appropriate sericulture techniques” International centre for training and Research in Tropical Sericulture, Mysore.

### **REFERENCE BOOKS**

1. M.L. Narasaiah. Problems and Prospects of Sericulture. Discovery publishing House Pvt. Ltd.
2. Ganga,G. and Sulochana Chetty, J. 1997. An introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
3. Krishnaswamy, S. (Ed). 1978. Sericulture Manual - Silkworm Rearing. FAO Agrl. Services bulletin, Rome.
4. Singh, S. 1975. Bee keeping in India. ICAR, New Delhi.
5. Glover, P.M. 1937. Lac cultivation in India. Indian Lac Research Institute, Ranchi.
6. Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.
7. Singh, D and Singh, D.P. 2006. A hand book of Beekeeping, Agrobios (India).

<b>HOR17R369</b>	<b>INFORMATION AND COMMUNICATION TECHNOLOGY</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>1</b>	<b>2</b>

## **THEORY**

### **UNIT I**

Introduction to Computers; Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture. e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer - controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc.

### **UNIT II**

Bio informatics – History – Links between modern biology genomics and Bio-informatics. Agro informatics – Intelligent technologies in Agriculture - Artificial intelligence – Natural language - Neural networks – Expert system – Robotics – Applications - Geographic Information Systems (GIS) - Remote Sensing – Geographic data and maps.

### **UNIT III**

Agriculture databases – Agricultural Literature Journals -Technical reports - Conference papers - Electronic publishing - Agricultural information Sources - Database Management System (DBMS) and its components - Data modeling and its components.

### **UNIT IV**

Introduction to Relational Database Management System (RDBMS) – Client Server computing – Overview of Codd’s rules – ORACLE – Creating tables using CREATE – Operating tables using SELECT, querying tables with view commands – use of SUM, AVERAGE, COUNT Options – Structured Query Language (SQL) Commands – Join types –self JOIN – Database Security Commands using GRANT, REVOKE options.

### **UNIT V**

Visual Basic – Building a Visual Basic Application – Writing codes – Working with controls – Managing Visual Basic data – Working with variables – Controlling program flow – More on program control – Looping – Handling of data from multiple databases - Controlling program flow – modules - creation of .exe files - Writing VB code for Excel data - VB Functions – Creating Visual Basic Function for MS Excel.

### **Practical Schedule**

1. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data.
2. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.
3. Introduction to World Wide Web (WWW). Introduction of programming languages.
4. Database Management Systems (DBMS), its components in generating agricultural information.
5. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop- Info/CropSyst/ Wofost.
6. Computation of water and nutrient requirements of crop using CSM and IT tools.



7. Applications - Geographic Information Systems (GIS) - Remote Sensing – Geographic data and maps.
8. Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.
9. Relational Database Management System (RDBMS) – Client Server computing – Overview of Codd's rules.
10. Structured Query Language (SQL) Commands.
11. Building a Visual Basic Application – Writing codes – Working with controls –Managing Visual Basic data.
12. Database Management System (DBMS) and its components - Data modeling and its components.
13. VB Functions – Creating Visual Basic Function for MS Excel.
14. Commands – Join types – self JOIN – Database Security Commands using GRANT, REVOKE options.
15. Bio-informatics in Agriculture – Analysing protein sequences – DNA and RNA sequences.
16. Usage of SWISSPROT, EMBL, BLAST software for similarities searches – Bio-informatics software programmes.

#### **REFERENCE BOOKS**

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

## SEMESTER VII

<b>HOR17R481</b>	<b>STUDENT READY-Placement in Villages</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>10</b>	<b>10</b>

The students in groups (4-5) shall be placed in different districts, in particular villages to study and explore the potentialities of horticulture crops as Village Stay Programme.

The students shall survey the village, collect general information on the village, infrastructure, cropping pattern, technology adoption, awareness on recent scientific advancements, social culture etc. They shall interview the individual farmers (marginal and big farmers) on different aspects and conclude with a report on the status of the village for exploring the horticulture potentialities. The students shall be attached with concerned Assistant Director of Horticulture at different districts of Tamil Nadu to study the organizational set up of Department of Horticulture and the schemes in operation, subsidy provision to farmers on different inputs, other activities etc.

The students shall also be attached with major Non-Government Organizations (NGO) in different districts of Tamil Nadu to study the organizational set up, role of NGO in upliftment of farmers, the schemes offered by NGO other activities etc.

<b>HOR17R482</b>	<b>STUDENT READY-Placement in Industries</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>10</b>	<b>10</b>

The students in groups (4 to 5) shall be placed under different horticultural industries across the country for practical exposure for setting up an industry, working of the industry, technology in adoption, marketing of the products and its logistic management. The different horticulture industries include

- Processing of fruits and vegetables
- Processing of spices and condiments
- Processing of medicinal plants
- Landscaping and turfing
- Marketing and logistic management
- Dry flower Industry
- Green house production of cut flowers and vegetables
- Tissue culture

<b>HOR17R483</b>	<b>EDUCATIONAL TOUR</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>2</b>	<b>2</b>

The students will visit various national and international institutions related to agriculture, horticulture, forestry and other allied fields in various regions of the country. During the tour programme, the students will gain first-hand information on different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities. The duration of the tour will be 16 days.

The following institutes may be visited based on the requirement.

1. Visit to CRIDA, Hyderabad, AP.
2. Visit to IIHR and Gardens, Bangalore.
3. Visit to seed production units, Bangalore.
4. Visit to Jain irrigation and banana hi-tech field at Jalgaon, Maharashtra
5. Visit to NRC for Grapes, Pune and near by pomegranate orchards.
6. Visit to NRC for Onion and Garlic, Nasik.
7. Visit to Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan
8. Visit to CPRI, Shimla and Mushroom Research Institute, Shimla.
9. Visit to PAU, Ludhiana
10. Visit to Rose Garden and Rock Garden, Chandigarh
11. Visit to Moghul Gardens at TajMahal, Agra
12. Visit to Forest College, Dehradun
13. Visit to Remote sensing unit, Dehradun
14. Visit to IARI, NBPGR & NSC, New Delhi.

The students will be evaluated as indicated below:

<b>S.No</b>	<b>Item</b>	<b>Marks</b>
1.	Attendance	10
2.	Behaviour	15
3.	Tour diary	15
4.	Tour record	15
5.	Written test	30
6.	Viva voce	15
7.	Total	100

## SEMESTER VIII

### ELP- I

<b>HOR17R484</b>	<b>ELP-I</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>10</b>	<b>10</b>

#### COMMERCIAL HORTICULTURE

Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control. Nursery production of ornamentals: Production of plantlets, production of potted plants, management and maintenance, sale and marketing. Protected cultivation of vegetables and flowers: Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing.

#### PROCESSING OF FRUITS AND VEGETABLES FOR VALUE ADDITION

Planning and execution of a market survey, preparation of processing schedule, preparation of project module based on market information, calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects, identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labelling, pricing and marketing of product.

#### FLORICULTURE AND LANDSCAPE ARCHITECTURE

Preparation of project report, soil and water analysis, preparation of land and layout. Production and Management of commercial flowers. Harvesting and postharvest handling of produce. Marketing of produce, Cost Analysis, Institutional Management, Visit to Flower growing areas and Export House, Attachment with private landscape agencies. Planning and designing, site analysis, selection and use of plant material for landscaping. Formal and informal garden, features, styles, principles and elements of landscaping. Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues. Making of lawns, use of software in landscape. Making of bouquets, button hole, wreath, veni and gazaras, car and marriage palaces. Dry flower Technology (identification of suitable species, drying, packaging and forwarding techniques).

#### BIO-INPUTS: BIO-FERTILIZERS AND BIO-PESTICIDES

Isolation and pure culture establishment of fertilisers and bio-pesticides. Culture methods and substrates. Scale of methods for bio-fertilizers and bio-pesticides. Substrate preparation and mixing techniques. Quality analysis of bio-fertilizers and bio-pesticides. Testing the final product in small scale level. Storage, marketing and cost analysis of bio-fertilizers and pesticides.

### **MUSHROOM CULTURE**

Construction cultivation room/structure and Disinfection. Compost preparation & pasteurization. Procurement of mother culture and spawn preparation. Procurement of casing soil and preparation for production. Mushroom seeding, Casing with soil and maintenance, Harvesting, processing, Grading, packing, marketing and Cost economics of mushroom culture.

### **BEE KEEPING**

Procurement and arrangement of bee keeping equipments. Location and collection of potent nectar yielding bee flora seeds from wild. Raising/ enriching the high nectar yielding bee flora in the campus. Location and hiving the natural bee colony from the wild. Establishing the apiary with suitable/favourable necessaries. Maintenance and multiplication of hived colonies. Management of natural enemies and diseases of bees. Maintenance of bee colonies during dearth and honey flow seasons. Harvesting and Processing of honey and bee wax. Marketing and cost analysis.

<b>HOR17R485</b>	<b>ELP-II</b>	<b>L</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>10</b>	<b>10</b>

### **PROTECTIVE CULTIVATION OF HIGH VALUE HORTICULTURE CROPS**

Visit to commercial polyhouses, Project preparation and planning. Specialised lectures by commercial export house. Study of designs of green- house structures for cultivation of crops. Land preparation and soil treatment. Planting and production: Visit to export houses; Market intelligence; Marketing of produce; cost analysis; Visit to export houses; Market intelligence; Marketing of produce; cost analysis; institutional management. Report writing and viva-voce.

### **MASS MULTIPLICATION OF PLANT AND MOLECULES THROUGH TISSUE CULTURE**

Preparation of stock solutions of tissue culture media. Preparation of solid media and liquid media. Initiation of in vitro culture and multiplication (preparation of explant, inoculation and culturing) (crop to selected). Sub-culturing, Hardening and establishment, Initiation of callus cultures – suspension cultures, Induction of selected biomolecules in callus, Harvesting and extraction of biomolecule, Marketing and cost analysis.

## COMMERCIAL ORNAMENTAL/MEDICINAL PLANT PRODUCTION.

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 – Bioaesthetic planning – Landscaping places of public importance – Flower arrangement –Bonsai making.

## SEED PRODUCTION IN VEGETABLE CROPS

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 – Ridgegourd – Bottlegourd – Snakegourd - Pumpkin – Ashgourd -Muskmelon – Watermelon – Cucumber – Cluster bean – Vegetable Cowpea – Lab lab – Amaranthus – Onion - Coriander – any other commercially important crops.

## COMMERCIAL PRODUCTION OF BIO CONTROL AGENT

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 lituragranulosus* 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 bio control laboratory at TNAU, Coimbatore.

## **FARM ADVISORY ON SOIL HEALTH QUALITY AND PLANT NUTRITION.**

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.

## **PRODUCTION AND MARKETTING ORGANIC MEDIA FOR KITCHEN AND ROOF GARDEN.**

Hands on experience on preparation of organic media using vermicompost, coirpith compost, vermiwash etc., for developing roof garden - Develop roof garden in a given area. Lay out of kitchen garden-make different models of kitchen garden. Identify the marketing channels in surrounding areas. Visit to vegetable markets.

