

B. Sc. (Hons.) Horticulture

**Curriculum and Syllabus
2018**



**DEPARTMENT OF HORTICULTURE
KALASALINGAM SCHOOL OF AGRICULTURE AND HORTICULTURE
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
Semester - I					
1.	HOR18R151	Fundamentals of Soil Science	2	1	3
2.	HOR18R152	Plant Propagation and Nursery Management	1	1	2
3.	HOR18R153	Fundamentals of Horticulture	2	1	3
4.	HOR18R154	Elementary Plant Biochemistry	1	1	2
5.	HOR18R155	Introductory Microbiology	1	1	2
6.	HOR18R156	Botany of Horticultural Crops	1	1	2
7.	TAM18R182/ HSS18R182	தமிழ் இலக்கியங்களில் வேளாண்மையும் அறிவியல் தமிழ் பயன்பாடும் /Developmental Education	0	1	1
8.	MAT18R112	Elementary Mathematics	1	0	1
9.	HOR18R157	Communication Skills and Personality Development	1	1	2
10.	HOR18R158	Fundamentals of Food Technology	1	1	2
11.	NG18R1001/ NG18R1002/	NCC/ NSS	0	1*	1*
12.	NG18R1003	Physical Education	0	1*	1*
Total			11	9+2*	20+2*

*Non Credit courses

Sl. No.	Course Code	Course Title	L	P	C
Semester - II					
1	HOR18R159	Tropical and Subtropical Fruits	2	1	3
2	HOR18R160	Tropical and Subtropical Vegetables	2	1	3
3	HOR18R161	Introductory Crop Physiology	1	1	2
4	HOR18R162	Agro-meteorology and Climate Change	1	1	2
5	HOR18R163	Weed and Water Management in Horticultural Crops	2	1	3
6	HOR18R164	Principles of Genetics and Cytogenetics	2	1	3
7	HOR18R165	Fundamentals of Plant Pathology	2	1	3
8	HOR18R166	Fundamentals of Extension Education	1	1	2
9	HOR18R167	Soil Fertility and Nutrient Management	1	1	2
10	HOR18R168	Livestock and Poultry: Production and Management.	1	1	2
Total			15	10	25

Sl. No.	Course Code	Course Title	L	P	C
Semester – III					
1	HOR18R251	Fundamentals of Entomology	2	1	3
2	HOR18R252	Temperate Vegetable Crops	1	1	2
3	HOR18R253	Principles of Plant Breeding	2	1	3
4	HOR18R254	Environmental Studies and Disaster Management	2	1	3
5	HOR18R255	Temperate Fruit Crops	1	1	2
6	HOR18R256	Commercial Floriculture	2	1	3
7	HOR18R257	Elementary Plant Biotechnology	1	1	2
8	HOR18R258	Economics and Marketing	2	1	3
9	HOR18R259	Principles of Quality Seed Production	1	1	2
10	HOR18R260	Principles of Landscape Architecture	1	1	2
		Total	15	10	25

Sl. No.	Course Code	Course Title	L	P	C
Semester – IV					
1.	HOR18R261	Soil, Water and plant Analysis	1	1	2
2.	HOR18R262	Spices and Condiments	2	1	3
3.	HOR18R263	Plantation Crops	1	1	2
4.	HOR18R264	Breeding of Fruit and Plantation Crops	2	1	3
5.	MAT18R212	Elementary Statistics and Computer Application	2	1	3
6.	HOR18R265	Farm Power and Machinery	1	1	2
7.	HOR18R266	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	2	1	3
8.	HOR18R267	Dry land Horticulture	1	1	2
9.	HOR18R268	Organic Farming	2	1	3
		Total	14	9	23

Sl. No.	Course Code	Course Title	L	P	C
Semester – V					
1	HOR18R351	Introduction to Major Field Crops	1	1	2
2	HOR18R352	Medicinal and Aromatic crops	2	1	3
3	HOR18R353	Introductory Agroforestry	1	1	2
4	HOR18R354	Breeding of Vegetable, Tuber and Spice Crops	2	1	3
5	HOR18R355	Diseases of Vegetables, Ornamentals and Spice Crops	2	1	3
6	HOR18R356	Ornamental Horticulture	1	1	2
7	HOR18R357	Growth and Development of Horticultural Crops	1	1	2
8	HOR18R358	Nematode pests of horticultural crops and their Management	1	1	2
9	HOR18R359	Orchard and Estate Management	1	1	2
10	HOR18R360	Potato and tuber crops	1	1	2
		Total	13	10	23

Sl. No.	Course Code	Course Title	L	P	C
Semester – VI					
1	HOR18R361	Apiculture, Sericulture and Lac culture	1	1	2
2	HOR18R362	Insect Pests of Vegetable, Ornamental and Spice Crops	2	1	3
3	HOR18R363	Postharvest Management of Horticultural Crops	1	1	2
4	HOR18R364	Seed production Techniques in Horticultural Crops.	2	1	3
5	HOR18R365	Processing of Horticultural Crops	1	1	2
6	HOR18R301	Horti-Business Management	2	0	2
7	HOR18R366	Entrepreneurship Development and Business Management	1	1	2
8	HOR18R367	Diseases of fruit, Plantation, Medicinal and Aromatic Crops	2	1	3

9	HOR18R368	Precision Farming and Protected Cultivation	2	1	3
10	NG18R3005	Information and Communication Technology	1*	1*	2*
		Total	14+1*	8+1*	22+2*

***Non Credit course offered by IT department**

Sl. No.	Course Code	Course Title	Days	L	P	C
Semester – VII						
1	HOR18R481	STUDENT READY- Placement in Villages 1. General Orientation and on campus Training by different faculties. 2. Village attachment	1 60	0	10	10
2	HOR18R482	STUDENT READY - Placement in Industries 1. Agro Industrial tie up 2. Plantation Internship	7 15	0	10	10
3	NG18R4001	Educational tour		0	2*	2*
		Total		0	20+2*	20+2*

***Non Credit courses**

Sl. No.	Course Code	Course Title	L	P	C
Semester – VIII			0	20	20
STUDENT READY:					
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.					
Experiential Learning programme			20 (0+20)		
HOR18R483		ELP- I	(0+10)		
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			
HOR18R484			ELP-II			(0+10)		
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 Marketing Organic Media for Kitchen and Roof garden.	0	10	10			
Total			20			20		

S. No.	SEMESTER	L	P	C
1.	SEMESTER I	11	9+2*	20+2*
2.	SEMESTER II	15	10	25
3.	SEMESTER III	15	10	25
4.	SEMESTER IV	14	9	23
5.	SEMESTER V	13	10	23
6.	SEMESTER VI	14+1*	8+1*	22+2*
7.	SEMESTER VII	0	20+2*	20+2*
8.	SEMESTER VIII	0	20	20
	TOTAL	82+1*	96+5*	178+6*

**Total credits with Non Credit courses (6 credits) as recommended by ICAR = 178+6*
=184**

SEMESTER I

HOR18R151	Fundamentals of Soil Science	L	P	C
		2	1	3

THEORY

UNIT I

Soil – Pedological and edaphological concepts – Origin of the Earth – Composition of Earth's crust - Rocks and minerals – primary and secondary minerals. 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 (13th Edition) McMillan Co., New York. Indian Publisher – Eurasia Publishing House (P) Ltd., Ramnagar, New Delhi – 55.
2. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, 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.

HOR18R152	Plant Propagation and Nursery Management	L	P	C
		1	1	2

THEORY

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 - protray 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 préparations - 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. India.
3. Edmond, J.B., T.L. Senna, F.S. Andrews and R.G. Halfacre. 1990. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd.
4. 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.

HOR18R153	Fundamentals of Horticulture	L	P	C
		2	1	3

THEORY

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 Acquah, 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.

HOR18R154	Elementary Plant Biochemistry	L	P	C
		1	1	2

THEORY

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. Physical and chemical constants of oils. Rancidity of oils. Waxes and phospholipids - types and importance. Plant pigments - structure and function of chlorophyll and carotenoids. Industrial applications of lipids.

UNIT III

Amino acids - classification and structure. Essential amino acids, properties of amino acids. Classification of proteins based on functions and solubility. Structure of proteins - primary, secondary, tertiary and quaternary. Enzymes - classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme action. Competitive, non-competitive and uncompetitive inhibitors. Industrial applications of enzymes.

UNIT IV

Carbohydrate metabolism - glycolysis and TCA cycle, Pentose phosphate pathway. Respiration - electron transport chain and oxidative phosphorylation. Bioenergetics of glucose. Metabolism of lipids. Fatty acid oxidation. Biosynthesis of fatty acids and triacyl glycerol. General catabolic pathway for amino acids - transamination, deamination and decarboxylation.

UNIT V

Structure and function of Nucleic acids – Purines and Pyrimidines, Central Dogma of Molecular biology - Replication, Transcription and Translation.

Practical schedule

1. Qualitative tests for carbohydrates.
2. Estimation of total sugars.
3. Determination of reducing sugars.
4. Estimation of proteins by Biuret method.
5. Estimation of total free amino acids by Ninhydrin method.
6. Estimation of free fatty acids of oil.
7. Determination of iodine number of an oil.
8. Assay of amylose.
9. Separation of amino acids through PC.
10. Separation of sugars through TLC.

TEXT BOOKS

1. Rastogi S.D., 2010, Biochemistry, 3rd edn, Tata McGraw-Hill, Delhi.
2. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W., 2003. 26th edn, Tata McGraw-Hill, New Delhi.

3. Nelson DL, Cox MM. 2004. Lehninger Principles of Biochemistry Fourth (Indian edition) Macmillian, Worth Publishers.
4. 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 5th 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.

HOR18R155	Introductory Microbiology	L	P	C
		1	1	2

THEORY

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

Plant growth promoting microorganisms and mushrooms – Economical importance, Industrially important microorganisms in large scale production and common microbial fermentations. Mushrooms- edible and poisonous types, nutritive values, Culturing and production techniques.

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 CO₂ evolution.
11. Demonstration of antibiosis – crowded plate assay.
12. Isolation of symbiotic N₂ fixing microorganism – Rhizobium.
13. Isolation of associative and non symbiotic N₂ 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. 11th 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.

HOR18R156	Botany of Horticultural Crops	L	P	C
		1	1	2

THEORY

UNIT I: Plant Morphology and Reproduction

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 of fruit crops

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 of Vegetable crops

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 of spices and Plantation crops

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 of floral and medicinal crops

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

Observation and description of the taxonomy and morphological characters of the crops in the families:

1. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.
2. Moraceae, Vitaceae and Caricaceae.
3. Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.

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

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).

TAM18R182/ HSS18R182	தமிழ் இலக்கியங்களில் வேளாண்மையம்	L	P	C
	அறிவியல் தமிழ் பயன்பாடும் /Developmental Education	0	1	1

நோக்கம்

இளநிலை வேளாண்மை பயிலும் மாணவர்களுக்கு தமிழ் இலக்கியங்கள் வழி வேளாண்மை மற்றும் வேளாண்மை சார்ந்த தொழில்நுட்பங்களையும் செய்திகளையும் அறியச் செய்தல்- தற்கால வேளாண் தொழில்நுட்பங்களோடு பொருத்திப் பார்த்தல் - வேளாண்மை தவிர தோட்டக்கலை - வனவியல்- வேளாண்பொறியியல் - மனையியல் சார்ந்த கருத்துக்களை வெளிக்கொணர்தல் - வேளாண்துறைக்கு இன்றியமையாத கலைச்சொற்கள் - மொழிப்பெயர்ப்பு - பாரம்பரிய தொழில்நுட்பங்களை அறியச்செய்தல் - மாணவர்களின் எதிர்காலத் தேவைக்கு அடிப்படையான பேச்சுப்பயிர்ச்சி - நேர்காணலை எதிர்கொள்ளும் வகையில் மென்திறன்களான தலைமைப்பண்பு - ஆளுமைப்பண்பு - காலமேலாண்மை ஆகியவற்றில் திறம்பெறச்செய்தல் - மாணவர்களின் ஆய்வுக்கட்டுரை திறனை வளர்த்தல் - வேளாண்மை இதழ்கள், நூல்கள் குறித்து விழிப்புணர்வை வழங்குதல் - கணினி வழி தமிழில் வேளாண் செய்திகளை பதிவேற்றம், பதிவிறக்கம் செய்யும் முறைகளை அறியச்செய்தல் ஆகியவற்றை நோக்கமாக கொண்டு பாடத்திட்டத்தை வரையறை செய்தல்.

பாடத்திட்டம்

தொல்காப்பியம் காட்டும் முதற்பொருள், கருப்பொருள் - சங்க இலக்கியத்தில் வேளாண் தொழில் நுட்பங்கள் - பதினெண் கீழ்க்கணக்கு நூல்களில் வேளாண்மைஅறிவியல் - பள்ளு இலக்கியங்கள், ஏரெழுபது, இலக்கியத்தில் வேளாண் பொறியியல் - தோட்டவியல் - வனவியல் மனையியல் - சூழலியல் வேளாண்மைப் பழமொழிகள் - இலக்கியம் காட்டும் வாழ்வியல் நெறிமுறைகள் - இக்கால இலக்கியங்களில் வேளாண்மைச் சிந்தனைகள் - பிழையின்றிஎழுதும் முறைகள் - பாரம்பரியத் தொழில்நுட்பங்கள் - இலக்கியத்தில் மென்திறன்கள் - அறிவியல் தமிழ் வளர்ச்சிநிலைகள் - கலைச்சொல்லாக்கம் - மொழிபெயர்ப்பு - கட்டுரைச் சுருக்கம் எழுதுதல் - கணினிஉலகில் தமிழ்

செய்முறைப் பயிற்சிகள்

1. தொல்காப்பியம் காட்டும் முதற்பொருள், கருப்பொருள், தாவரவியல் அறிவு, வேளாண் மாந்தர் குறித்த செய்திகளை அறிதல்
2. சங்க இலக்கியத்தில் வேளாண் தொழில் நுட்பங்கள் - (எட்டுத்தொகை, பத்துப்பாட்டு)
3. பதினெண் கீழ்க்கணக்கு நூல்களில் வேளாண்மைஅறிவியல்
4. பள்ளு இலக்கியங்கள், ஏரெழுபது-உழவர் வாழ்வியல் நெறிமுறைகளும் வேளாண்மைத் தொழில் நுட்பங்களும்
5. இலக்கியத்தில் வேளாண் பொறியியல் - தோட்டவியல் - வனவியல் - மனையியல் - சூழலியல்
6. வேளாண்மைப் பழமொழிகள் - உழவு விதைஅறிவியல் - பருவம் - மழை - நாற்றுநடுதல் - எரு இடுதல் - நீர்ப்பாசனம் - களைமேலாண்மை-பயிர்பாதுகாப்பு - அறுவடை-உழவர் சமுதாயம்
7. இலக்கியம் காட்டும் வாழ்வியல் நெறிமுறைகள்
8. இக்கால இலக்கியங்களில் வேளாண்மைச் சிந்தனைகள் - பாரதி, பாரதிதாசன் படைப்புகள் - புதுக்கவிதை
9. இடைநிலைப் பருவத்தேர்வு
10. பிழையின்றிஎழுதும் முறைகள் - எழுத்துப் பிழைகள் - சொற்பிழைகள் - சொற் பிரிப்புப்பிழை-வாக்கியப்பிழை-மெய்ப்புத் திருத்தம்
11. பாரம்பரிய வேளாண்மைத் தொழில்நுட்பங்கள்

12. இலக்கியத்தில் மென்திறன்கள் - தலைமைப்பண்பு - காலமேலாண்மை
13. ஆளுமைப்பண்பு மேம்பாடு-மனித உறவுத்திறன்கள் வளர்த்தல்
14. அறிவியல் தமிழ் வளர்ச்சிநிலைகள், வேளாண் நூல்கள், வேளாண் இதழ்கள் - அலுவலகக் கடிதம்
15. கலைச்சொல்லாக்கம் - வேளாண் கலைச் சொற்களை உருவாக்கும் முறை-தரப்படுத்துதல் - இலக்கியவேளாண் கலைச்சொற்கள், வட்டாரவேளாண்மைவழக்குச் சொற்கள் - அகராதியியல்
16. மொழிபெயர்ப்பு - முக்கியவிதிகள் - படிநிலைகள் - மொழிபெயர்பாளரின் இன்றியமையாப் பண்புகள் - வேளாண் செய்திகளை மொழிபெயர்த்தல் - கட்டுரைச் சுருக்கம் எழுதுதல்
17. கணினி உலகில் தமிழ் - விக்கிபீடியா-வேளாண் செய்திகளைப் பதிவேற்றம் செய்தல் - வேளாண் செய்திகளை இணையதளவழி அறிதல்

மேற்பார்வை நூல்கள்

1. கந்தசாமி. இல. செ. வேளாண்மையும் பண்பாடும், தமிழ்நாடு வேளாண்மைப் பல்கலைக்கழகம், கோயம்புத்தூர், 1974
2. கந்தசாமி. இல. செ. இலக்கியத்தில் வேளாண்மை, தமிழ்நாடு வேளாண்மைப் பல்கலைக்கழகம், கோயம்புத்தூர் 1981.
3. கந்தசாமி. இல. செ. வேளாண்மைபழமொழிகள், கலைச்செல்வம் பதிப்பகம், கோயம்புத்தூர் 1983.
4. குழந்தைசாமி. வா. செ. அறிவியல் தமிழ், பாரதிபதிப்பகம், சென்னை
5. மீனாட்சிசுந்தரம். மா. மற்றும் ஏ. இல. விசயலட்சுமி., தகவல் தொடர்பில் தமிழ் மொழிப்பயன்பாடு, கே. ஆர். எ. ஆப்செட் பிரிண்டர், கோவை- 2002
6. மணிமேகலை. ம. தமிழ் மொழித் தடத்தில் வேளாண் அறிவியலின் சுவடுகள், தேவிபதிப்பகம், திருச்சிராப்பள்ளி, 2002
7. இலக்கியமும் வேளாண்மையும், அனைத்திந்திய அறிவியல் தமிழ்க் கழகம், தஞ்சாவூர், 2006
8. தமிழரின் மரபுச்செல்வங்கள், உலகத் தமிழராய்ச்சிநிறுவனம், சென்னை
9. சந்திரசேகரன், இரா, மொழிப்பாடம் - படைப்பாக்கத்திறன் வளர்த்தல்
10. வேளாண் கலைச்சொல் பேரகராதி, தமிழ் நாடு வேளாண்மைப் பல்கலைக்கழகம், கோயம்புத்தூர், 2008.
11. பாவேந்தன், இரா, தமிழில் அறிவியல் இதழ்கள், சாமுவேல், ஃபிஷ் கிறிஸ் பதிப்பகம், கோயம்புத்தூர்
12. டாக்டர் இராதாசெல்லப்பன், கலைச்சொல்லாக்கம், தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

OR

HSS18R*** Developmental Education (0+1)

Practical schedule

1. Basic principles of learning. Binary terms viz –growth and development, education – for –life and life –long education, motivation and morale –occupation and profession, training and education, lateral thinking and conventional thinking, teaching and learning –discussion.
2. Bloom's classification of educational objectives –Cognitive, Affective, Psychomotor domain(s) – discussion.
3. Career development –opportunity for graduates of agriculture and allied sciences – discussion.
4. Success story of a farmer –factors involved–role –play.
5. Brainstorming –Demonstration.
6. Simulation –Convergent task –demonstration.
7. Simulation –Divergent task–demonstration.
8. Role –play –interpersonal communication –Fax, email –Transactional communication –ice breaker.
9. Verbal and analytical skills–interactive CD-ROM.

10. Writing and Editing –demonstration.
11. Writing popular articles.
12. Project Report –discussion on a mutilated cloze text.
13. Project Report –Role play.
14. Scientific articles –Selection, organization and presentation—a discussion.
15. Writing a scientific article.

REFERENCE BOOKS

1. Anderson, L. W. and David R. Krathwohl, D. R., et al (Eds..) (2001) A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Allyn & Bacon. Boston, MA (Pearson Education Group)
2. David H. Janessen (2009) Learning to solve problems: A hand bool for solvogng learning Environments Routledge. USA
3. Gay Lumsden, Donald Lymysaden, CarolynWieytsstoff (2009) Communicating in Groups and Teams: Sharing Leadership: Wadsw oth Cengage Learning. Boston.USA
4. Michael, Michalko.Thinkertoys: A Handbook of Creative-Thinking Techniques (2nd Edition) (June 8, 2006) Ten Speed Press. Canada
5. Sudarsanam. R (1985) Development Education: Vibhuvan publishers. Coimbatore.

MAT18R112	Elementary Mathematics	L	P	C
		1	0	1

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

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.

HOR18R157	Communication Skills and Personality Development	L	P	C
		1	1	2

THEROY

Unit I

Structural Grammar: Introduction of Word Classes
 Structure of Verb in English
 Uses of Tenses

Unit II

Study of Voice
 Study of Conjunctions and Prepositions
 Sentence Patterns in English

Unit III

Spoken English: Conversations of different situations in everyday life
 The concept of stress
 Stress shift in words and sentences
 Silent letters in words and pronunciation of words with silent letters
 The basic intonation patterns

Unit IV

Reading and comprehension of general and technical articles
 Précis writing
 Summarizing ,Abstracting
 Individual and Group presentations
 Impromptu Presentation

Unit V

Public speaking
 Group Discussion.
 Organizing Seminars and Conferences.

PRACTICAL

1. Practical session of Word Classes
2. Identification verbs in sentences
3. Application of Tenses
4. Application of Voice
5. Exercises in Conjunctions
6. Exercises in Prepositions
7. Report writing
8. Letter writing (Formal letters)
9. Letter writing (Informal letters)
10. Exercise on Conversations of everyday life
11. Identification Silent letters in words
12. Identification of Intonation patterns

Text Book

1. Mohan Krishna and Meera Banerjee. 1990. *Developing Communication Skills*. Macmillan India Ltd. New Delhi.

Reference Books

1. Wren and Martin, S. Key to High School English Grammar and Composition- Chand and Company Ltd., New Delhi
2. Balasubramanian T. 1989. *A Text book of Phonetics for Indian Students*. Orient Longman, New Delhi.

HOR18R158	Fundamentals of Food Technology	L	P	C
		1	1	2

THEORY

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

SEMESTER II

HOR18R159	Tropical and Subtropical Fruits	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical 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.

HOR18R160	Tropical and Subtropical Vegetables	L	P	C
		2	1	3

THEORY

UNIT I

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economics of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and storage.

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 sweet pepper Moringa, amaranthus

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. Crops: Okra, cowpea, cluster bean, lab lab and snapbean. , basella and portulaca.

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: Cucurbitaceous crops.

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. Crops: Tapioca, sweet potato, yam, dioscorea, colocasia and Onion.

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.

HOR18R161	Introductory Crop Physiology	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical schedule

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

HOR18R162	Agro-meteorology and Climate Change	L	P	C
		1	1	2

THEORY

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.

HOR18R163	Weed and Water Management in Horticultural Crops	L	P	C
		2	1	3

THEORY

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.

HOR18R164	Principles of Genetics and Cytogenetics	L	P	C
		2	1	3

THEORY

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 Monod; 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 – CIB 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 F₂ and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; working out interference, coincidence and drawing genetic maps.

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.

HOR18R165	Fundamentals of Plant Pathology	L	P	C
		2	1	3

THEORY

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 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.

UNIT II

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 *Plasmodiophora brassicae* (club root), *Pythium* (damping off), *Phytophthora* (late blight).

3. Study of symptoms, fungal characters and host parasite relationships of *Plasmodiophora brassicae* (club root), *Pythium* (damping off), *Phytophthora* (late blight).
4. Study of symptoms, fungal characters and host parasite relationships of *Plasmodiophora brassicae* (club root), *Pythium* (damping off), *Phytophthora* (late blight).
5. Study of symptoms, fungal characters and host parasite relationships of *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 *Taphrina* (leaf curl), *Protomyces* (stem gall), *Capnodium* (sooty mould), *venturia* (scab) and *Mycosphaerella* (leaf spot).
8. 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).
9. Study of symptoms, fungal characters and host parasite relationships of *Erysiphe*, *Podosphaeria*, *Sphaerthea*, *Leveillula* (powdery mildew), *Puccinia*, *Uromyces*, *hemileia* (Rust) and *Ganoderma* (basal stem rot).
10. Study of symptoms, fungal characters and host parasite relationships of *Helminthosporium*, *Cercospora* (leaf spot), *Alternaria* ((leaf blight), *Colletotrichum* (Anthracnose) and *Gloeosporium* (fruit rot).
11. Study of symptoms, fungal characters and host parasite relationships of *Helminthosporium*, *Cercospora* (leaf spot), *Alternaria* ((leaf blight), *Colletotrichum* (Anthracnose) and *Gloeosporium* (fruit rot).
12. Symptoms of bacterial, viral and phytoplasma diseases – leaf spot, blight, canker, scab, crown gall, wilt and soft rot.
13. 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.
14. Biocontrol agents – mass production of *Trichoderma viride* and *Pseudomonas fluorescens*.
15. Preparation of leaf extracts, oil emulsion of neem and other botanicals and antiviral principles.
16. Survey and assessment of foliar crop diseases, post harvest diseases, soil borne and viral diseases.

TEXT BOOKS

1. Agrios, G.N. Plant Pathology, 2008 5th 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.

HOR18R166	Fundamentals of Extension Education	L	P	C
		1	1	2

THEORY

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. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise).
11. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise).
12. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise).
13. Visit to a village to collect data (Group exercise).
14. Visit to a village to collect data (Group exercise).
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.

HOR18R167	Soil Fertility and Nutrient Management	L	P	C
		1	1	2

THEORY

UNIT I

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils – characteristics and management.

UNIT II

Soil organic matter, Role of microorganisms in organic matter- decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition, soil buffering capacity.

UNIT III

Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions. Deficiency symptoms, visual diagnosis. Plant nutrient toxicity symptoms and remedies measures. Soil test crop response and targeted yield concept.

UNIT IV

Biofertilizer. Nutrient use efficiency and management. Secondary and micronutrient fertilizer. Fertilizer control order. Manures and fertilizers classification and manufacturing process. Properties and fate of major and micronutrient in soils. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity.

UNIT V

Agriculture – Nano fertilizers – Nano-herbicides – Nano-pesticides – Seed technology - Nanotechnology in Food Systems – Nano foods, Nano-encapsulation of functional foods, Nano-packaging, Quality assessment. Nanotechnology applications in Energy and Environment - Applications in Health Sciences and Nanotoxicology -. Social, Economic and Ethical Issues in Nanotechnology.

Practical schedule

1. Analysis of soil organic matter.
2. Analysis of available N, P, K in soil.
3. Analysis of Micronutrients and interpretations.
4. Gypsum requirement of saline and alkali soils.
5. Lime requirement of acid soils.
6. Estimation of organic carbon content in soil.
7. Determination of Boron and chlorine content in soil.
8. Determination of Calcium, Magnesium and Sulphur in soil.
9. Sampling of organic manure and fertilizer for chemical analysis.
10. Physical properties of organic manure and fertilizers.
11. Physical properties of organic manure and fertilizers.
12. Total nitrogen in urea and farm yard manure.
13. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer.
14. Estimation of water soluble P₂O₅, Ca and S in SSP, Lime and Gypsum.
15. Estimation of Potassium in MOP/SOP and Zinc in zinc sulphate.
16. Visiting of fertilizer testing laboratory and Nanotechnology laboratory.

TEXT BOOKS

1. Yawalkar K S, Agarwal JP and Bokde S, 1992. Manures and Fertilizers. Agri. Horticultural Publishing House, Nagpur.
2. Tandon HLS, 1994. Fertilizers Guide. Fertilizers Development Consultation Organization, New Delhi.
3. Seetharaman S, Biswas B C, Yadav D S and Matheswaru S. Usage 1996. Hand Bookon Fertilizers. Oxford and IBH Publishing Company, New Delhi.
4. Nano: The essentials understanding nanoscience and Nano- T. Pradeep - 2009 - Mc Graw Hill.
5. Nano materials - B. Viswanathan - 2009 - Narosa.

REFERENCE BOOKS

1. The fertilizer Association of India, Shaheed Jit singh marg, New Delhi, 1985. Fertilizer control order.
2. Ranjan Kumar Basak, 2000. Fertilizers A Text book. Kalyani publishers, New Delhi.
3. The Pesticide Manual, A – World Compendium. Sree Ramulu US, 1991. Chemistry of Insecticides. Oxford and IBH Publishing and Fungicides Company, New Delhi.
4. Introduction to nanotechnology - Charles P. Poole; Frank J. Owens – 2008

HOR18R168	Livestock and Poultry: Production and Management.	L	P	C
		1	1	2

THEORY

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

SEMESTER III

HOR18R251	Fundamentals of Entomology	L	P	C
		2	1	3

THEORY

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 and study of digestive system.
7. Study of male and female reproductive systems.
8. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota -Odonata and Ephemeroptera and Phasmida.
9. Dictyoptera, Dermaptera, Embioptera, Orthoptera (Acrididae, Tettigonidae, Gryllidae and Gryllotalpidae), Mallophaga and Siphunculata.
10. 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).
11. Observing the characters of orders Thysanoptera and Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae).
 12. Observing the characters of Hymenoptera (Tenthredinidae, Apidae, Sphecidae
 13. Vespidae, Formicidae, Xylocopidae, Chalcididae Megachilidae Ichneumonidae, Bethyridae, Braconidae, Agaonidae, Evaniidae, Encyrtidae, Eulophidae and Trichogrammatidae).
 14. 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).
 15. Observing the characters of Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochliidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae and Hesperidae).
 16. 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 Devices Springer Dordrechse, New York.
4. Snodgrass. R.E. 1993. Principles of Insect Morphology, Cornell University Press, New York

HOR18R252	Temperate Vegetable Crops	L	P	C
		1	1	2

THEORY

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, sprouting broccoli, Brussels sprout and Chinese cabbage, Chow chow.**

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.**

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.

HOR18R253	Principles of Plant Breeding	L	P	C
		2	1	3

THEORY

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.

HOR18R254	Environmental Studies and Disaster Management	L	P	C
		2	1	3

THEORY

UNIT I

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources, b) Water resources, c) Mineral resources, d) Food resources, e) Energy resources, f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

UNIT II

Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT III

Biodiversity and its conservation: Introduction, definition. Biodiversity at global, National and local levels. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards.

UNIT IV

Definition, introduction to natural and manmade disaster, Levels of disasters, History on natural disasters in India, Disaster phenomena and events (global national and regional), Concept of risk, hazard, and vulnerability.) Hydro meteorological Disasters: Floods and flash floods: General characteristics, causes, nature and frequency of flooding, floodplains, flood hydrographs, river and coastal floods, lake outburst, cloud burst; Droughts: Causes, classification – agricultural, hydrological and meteorological droughts; drought frequency and intensity; Cyclones.

UNIT V

Tsunami: Structure and nature of cyclones and tsunami, characteristics, factors, hazard potential; Frost, heat and cold waves: cause, intensity and extent of frost, heat and cold waves and its impact on agricultural crops. Geological disaster - Landslides: causes, susceptibility to landslides and slope failures; Manmade Disasters: chemical hazards, nuclear hazards, forest fire, oil spill and road accidents.

PRACTICAL SCHEDULE

1. Collection, processing and storage of effluent samples.
2. Determination of Biological oxygen demand(BOD) in effluent sample.
3. Determination of Chemical oxygen demand (COD) in effluent sample.
4. Estimation of dissolved oxygen in effluent samples.
Determination of sound level meter.
5. Estimation of respirable and non-respirable dust in the air by using portable dust sampler.
6. Determination of total dissolved.
7. Pollution case studies. Case Studies - Field work.
8. Visit to a local area to document environmental assets river and forest.

9. Visit to a local area to document environmental assets grassland, hill/ mountain.
10. Visit to a local polluted site-Urban/Rural - Visit to a local polluted site- Industrial/ Agricultural.
11. Study of common plants, common insects and common birds.
12. Study of simple ecosystems- pond, river and hill slopes.
13. Pollution case studies - Case Studies- Field work: Visit to a local area to document environmental assets hill/ mountai.
14. Pollution case studies - Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland.
15. Visit to a local polluted site-Urban/Rural/Industrial/ Agricultural, study of common plants, insects, birds.
16. Visit to a local polluted site- study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE BOOKS

1. Frame,B., Y.Medury and Y.Joshi (eds.). 1992. Global climate change – Science, Impactand Response. Proc. Indo British symposium on climate change, 15 - 17,Jan. 1992, New Delhi, 267pp.
2. Lal. D.S., 2012. Climatology. Published by Shradha Pustak Bhavan, Allahabad. ISBN:13–978 81 862 04122. 448 pp.
3. De. A.K., 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp.
4. Dhar Chakrabarti. P.G., 2011. Disaster management & climate change - India’s risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Banaalore. 36 pp.

HOR18R255	Temperate Fruit Crops	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical schedule

1. Nursery Management Practices.
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 fruit crops.
6. Identification of physiological disorders and remedies in 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. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi.
3. Chattopadhyay, T.K., 2001. A Text Book on Pomology (4 volumes) Kalyani Publishers, Ludhiana.
4. Mitra S.K, Rathore D.S and Bose T .K. 1992. Temperate Fruit Crops. Horticulture and Allied Publishers, Calcutta.

REFERENCE BOOKS

1. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
2. Bandyopadhyay F.A. and Sharma M.K. 2010. Advances in Temperate Fruit Production. Kalyani Publishers. B-1/292, Rajinder Nagar, Ludhiana-141008.
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.

HOR18R256	Commercial Floriculture	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical 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 - Rose, jasmine and tuberose- extraction of floral concrete – lecture / Field visit
16. 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.

HOR18R257	Elementary Plant Biotechnology	L	P	C
		1	1	2

THEORY

UNIT I

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement: Totipotency and Morphogenesis, Nutritional requirements of in-vitro cultures; Techniques of In-vitro cultures.

UNIT II

Micropropagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements; Somaclonal variation.

UNIT III

Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement.

UNIT IV

Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement.

UNIT V

Nanotechnology: Definition and scope, types of nano material and their synthesis, green synthesis. Tools and techniques to characterize the nano particles. Nano-biotechnological applications with examples, Nano toxicology and safety.

Practical Schedule

1. Requirements for Plant Tissue Culture Laboratory.
2. Techniques in Plant Tissue Culture.
3. Media components and preparations.
4. Sterilization techniques and Inoculation of various explants.
5. Aseptic manipulation of various explants.
6. Callus induction and Plant Regeneration.
7. Micro propagation of important crops.
8. Anther, Embryo and Endosperm culture.
9. Hardening / Acclimatization of regenerated plants.
10. Somatic embryogenesis and synthetic seed production.
11. Isolation of protoplast and demonstration of Culturing of protoplast.
12. Demonstration of Isolation of DNA.
13. Demonstration of Gene transfer techniques, direct and indirect methods.
14. Demonstration of Confirmation of Genetic transformation.
15. Demonstration of gel- electrophoricsis techniques.
16. Green synthesis of nano particles and their size characterization.

TEXT BOOKS

1. Singh, B D, 2004. Biotechnology Expanding Horizons 2nd Edn. Kalyani Publishers, New Delhi.
2. Gupta, P.K., 2015. Elements of Biotechnology 2nd Edn. Rastogi and Co., Meerut.
3. Razdan M K, 2014. Introduction to plant Tissue Culture 2nd Edn. Science Publishers, inc. USA.
4. Gautam V K, 2005. Agricultural Biotechnology. Sublime Publications.
5. Thomar, R.S., Parakhia, M.V., Patel, S.V. and Golakia, B.A., 2010. Molecular markers and Plant Biotechnology, New Publishers, New Delhi.

REFERENCE BOOKS

1. Purohit, S.S., 2004. A Laboratory Manual of Plant Biotechnology 2nd Edn. Agribios, India.
2. Singh, B.D. 2012. Plant Biotechnology. Kalyani publishers, Ludhiana.
3. Bilgrami, K.S. and Pandey, A.K.1992. Introduction to Biotechnology. CBS Pub. New Delhi.
4. Gupta, P.K. 1994. Elements of Biotechnology. Rastogi Pub. Meerut.
5. Chahal, G.S. and Gosal, S.S.2003. Principles and Procedures of Plant Approaches Breeding Biotechnological and Conventional. Narosa Publishing House, New Delhi.

HOR18R258	Economics and Marketing	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

Marketing- definition – Marketing Process – Need for marketing – Role of marketing — Marketing functions – Classification of markets – Marketing of various channels – Price spread – Marketing Efficiency – Integration – Constraints in marketing of agricultural produce. Market intelligence – Basic guidelines for preparation of project reports- Bank norms – Insurance – SWOT analysis – Crisis management.

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. Visit to different Markets.
15. Functioning of E-markets
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.

HOR18R259	Principles of Quality Seed Production	L	P	C
		1	1	2

THEORY

UNIT I: Factors affecting seed production and quality

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: Seed Treatment and storage

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

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

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 Legislation

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 pre sowing seed management techniques (dormancy breaking treatment, priming, coating and pelleting).
4. Identification of contaminants and practising roguing.
5. Studies on physiological and harvestable maturity and seed extraction.
6. Practicing field counting.
7. Visit to seed processing unit.
8. Visit to Directorate of Seed Certification.
9. Visit to grow out test plots.
10. Seed sampling, mixing and dividing.
11. Analysis of physical purity and estimation of seed moisture.
12. Conducting germination tests.
13. Seedling evaluation and seed health test.
14. Practicing quick viability test.
15. Practicing seed vigour test.

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.

HOR18R260	Principles of Landscape Architecture	L	P	C
		1	1	2

THEROY

UNIT I

Historical Importance of Indian gardens, Gardens of ancient world, Definitions, Famous gardens of India and abroad, formal, informal, free style and wild gardens, basic themes of gardens viz. circular, rectangular and diagonal themes, Steps in preparation of garden design.

UNIT II

Use of Auto CAD and Arch CAD in designing gardens. Factors affecting landscape design viz., intial approach, view, human choice, simplicity, topography etc., Principles of Landscape gardens viz. Axis, rhythm, balance, time and light, space, texture, form, mass effect, focal point, mobility, emphasis, unity and harmony etc..

UNIT III

Elements of landscape gardens viz. tangible and intangible elements. Bio-aesthetic planning, definition, objectives, Planning and designing of home gardens, colonies, country planning, urban landscape.

UNIT IV

Development of institutional gardens, planning and planting of avenues, beautifying schools, railway lines, railway stations, factories, bus stands, airports corporate buildings, dams, hydro electric stations, river banks, play grounds, Gardens for places of religious importance viz. temples, churches, mosques, tombs etc.,

UNIT V

Importance, features and establishment of English garden , Japanese gardens , Mughal, gardens, French and Persian garden, Italian gardens, Hindu gardens and Buddhist gardens, Xeriscaping, definition, principles and practice.

Practical schedule

1. Study of garden equipments.
2. Study of Graphic language.
3. Use of drawing equipments.
4. Graphic symbols and notations in landscaping designing.
5. Study and designing of different styles of gardens.
6. Study and designing of gardens based on different themes.
7. Designing gardens using Auto-cad/archi-cad.
8. Designing gardens for home, traffic islands, schools and colleges.
9. Designing gardens for public buildings and factories.
10. Designing gardens for railway stations, air ports, temples, churches.
11. Designing gardens for play grounds, corporate buildings/ malls.
12. Designing and planting of avenues for state and National highways.
13. Design and establishment of Japanese gardens.
14. Design and establishment of English gardens.
15. Design and establishment of Mughal gardens.

16. Visit to public, institutional and botanical gardens.

TEXT BOOKS

1. A.K. Tiwari and R. Kumar. 2012. *Fundamentals of ornamental horticulture and landscape gardening*. New India.
2. H.S.Grewal and Parminder Singh. 2014. *Landscape designing and ornamental plants*.

REFERENCE BOOKS

1. R.K. Roy. *Fundamentals of Garden designing*.2013.New India publishing agency, Pitampura, New Delhi.
2. Rajesh Srivastava. 2014. *Fundamentals of Garden designing*. Agrotech press, Jaipur, New Delhi.
3. L.C. De. *Nursery and landscaping*.2013. Pointer publishers, Jaipur India.
4. Arora, J.S. 2006. Kalyani publishers, Ludhiana. *Introductory Ornamental Horticulture*. Kalyani publishers, Ludhiana.
5. Randhawa, G.S. and Amitabha Mukhopadhyay 2004. *Floriculture in India*. Allied Publishers Pvt. Ltd., New Delhi.

SEMESTER IV

HOR18R261	Soil, Water and plant Analysis	L	P	C
		1	1	2

THEORY

UNIT I

Methods of soil and plant sampling and processing for analysis. Characterization of hydraulic mobility – diffusion and mass flow. Renewal of gases in soil and their abundance.

UNIT II

Methods of estimation of oxygen diffusion rate and redox potential. Use of radio tracer techniques in soil fertility evaluation. Soil micro-organisms and their importance.

UNIT III

Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Chemical and mineral composition of horticultural crops. Leaf analysis standards, index tissue, interpretation of leaf analysis.

UNIT IV

Values Quality of irrigation water. Radio tracer technology application in plant nutrient studies. Rapid tissue tests for soil and plant.

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 horticulture. Management of poor quality irrigation water in crop management. Soil and Water pollution.

Practical Schedule

1. Introduction to analytical chemistry.
2. Collection and preparation of soil for analysis.
3. Collection and preparation of water for analysis.
4. Collection and preparation of plant samples for analysis.
5. Determination of pH.
6. Determination of electrical conductivity.
7. Determination of sodium adsorption ratio and exchangeable sodium percentage of soils.
8. Estimation of available macro and micronutrient elements in soils and their contents in plants.
9. Irrigation water quality analysis.
10. Determination of pH and EC in irrigation water samples,
11. Determination of Carbonates and bicarbonates in soil and irrigation water,
12. Determination of Calcium and Magnesium in soil and irrigation water.
13. Determination of N, P and K in soil and plant sample.
14. Determination of Ca, Mg and micronutrients in Soil in plant samples.
15. Determination of Sodium and Potassium in irrigation water.
16. Determination of Chlorine and Boron in irrigation water.

TEXT BOOKS

1. H.L.S. Tandon. 2013, Methods of analysis of soil, plant, water and fertilizers. FDCO, New Delhi.
2. Yawalkar, K. S. Agarwal, J. P. and Bokde, S., 1977. Manures and Fertilizers. Agri-Horticultural Publishing House, Nagpur.
3. Sehgal J. A., 2005. Textbook of Pedology Concepts and Applications. Kalyani Publishers, New Delhi.
4. Jaiswal, P.C., 2006. Soil, Plant and Water Analysis (2nd Edition), Kalyani Publishers, Ludhiana.
5. Jackson M. L, 1967. Soil Chemical Analysis, Oxford and IBH Publishing Co., New Delhi.

REFERENCE BOOKS

1. Richards L A, 1968. Diagnosis and Improvement of Saline and Alkaline Soils. Oxford and IBH publishing Co. New Delhi (USDA Hand Book No. 60)
2. Chopra S.C. and Kanwar, J. S 1976. Analytical Agricultural Chemistry, Kalyani Publishers, Ludhiana.
3. C. S. Piper. 2014, Soil and plant analysis, Scientific publishers India.
4. Mushtaq A. Wan., 2014, Soil, plant and water analysis manual. Agrotech publishing company, Udaipur.
5. P. K. Gupta., 2013, Soil, plant, water and fertilizer analysis. Agrobios, India.
6. M. V. Durai., 2014, Hand book of Soil, plant, water, fertilizers and manure analysis. New India Publishing Agency.

HOR18R262	Spices and Condiments	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

UNIT III

Importance, origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing, storage and value added products. **Crops:** Clove, Nutmeg, Cinnamon, All spice, Curry leaf, Tamarind and Kokum.

UNIT IV

Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products. **Crops:** Coriander, Fenugreek, Fennel, Cumin, Dill, Celery, Bishop weed, Rosemary, Thyme, Vanilla, Saffron, Asafoetida.

UNIT V

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

Practical schedule

1. Identification of major spices and Condiments crops varieties.
2. Rapid multiplication technique and nursery management in black pepper.
3. Seed spices – main field preparation – manuring - use of herbicides.
4. Seed treatment – sowing and irrigation.
5. Turmeric and Ginger - main field preparation – rhizome selection - treatment and planting - nutrient, water and weed management.
6. Use of PGR - maturity indices, harvesting and curing.
7. Tamarind, Curry leaf - practices in propagation - nursery preparation and maintenance
8. Tamarind, Curry leaf - Planting - nutrient, water and weed management.
9. Use of PGR - maturity indices and harvest.
10. Tree spices – Practices in propagation – cropping – harvest.

11. Visit to Spices Gardens.
12. Harvesting, curing and cleaning of seed spices.
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. Ravindran, P.N., K.N. Shiva, Johny. A. Kallapurackal and K. Nirmalbabu. 2006. Advances in Spices Research. Agrobios, India.

REFERENCE BOOKS

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

HOR18R263	Plantation Crops	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical Scedule

1. Description and identification of coconut varieties.
2. Selection of coconut and arecanut mother palm and seed nut.
3. Planting of seed nuts in nursery.
4. Layout and planting of coconut, arecanut, oil palm.
5. Layout and planting of cashew nut, cacao gardens.
6. Manuring, irrigation; mulching for plantation crops.
7. Raising masonry nursery for palm.
8. Nursery management in cacao.
9. Description and identification of species and varieties in coffee
10. Coffee- harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry Collection, seed extraction, treatment and sowing of coffee.

11. Coffee- harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry Collection, seed extraction, treatment and sowing of coffee.
12. Epicotyl, softwood, grafting and top working in cashew.
13. Working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc.,
14. Working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc.,
15. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea.
16. Visit to coconut nursery.

TEXT BOOKS

1. Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I. 1997. Introduction to spices, Plantation crops and Aromatic plants. Oxford & IBH, New Delhi.
2. Thampan, P.K. 1981. Hand Book of Coconut Palm. Oxford IBH, New Delhi.
3. Nair 1979. Cashew. CPCRI, Kerala y Wood, GAR, 1975. Cacao. Longmen, London.

REFERENCE BOOKS

1. Ranganadhan, V. 1979. Hand Book of Tea Cultivation. UPASI Tea Research Station, Cinchona.
2. Thompson, P.K. 1980. Coconut. Oxford & IBH Publishing Co. Ltd., New Delhi.

HOR18R264	Breeding of Fruit and Plantation Crops	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

Breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – in vitro breeding tools in Cashew, cocoa.

UNIT III

Breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – in vitro breeding tools in Rubber, oilpalm and palmyrah.

UNIT IV

Breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – in vitro breeding tools in Tropical and Sub tropical fruits.

UNIT V

Breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – in vitro breeding tools in Temperate and arid zone fruits.

Practical schedule

1. Exercises on floral biology, pollen viability of fruit crops.
2. Exercises on floral biology, pollen viability of plantation crops.
3. In vitro breeding tools for fruit crops.
4. In vitro breeding tools for plantation crops.
5. Emasculation and pollination procedures.
6. Hybrid seed germination; raising and evaluation of segregating populations.
7. Use of mutagens to induce mutations and polyploidy in Mango, Banana, Citrus.
8. Use of mutagens to induce mutations and polyploidy in Mango, Banana, Citrus.
9. Use of mutagens to induce mutations and polyploidy in Grapes, Guava, Sapota.
10. Use of mutagens to induce mutations and polyploidy in Papaya, Custard apple.
11. Use of mutagens to induce mutations and polyploidy in Aonla, Ber, Litchi, Pomegranate.
12. Use of mutagens to induce mutations and polyploidy in Jamun, Arecanut, Coconut.
13. Use of mutagens to induce mutations and polyploidy in Pistchonut, Apple, Pear, Plum.
14. Use of mutagens to induce mutations and polyploidy in Pistchonut, Apple, Pear, Plum.
15. Use of mutagens to induce mutations and polyploidy in Peach, Apricot and Strawberry.
16. Field visit.

TEXT BOOKS

1. Nijar 1985. Fruit breeding in India, Oxford & IBH Publishing Co. New Delhi.
2. Anil Kumar Shukla 2004. Fruit breeding approaches & Achievements. International Book Distributing Co. New Delhi.

REFERENCE BOOKS

1. Kumar, N. 1997. Breeding of Horticultural Crops, Principles and Practices. New India Publishing Agency, New Delhi.
2. Singh, B.D. 1983. Plant Breeding Principles and methods. Kalyani Publishers, New Delhi.

MAT18R212	Elementary Statistics and Computer Application	L	P	C
		2	1	3

THEORY

UNIT I

Introduction to statistics, limitations of statistics. Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data, construction of frequency distribution, tables, graphic representation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve average.

UNIT II

Measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadrilles, for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. Probability: Basic concept, additive and multiplicative laws.

UNIT III

Theoretical distributions, binominal, poison and normal distributions, sampling, basic concepts, sampling vs. complete enumeration parameter and statistic, sampling methods, simple random sampling and stratified random sampling. Tests of Significance: Basic concepts, tests for equality of means, and independent and paired t-tests, chi-square test for application of attributes and test for goodness of fit of Mendalian ratios.

UNIT IV

Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of simple linear regression, test of significance of correlation and regression coefficient. Experimental designs: Basic concepts, completely randomized design, randomized block design, latin square designs, factorial experiments, basic concepts, analysis of factorial experiments up to 3 factors – split plot design, strip plot design, long term experiments, plot size, guard rows.

UNIT V

Computer application: Introduction to computers and personal computers, basic concepts, operating system, DOS and Windows, MS Word- Features of word processing, creating document and tables and printing of document, MS Excel-Concept of electronic spreadsheet, creating, editing and saving of spreadsheet, inbuilt statistical functions and formula bar, MS Power point-preparation, presentation of slides and slide show. Introduction to programming languages, BASIC language, concepts, basic and programming techniques, MS Office, Win Word, Excel, Power point, introduction to multi-media and its application. Visual basic-concepts, basic and programming techniques, introduction to internet.

Practical schedule

1. Construction of frequency distribution table and its graphical representation.
2. Construction of frequency distribution table and its graphical representation.
3. Histogram, frequency polygon, frequency curve.
4. Bar chart, simple, multiple, component and percentage bar charts, pie chart.
5. Mean, mode for row and grouped data.
6. Percentiles, quadrille, and median for raw and grouped data.
7. Coefficient of variation.
8. 't' test for independent, with equal and unequal variants.

9. Paired 't' test.
10. Chi-Square test for contingency tables and theoretical ratios.
11. Chi-Square test for contingency tables and theoretical ratios.
12. Correlation and linear regression.
13. Studies on computer components – Basic language.
14. Visual basic, programming techniques.
15. MS Office.
16. Excel, power point.

TEXT BOOKS

1. Gupta, S. C. and Kapoor, V. K. 2014. Fundamentals of Mathematical Statistics. Sultan chand and sons. New Delhi.
2. Nageswara Rao, G. 2007. Statistics for Agricultural Sciences. B.S. Publications, Hyderabad.
3. Rangaswamy, R. 1995. A Text Book of Agricultural Statistics. New Age International Publishing Limited, Hyderabad.
4. Gupta, V. 2002. Comdex Computer Kit. Dream Tech Press, New Delhi.

REFERENCE BOOKS:

1. Parmar, A. Mathur, N. Deepti P .U. and Prasanna, V. B. 2000. Working with WINDOWS A Hands on Tutorial. Tata Mc Graw Hill Publishing Co., New Delhi.
2. Bandari, V. B., 2012. Fundamentals of Information Technology. Pearson Education, New Delhi.
3. Fundamentals of Computers. 2011. Pearson Education-ITL ESL, New Delhi.

HOR18R265	Farm Power and Machinery	L	P	C
		1	1	2

THEORY

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.

HOR18R266	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	L	P	C
		2	1	3

THEORY

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 synomones - role of pheromones in pest management. Insect growth regulators – moult inhibitors, JH mimics, insect antifeedants, repellants and botanicals in pest management. Biotechnology in pest management.

UNIT III

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

UNIT IV

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

UNIT V

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

Practical schedule

Identification of symptoms of damage and life stages of important

1. Pests of Mango.
2. Pests of citrus.
3. Pests of Sapota and papaya.
4. Pests of Pomegranate and amla.
5. Pests of Ber and apple.
6. Pests of Banana and grapevine.
7. Pests of Guava and jamun.
8. Pests of Peach, Pear and plum.

9. Pests of Citrus and Jack.
10. Pests of Coriander, onion and garlic.
11. Pests of chilli and curry leaf.
12. Pests of coconut and arecanut.
13. Pests of coffee, cocoa and tea.
14. Pests of cashew and rubber.
15. Pests of turmeric and tamarind.
16. Pests of cardamom, pepper and betelvine.

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. K. P. Srivastav and Y. S. Ahawat. Pest management in citrus.
2. Ramnivas Sharma. Identification and management of horticulture pest.
3. Metcalf, R. Land Luckman, W.H. 1982. Introduction to Insect pest management.
4. Wiley InterScience Publishing, New York y Butani, D.

HOR18R267	Dry land Horticulture	L	P	C
		1	1	2

THEORY

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.

HOR18R268	Organic Farming	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical schedule

1. Resource inventory of organic farm- Soil sampling and analysis for organic carbon and pesticide residues / contaminants.
2. Raising of green manures (Sunnhemp / Daincha / Fodder cowpea).
3. Incorporation of green manure – seed treatment and raising of Horticultural crops.
4. Hands on practice on preparatory cultivation; soil and water conservation methods.
5. Hands on experience on recycling techniques; bio-composting and vermicomposting.
6. Quantification of nutrients from organic sources and application of manures and bio-fertilizers.
7. Exposure visit to an organic farm to learn ITK based preparations.
8. Organic crop production and weed management.
9. Exposure visit to bio-pesticide and pheromone manufacturing units.
10. Organic crop production and pest management.
11. Exposure visit to bio-control agent (*Pseudomonas*, *Trichoderma* etc.,) production units
12. Organic crop production and diseases management.
13. Exposure on macro quality analysis of crop produces in laboratories.
14. Hands on training on grading, packaging and post-harvest management.
15. Exposure visit to organic market out lets.
16. Exposure visit to organic certification agencies / Directorate of Organic Certification, Tamil Nadu.

REFERENCE BOOKS

1. Nicholas lampkin 1994. Organic farming. farming press London.
2. Arunkumar sharma 2008. A Hand book of organic farming. Agrobios Publishers.
3. Dahama, A.K.2009. Organic farming for sustainable agriculture, Agrobros publishers.
4. Veeresh, G.K. 2010. Organic farming, Cambridge university press.
5. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.
6. Stockdale, E *et al.*, 2000. Agronomic and environmental implications of organic farming systems. *Advances in Agronomy*, 70, 261-327.

SEMESTER V

HOR18R351	Introduction to Major Field Crops	L	P	C
		1	1	2

THEORY

UNIT I

Definition of agriculture and agronomy–Factors affecting crop growth–climate and weather parameters– Soil fertility and productivity–tillage and tilth- objective and principles– different kinds of tillage.

UNIT II

Seeds and seed treatment–sowing and planting–different methods–crop geometry–manures and fertilizers – source, nutrient contents and methods of application – bio fertilizers – irrigation techniques for different soils and crops.

UNIT III

Weeds–classification of weeds–principles and methods of weed management–cropping systems–mono culture and multiple cropping–inter, mixed, relay, strip and multitier cropping.

UNIT IV

Package of practices for important field crops–rice, maize, pulses–black gram, green gram and red gram–oilseeds–soybean, groundnut and sunflower.

UNIT V

Package of practices of cotton, Sugarcane, biofuel crops–Jatropha, sweet sorghum and sugar beet.

Practical Schedule

1. Acquiring skill on the organizational setup of the agricultural farm.
2. Identification of different crops in the crop cafeteria.
3. Identification of seeds, manures and fertilizers.
4. Visit to wet land to learn important cropping systems and Hi Tech nursery.
5. Visit to wet land to learn important cropping systems and Hi Tech nursery.
6. Visit to irrigated dry land to learn irrigated dry land cropping systems and irrigation methods.
7. Visit to dry land farm to learn dry land cropping systems.
8. Visit to NPRC, Vamban to learn about pulses and pulses based cropping systems.
9. Visit to SWMRI, Thanjavur to learn about important Rice based cropping systems.
10. Working out seed rate for different field crops.
11. Working out seed rate for different field crops.
12. Working out fertilizer schedule for major crops of wet, garden and dry land
13. Working out fertilizer schedule for major crops of wet, garden and dry land
14. Identification of meteorological instruments.
15. Identification of farm tools and implements.
16. Practicing different methods of seed treatment, sowing and planting.

TEXT BOOKS

1. Balasubramain, P and SP. Palniappan 2001. "Principles and Practices of Agronomy"
Agro bios publishers, Ludhiana.
2. Chandrasekaran, B. , K. Annadurai and E. Soma sundaram, 2007. A Text book of
Agronomy. Scientific publishers, Jodhpur.

REFERENCE BOOKS

1. Palaniappan, S.P and S. Sivaraman, 1998 (2nd edition) "Cropping systems in the tropics
principles and management", New Age international publishers, NewDelhi.
2. Sankaran, S. and V.T. Subbaiah Mudaliar, 1993."Principles of Agronomy". The
Bangalore printing and pub co. Bangalaore.
3. Yellamanda Reddy.T and G.H .Sankara Reddi.2005."Principles of Agronomy",
Kalyani publishers, Ludhiana.

HOR18R352	Medicinal and Aromatic Crops	L	P	C
		2	1	3

THEORY

UNIT I

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

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

UNIT II

Importance and uses, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements, harvesting and processing. **Crops:** Senna, Coleus, Aswagandha, Aloe, Centella, Insulin Plant, Noni and Indian long pepper.

UNIT III

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

UNIT IV

Importance and uses, origin, distribution, area and production, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield. **Crops:** Lemongrass, Citronella grass, Palmarosa, Lavender, Geranium and Patchouli.

UNIT V

Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, transplanting, spacing, manures and fertilizers, irrigation, interculture, harvesting and yield. **Crops:** Ambrette (Musk), Bursera, Ocimum, Davana, Vetiver, Mint and Sweet flag.

Practical 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.

HOR18R353	Introductory Agroforestry	L	P	C
		1	1	2

THEORY

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

HOR18R354	Breeding of Vegetables, Tuber and Spice Crops	L	P	C
		2	1	3

THEORY

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 Vegetables : tomato, brinjal, chilli, bhendi, bitter gourd, cucumber, watermelon, bottle gourd, peas and beans.

UNIT III

Floral biology, methods of breeding and achievements in crop improvement of vegetable crops : potato, tapioca, sweet potato, onion, carrot, cabbage and cauliflower.

UNIT IV

Floral biology, methods of breeding and achievements in crop improvement of spice crops: black pepper, cardamom, clove and nutmeg.

UNIT V

Floral biology, methods of breeding and achievements in crop improvement of spice crops: coriander, garlic, turmeric and ginger.

Practical schedule

1. Study of floral biology and pollination mechanism, practices in selfing and crossing in tomato and chillies.
2. Study of floral biology and pollination mechanism, practices in selfing and crossing in brinjal and bhendi.
3. Study of floral biology and pollination mechanism, practices in selfing and crossing in tapioca and sweet potato.
4. Study of floral biology and pollination mechanism, practices in selfing and crossing in peas and beans.
5. Study of floral biology and pollination mechanism, practices in selfing and crossing in bitter gourd, watermelon and cucumber.
6. Study of floral biology and pollination mechanism, practices in selfing and crossing in onion, amaranth and annual moringa.
7. Study of floral biology and pollination mechanism, practices in selfing and crossing in coriander.
8. Study of floral biology and pollination mechanism, practices in selfing and crossing in Spices.
9. Study of mutagenic treatments and various methods of mutation.
10. Study of mutagenic treatments and various methods of mutation.
11. Study of polyploidy and methods of development of polyploids.
12. Exploitation of heterosis and techniques of F₁ hybrid production in self-pollinated crops.

13. Exploitation of heterosis and techniques of F₁ hybrid production in cross-pollinated crops.
14. Variety release, procedures involved and DUS testing.
15. Variety release, procedures involved and DUS testing.
16. Field Visit.

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.

HOR18R355	Diseases of Vegetables, Ornamental and Spice Crops	L	P	C
		2	1	3

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Post harvest diseases of vegetables and ornamental crops, 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 tomato and brinjal.
2. Diseases of cucurbits and crucifers.
3. Diseases of cucurbits and crucifers.
4. Diseases of beans, peas and potato.
5. Diseases of cassava and sweetpotato.
6. Diseases of radish and beet root.
7. Diseases of fenugreek and turmeric.
8. Diseases of yam and colocasia.
9. Diseases of onion, garlic and chilli.
10. Diseases of pepper and betelvine.
11. Diseases of cumin and cardamom.
12. Diseases of nutmeg, coriander and clove.
13. Diseases of Jasmine, Rose and crossandra.
14. Diseases of Jasmine, Rose and crossandra.

15. Diseases of tuberose, gerbera and anthurium.
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 Mashkooor 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.
7. Godara S.L., BBS Kapoor, B.S. Rathore. Disease management of spice crops-, Madhu Publications.
8. Sohi, H.S. 1992. Diseases of Ornamental plants in India. ICAR, New Delhi.

HOR18R356	Ornamental Horticulture	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical 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. Dry flower technology – practice, preparation of floral crafts and cards.
11. Practicing landscape design and plan – home and industrial garden.
12. Study of Bonsai techniques, Bonsai practicing and training.
13. Study of Bonsai techniques, Bonsai practicing and training.
14. Visit to nurseries and floriculture units.
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 Distributors, Jaipur.
3. Bose T.K., B. Chowdhury and S.P. Sharma 2001. Tropical garden plants in colour. Horticulture and Allied Publishers, Kolkata.
4. Auto CAD – 2010 Edition.

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. Goplasamy Iyengar. 1990. Complete gardening in India. IBH. Bangalore.

HOR18R357	Growth and Development of Horticultural Crops	L	P	C
		1	1	2

THEORY

UNIT I

Growth and development-definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves.

UNIT II

Crop development and dynamics (Case studies of annual/perennial horticultural crops), growth analysis in horticultural crops. Plant bio-regulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants.

UNIT III

Basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering, photoperiodism-long day, short day and day neutral plants.

UNIT IV

Vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning-source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops.

UNIT V

Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

Practical schedule

1. Estimation of photosynthetic potential of horticultural crops.
2. Estimation of leaf area index.
3. Growth analysis parameters.
4. Estimation of harvest index.
5. Bioassay of plant hormones.
6. Identification of synthetic plant hormones and growth retardants.
7. Identification of synthetic plant hormones and growth retardants.
8. Preparations of hormonal solution and induction of rooting in cuttings.
9. Preparations of hormonal solution and induction of rooting in cuttings.
10. Preparations of hormonal solution for ripening of fruits and control of flower and fruit drop.
11. Important physiological disorders and their remedial measures in fruits and vegetables.
12. Important physiological disorders and their remedial measures in fruits and vegetables.
13. Important physiological disorders and their remedial measures in fruits and vegetables.
14. Seed dormancy.

15. Seed germination.
16. Seed Dormancy breaking with chemicals and growth regulators.

TEXT BOOKS:

1. Salisbury. 2007. Plant Physiology. CBS. New Delhi. y Taiz, L. 2010. Plant Physiology. SINAUR. USA.
2. Zeiger. 2003. Plant Physiology. PANIMA. New Delhi. y Edward E. Durna. 2014. Principles of Horticultural Physiology. CABI, UK.
3. Delvin, R.M . 1986. Plant Physiology. CBS. Delhi. y Richard, N. Arteca. 2004. Plant Growth Substances. CBS. New Delhi.
4. Jacobs, W. P. 1979. Plant Hormones And Plant Development. Cambridge Univ. London. y Basra, A. S. 2004. Plant Growth Regulators In Agriculture & Horticulture. HAWARTH press. New York.
5. Lincoln Taiz and Eduards Zeiger (5th Edition). Plant physiology. Sinauer Associates, Inc.

REFERENCE:

1. Noggle G.R and Fritz T.G.1944. Introductory Plant Physiology.
2. JKA Bleasdale, Plant Physiology in relation to Horticulture y Amarjit Basra, Plant Growth Regulators in Agriculture and Horticulture: Their role & Commercial Uses
3. C.Rajendran, K.Ramamoorthy and S. Juliet Hepziba, Nutritional and Physiological Disorders in Crop Plants

HOR18R358	Nematode pests of horticultural crops and their Management	L	P	C
		1	1	2

THEORY

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Nematode diseases of fruits (banana, citrus, grapevine, papaya) – vegetables (tomato, brinjal, bhendi, chilli, potato) - spices (turmeric, pepper, cardamom) flowers (crossandra, rose, jasmine, tuberose) plantation crops (tea, coffee, betel vine) mushroom, medicinal and aromatic plants and nematode problem in protected cultivation.

Practical schedule

1. Sampling techniques for nematode assay.
2. Processing of soil samples for extraction of active nematodes by Cobb's method
3. Extraction of nematodes by centrifugal floatation and extraction of cyst nematodes.
4. Extraction of nematodes from plant samples.
5. Staining techniques, direct examination and Blender technique.
6. Killing, fixing, preservation and counting of nematodes.
7. Processing and mounting of nematodes.
8. Observation of morphological characters of Tylenchida (*Hoplolaimus*) and Dorylaimida (*Xiphinema*)
9. Identification of nematodes *Helicotylenchus*, *Tylenchorhynchus*, *Hoplolaimus*.
10. Identification of nematodes *Pratylenchus*, *Longidorus*, *Xiphinema*.
11. Identification of nematodes *Hemicriciconemoides* / *Hemicyclophora* and *Tylenchulus* and *Aphelenchoides*.
12. Study of life stages of *Meloidogyne* and *Globodera*
13. Study of life stages of *Rotylenchulus* and *Radopholus*

14. Nematode disease symptoms in fruit crops.
15. Nematode disease symptoms in vegetables, spices, flower crops and medicinal plants.
16. Nematicides, bio-control agents, application methods and calculation of dosages.

TEXT BOOKS

1. Jonathan, E.I. 2010. Fundamentals of Plant Nematology, Devi Publications, Tiruchirapalli. P. 232.
2. Ravichandra, N.G. 2008. Plant Nematology. I.K. International Publishing House, New Delhi. P 688.

REFERENCE BOOKS

1. Bhatti, D.S. and R.K.Walia. 1992. Nematode pests of crops, CBS Publishers and Distributors, Delhi, P381.
2. Goodey, J.B. 1963. Technical Bulletin No 2 – Laboratory methods for work with plant and soil nematode., Ministry of Agriculture, Fisheries and food, London, p. 72.
3. Gopal Swarup and Dasgupta, D. 1986 Plant parasitic nematodes of India – Problems and progress, ICAR, New Delhi. 76.
4. Webster, J. 1972. Economic Nematology. Academic Press, London, p. 396. 5. Ravichandra, N.G. 2010. Methods and Techniques in Plant Nematology. PHI Learning Private Limited. New Delhi. 595.

HOR18R359	Orchard and Estate Management	L	P	C
		1	1	2

THEORY

UNIT I

Orchard & estate management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches.

UNIT II

Tropical, sub-tropical and temperate horticultural systems. competitive and complimentary effect of root and shoot systems. Biological efficiency of cropping systems in horticulture.

UNIT III

layout and management of an orchard- wind breaks - after-cultural practices – clonal orchards- Systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties.

UNIT IV

Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, Integrated nutrient and pest management. Utilization of resources constraints in existing systems.

UNIT V

Crop model and crop regulation in relation to cropping systems. Climate aberrations and mitigation measures of Horticultural crops.

Practical schedule

1. Practical Layout of different systems of orchard.
2. Study of different features of an orchard
3. Planning and layout of estate.
4. Use of mulch materials, organic and inorganic, moisture conservation, weed control.
5. Use of mulch materials, organic and inorganic, moisture conservation, weed control.
6. Layout of various irrigation systems.
7. Preparation of pits and planting of fruit plants
8. Practice in nursery management of tea, application of fertilizers,
9. Identification of nutrient deficiencies, foliar feeding of nutrients, mulching and weed management in tea.
10. Identification of nutrient deficiencies, foliar feeding of nutrients, mulching and weed management in tea.
11. Estate management, budgeting, preparation of project for establishment of tea estates.
12. Identification and correction of nutritional and physiological disorders
13. Study of bearing habits in tree crops.
14. Study of bearing habits in tree crops.
15. Visit to private orchards and cold storage unit.
16. Visit to various estates in the Nilgiris located at different altitudes.

TEXT BOOKS

1. Kumar, 1990. Introduction to Horticulture crops. Rajyalakshmi Publications, Nagercoil, Tamilnadu.
2. Palaniappan, S.P. and Sivaraman, K. 1996. Cropping systems in the Tropics. New age International (P) Ltd., Publishers, New Delhi.
3. Shanmugavelu, K.G.1989. Production Technology of Fruit Crops. Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.
4. WS. Dhillon and Bhatt. 2011. Fruit Tree Physiology. Narendra Publishing House, y New Delhi.

REFERENCE BOOKS

1. B .C. Mazumdar. 2004. Principles and Methods of Orchard Establishment. Daya Publishing House, New Delhi.
2. T. Pradeep Kumar, B. Suma, Jyothi Bhaskar and K.N.Satheson. 2008. Management of Horticultural Crops. New India Publishing Agency, New Delhi.
3. B .C. Mazumdar. 2004. Orchard Irrigation and Soil Management Practices Daya Publishing Agency, New Delhi. Daya Publishing Agency, New Delhi.

HOR18R360	Potato and Tuber Crops	L	P	C
		1	1	2

THEORY

UNIT I

Origin, area, production, economic importance and export potential of potato and tropical, sub-tropical and temperate tuber crops; description of varieties and hybrids.

UNIT II

Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies.

UNIT III

Use of chemicals and growth regulators; cropping systems. Harvesting practices, yield; economic of cultivation.

UNIT IV

Post- harvest handling and storage, field and seed standards, marketing.

UNIT V

Crops to be covered – potato, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, Jerusalem artichoke, horse radish and other under exploited tuber crops.

Practical Schedule:

1. Identification and description of potato and tropical tuber crops.
2. Identification and description of sub-tropical tuber crops.
3. Identification and description of temperate tuber crops.
4. Planting systems and practices.
5. Field preparation and sowing/planting.
6. Top dressing of fertilizers.
7. Intercultural operations
8. Use of herbicides and growth regulators.
9. Identification of nutrient deficiencies.
10. Physiological disorders.
11. Harvest indices and maturity standards.
12. Post-harvest handling and storage.
13. Marketing.
14. Seed collection.
15. Working out cost of cultivation.
16. Project preparation of commercial cultivation.

TEXT BOOKS:

1. S. Thamburaj. 2014. *Text book of vegetable, tuber crops and Spices*. ICAR, New Delhi.
2. B.R.Choudhary 2009. *A Text book on production technology of vegetables*. Kalyani Publishers. Ludhiana.

REFERENCE BOOKS:

1. T.K.Bose. 2002.*Vegetable Crops*. Nayaprakash. Kolkata.
2. P.Hazra. 2011. *Modern Technology in Vegetable Production*. New India Publishing Agency. New Delhi.
3. T.R.Gopal Krishnan, 2007. *Vegetable Crops*. New India Publishing Agency. New Delhi.
4. K.V.Kamath. 2007.*Vegetable Crop Production*. Oxford Book Company. Jaipur.
5. M.S.Dhaliwal, 2008.*Handbook of Vegetable Crops*. Kalyani Publishers. Ludhiana.
6. Singh, Umashankar, 2008. *Indian Vegetables*. Anmol Publications. Pvt.Ltd .New Delhi.
7. K S Yawalkar, 2004.*Vegetable crops in India*. Agri-Horticultural Pub. House. Nagpur.
8. M.K.Rana, 2008.*Olericulture in India*. Kalyani Publishers. Ludhiana.
9. P.Hazra. 2006.*Vegetable science*. Kalyani Publishers. Ludhiana.
10. Pratibha Sharma, 2007.*Vegetables: Disease Diagnosis and Biomanagement*. Avishkar Publishers. Jaipur.
11. Uma Shankar. 2008. *Vegetable Pest Management Guide for Farmers*. International Book Distribution Co. Publication. Lucknow.
12. Nath Prem. 1994.*Vegetables for the Tropical Regions*. ICAR New Delhi.
13. K.L.Chadha. 1993.*Advances in Horticulture*. Malhotra publishing house. New Delhi.
14. Shanmugavelu, K.G. 1989. *Production technology of vegetable crops*. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
15. Bose, T.K. 2003. *Vegetable Crops*. Naya udyog publishers, Kolkata. 2002. Naya Prakash, Calcutta.
16. Prem Singh Arya, 1999. *Vegetable Seed Production Principles*. Kalyani Publishers, New Delhi.
17. Choudhery, B., 1990. *Vegetables*. 8th edition. National Book Trust, New Delhi.
18. Vincent Lebot, 2008.*Tropical roots and tuber crops*. CAVI.
19. J.E. Bradshaw, 2010. *Root and tuber crops*. Springer Publications.

SEMESTER VI

HOR18R361	Apiculture, Sericulture and Lac culture	L	P	C
		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 Re search 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).

HOR18R362	Insect Pests of Vegetable, Ornamental and Spice Crops	L	P	C
		2	1	3

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, Nerium and 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, paprika, 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. Pest 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.

HOR18R363	Post Harvest Management of Horticultural Crops	L	P	C
		1	1	2

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.

HOR18R364	Seed Production Techniques in Horticulture Crops	L	P	C
		2	1	3

THEORY

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.

UNIT V

Seed production - coriander and fenugreek –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. Practising 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
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.

HOR18R365	Processing of Horticultural Crops	L	P	C
		1	1	2

THEORY

UNIT I

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

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.

HOR18R301	Horti-Business Management	L	P	C
		2	0	2

THEORY

UNIT I

Farm management - definition, nature, characteristics and scope. Farm management principles and decision making, production function, technical relationships, cost concepts, curves and functions – factors, product, relationship – factors relationship, product relationship, optimum conditions.

UNIT II

Principles of opportunity cost-equi-marginal returns and comparative advantages, time value of money, economic of scale, returns to scale, cost of cultivation and production, break even analysis, decision making under risk and uncertainty.

UNIT III

Farming systems and types. Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans. Organizations – forms of business organizations, organizational principles, division of labour. Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability.

UNIT IV

Direction – guiding, leading, motivating, supervising, coordination – meaning, types and methods of controlling – evaluation, control systems and devices. Budgeting as a tool for planning and control. Record keeping as a tool of control. Functional areas of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality.

UNIT V

Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ). Personnel management – recruitment, selection and training, job specialization. Marketing management – definitions, planning the marketing programmes, marketing mix and four P's. Financial management – financial statements and ratios, capital budgeting. Project management – project preparation evaluation measures.

REFERENCE BOOKS

1. Heady Earl O and Herald R. Jenson, 1954, Farm Management Economics. Prentice Hall, New Delhi S.S. Johl, J.R. Kapur ,2006, Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi
2. Karan Singh and Kahlon A S. Economics of Farm Management in India. Theory and Practice. New Delhi.
3. Allied L.M. Prasad. 2001. Principles and Practices of Management, 9th Ed. S. Chand & Sons, New Delhi.
4. Gittiner, J P., Economic analysis of agricultural projects. The John Hopkins University Press Baltimore, USA, 1982
5. Benjamin Mc Donald P 1985. Investment Projects in Agriculture- Principles and Case studies. Longman Group Limited. Essex. UK.
6. Pandey U K 1990. An Introduction to Agricultural Finance .Kalyani Publishers New Delhi.

HOR18R366	Entrepreneurship Development and Business Management	L	P	C
		1	1	2

THEORY

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.

HOR18R367	Diseases of fruit, Plantation, Medicinal and Aromatic crops	L	P	C
		2	1	3

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.

HOR18R368	Precision Farming and Protected Cultivation	L	P	C
		2	1	3

THEORY

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 foliages 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.

TEXT 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.

REFERENCE BOOKS

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.

SEMESTER VII

HOR18R481	STUDENT READY-Placement in Villages	L	P	C
		0	10	10

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.

HOR18R482	STUDENT READY-Placement in Industries	L	P	C
		0	10	10

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

SEMESTER VIII

ELP- I

HOR18R483	ELP-I	L	P	C
		0	10	10

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 necessities. 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.

HOR18R484	ELP-II	L	P	C
		0	10	10

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 Marketing 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.

NON CREDIT COURSES

NG18R1001 or 02 and 03	NSS or NCC and Physical Education	L	P	C
		0	2	2

National Service Scheme/National Cadet Corps (NC) (0+2)

Practical

NSS: Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition.

NCC:

Introduction to NCC, defense services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training – rifle bayonet, light machine gun, sten machine carbine, introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self-defense, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defense, leadership and NCC song.

Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules are regulations of important games, skill development in any one of the games – football, hockey, cricket, volleyball, ball badminton, throw ball, tennikoit. Participation in one of the indoor games. Report of the ICAR Fifth Deans' Committee – shuttle badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events – broad jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-today activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience. Importance of Asanas and Surya namaskar. Free hand exercises and Yoga. Recreation: definition, agencies promoting recreation, camping and recreation.

Note: Warming up and conditioning exercises are compulsory before the commencement of each class.

NG18R3005	Information and communication Technology	L	P	C
		1	1	2

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.

NG18R4001	EDUCATIONAL TOUR	L	P	C
		0	2	2

The students will visit various national and international institutions related to agriculture, horticulture, forestry and other allied fields in various regions of the country. 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:

S.No	Item	Marks
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