Experiential Learning Programme – Module
Protected Cultivation of High Value crops
The Dr. Y.S.R. Horticultural University (formerly A.P. Horticultural University) has been established during 2007 by the Government of Andhra Pradesh with the objectives of developing human resources and technology in accordance with the changing demands of Horticultural industry. The university offers a four year B.Sc. (Hons.) Horticulture Programme in four constituent colleges, namely Colleges of Horticulture at Venkataramannagudem (West Godavari District); Rajendranagar (Ranga Reddy District); Mojerla (Mahaboobnagar District) and Anantharajupet (Kadapa District), to produce graduates in Horticulture with professional competence and up to date knowledge.

To make the Horticultural Education more relevant to the ever changing scenario of the Horticulture in the State and to meet the challenges and users needs, the course curriculum of B.Sc.(Hons.) Horticulture is prepared during the year, 2008. Hence, this Lecture Outlines is brought out for the students of B.Sc (Hons.) Horticulture based on the revised syllabus in the light of the recommendations of the IV Deans Committee of ICAR giving due importance to location specific topics of the state. As per the new course catalogue the Lecture Outlines for all the courses as well as Experiential Learning Programme which emphasizes on practical training to the students is incorporated in the final year of B.Sc.(Hons.) Horticulture Programme.

I appreciate the efforts made by the Dean of Horticulture and the members of the faculty in the preparation of the Lecture Outlines and bringing out a publication on Lecture Outlines for U.G. Programme which is helpful to the Teachers as well as Students of the University.

Dt. 31-12-2011
Venkataramannagudem.

DR. C.V.S.K.SARMA
VICE-CHANCELLOR
Dr. Y.S.R. HORTICULTURAL UNIVERSITY

FOREWORD

The Dr. Y.S.R. Horticultural University (formerly A.P. Horticultural University) has been established during 2007 by the Government of Andhra Pradesh with the objectives of developing human resources and technology in accordance with the changing demands of Horticultural industry. The university offers a four year B.Sc. (Hons.) Horticulture Programme in four constituent colleges, namely Colleges of Horticulture at Venkataramannagudem (West Godavari District); Rajendranagar (Ranga Reddy District); Mojerla (Mahaboobnagar District) and Anantharajupet (Kadapa District), to produce graduates in Horticulture with professional competence and up to date knowledge.

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Dt. 31-12-2011
Venkataramannagudem.

VICE-CHANCELLOR
ACKNOWLEDGEMENTS

Constant encouragement and guidance rendered by Dr. C.V.S.K.Sarma, Hon'ble Vice-Chancellor, of Dr. Y.S.R. Horticultural University in bringing out this publication is hereby acknowledged. The help rendered by the, Dr. K. Purushotham, Director of Research, and B.Srinivasulu, Controller of Examination, Dr.Y.S.R.H.U. is here by acknowledged.

Thanks are also due to Dr. G.Subbi Reddy, Associate Dean & COH, Venkataramannagudem, Dr. D. Srijan, Associate Dean, COH, Mojerla, Dr M. Lakshminarayana Reddy, COH, AR Peta and Dr. S. Amarender Reddy, COH, Rajendranagar is acknowledged. The assistance extended by all the Teachers in the Colleges of Horticulture of Various departments is acknowledged. The coordination extended by Dr. B. Prasanna Kumar, Technical officer to D.H, of Dr. Y.S.R.H.U in bringing out this publication of Lecture Outlines for B.Sc (Hons.) Horticulture Programme is acknowledged.

Dt. 31-12-2011  
Venkataramannagudem
DR. B. SRINIVASULU  
CONTROLLER OF EXAMINATIONS  
Dr. Y.S.R. HORTICULTURAL UNIVERSITY

PREFACE

Dr. Y.S.R. Horticultural University (formerly Andhra Pradesh Horticultural University) has been established during 2007 by the Government of Andhra Pradesh with the objectives of developing human resources and technology in accordance with the changing demands of Horticultural industry. The university offers a four year B.Sc. (Hons.) Horticulture programme to produce graduates in Horticulture with professional competence and up to date knowledge.

To make the Horticultural Education more relevant to the ever changing scenario of the Horticulture in the State and to meet the challenges and users needs Course Catalogue is brought out for the students for B.Sc. (Hons.) Horticulture duly revising the syllabus in the light of the recommendations of the IV Deans Committee of ICAR giving due importance to location specific topics of the state. While several courses are strengthened and new courses introduced, there is a need to provide lecture outlines. Lecture Outlines prepared for fifty five courses belonging to twelve Departments is an excellent document and also a planner for teachers.

Appreciation goes to the Dean of Horticulture and the members of faculty in the preparation of the syllabus and bringing out a publication on Lecture Outlines for B.Sc. (Hons.) Horticulture.

Dt: 31-12-2011  
Venkataramannagudem  

B.Srinivasulu  
31/12/11  
(B. SRINIVASULU)  
CONTROLLER OF EXAMINATIONS
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2. Nutritive value of horticultural crops. Divisions of horticulture with suitable examples and their importance.

3. Horticultural research stations in Andhra Pradesh and National level horticultural research stations in India.

4. Classification of horticultural crops based on soil and climatic requirements

5. Fruit and Vegetable zones of India and Andhra Pradesh.

6. Definition of a nursery, different types of nursery beds-flat beds, raised beds and sunken beds, their merits and demerits

7. Different nursery techniques and their management

8&9. Vegetable gardens nutrition and kitchen garden, truck garden, vegetable forcing, market gardens and roof gardens

10. Establishment of orchards – Explanation of points to be kept in mind while selecting site for the establishment of orchards

11. Different steps in planning and layout of orchards.

12. Different steps in establishment of orchards and management of orchards

13&14. Different systems of planting orchards-square, rectangle, quincunx, hexagonal and contour systems of planting-their merits and demerits

15. Calculation of planting densities in different systems of planting

16. Definition of pruning, objectives of pruning, principles and methods of pruning of fruit crops.

17&18. Definition of training, objectives and training, principles and methods of training of fruit crops-open centre, closed centre and modified leader systems their merits and demerits

19. Practical use of growth regulators in horticulture

20&21. Definition of irrigation-Different methods of irrigation followed in horticultural crops, their merits and demerits

22&23. Definition of manures and fertilizers-different methods of application of manures and fertilizers to horticultural crops
24&25 Cropping systems-inter cropping and multi-tier cropping, their merits and demerits with suitable examples

26 Definition of mulch-objectives of mulching-different types of mulches-organic and inorganic mulches with suitable examples

27 Bearing habits of fruit trees

28&29 Definitions of fruitfulness and unfruitfulness-factors influencing the fruitfulness and unfruitfulness with suitable examples.

30 Rejuvenation of old orchards-importance of rejuvenation-top working and frame working.

31 Maturity-definition of maturity, different methods of judge maturity in horticultural crops

32 Harvesting, grading, packaging and storage of horticultural produce, different methods of storage.

PRACTICALS:

1 Study of Tools and implements in Horticulture
2 Study of features of orchard
3 Lay out of different planting systems
4 Lay out of nutrition garden
5 Preparation of nursery beds for sowing of vegetables seeds
6 Digging of pits for fruit plants
7 Study of different methods of Training
8 Study of different methods of pruning
9 Preparation of fertilizer mixtures and field application
10 Preparation and application of growth regulators
11 Lay out of different irrigation systems
12 Identification and management of nutritional disorders in fruits
13 Identification and management of nutritional disorders in vegetables
14 Study of bearing habits in horticultural crops
15 Study of maturity standards and harvesting of important fruits and vegetables
16 Study of grading, packaging and storage of fruits and vegetables.
THEORY:

1. Propagation, Need and Potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages

2. Seed dormancy – means to break seed dormancy (Stratification and Scarification) – internal and external factors and seed treatment for germination and disease control; use of growth regulators to overcome the seed dormancy

3. Nursery techniques, apomixes, mono embryony, poly embryony, chimera and bud sports; nursery tools and implements.

4. Propagation by division – suckers, rhizomes, corms, tubers, cloves and bulbs

5. Propagation structures: Mist chamber, humidifier, greenhouses, glasshouses, cold frames, hot beds and poly houses


8. Propagation by layering – types of layering; establishment of layers in the field; physiological and biochemical basis for rooting in layering – use of growth regulators in layering.

9 & 10. Methods of grafting – Approach grafting; Veneer grating; Wedge grafting; Saddle grafting; Tongue grafting; Whip grafting; Bridge grafting; Epicotyl grafting; Sofwood grafting. Physiological basis for graft union, Graft incompatibility (Localised and translocated) – Selection of mother plant – Establishment of progeny orchard/mother plant block; - procuring of section.

11. Anatomical studies of graft unions – means for graft success

12. Methods of budding – ‘T’ budding, Inverted ‘T’ budding, Shield budding; Chip budding; Flute budding; Ring budding; ‘I’ budding.

13. Stock – scion relationship; Characteristics of a good root stock

14 & 15. Micro propagation – Choice of explant (Totepotency); media-MS-media, Growth regulators in culture, sterilization of the explant, sub-culturing of the callus, Organogenesis – Somaclonal Variation-Hardening of plants

16. Bud wood certification and nursery registration Act
PRACTICALS:

1. Study of various propagation media for nursery beds, pots and mist chamber.
2. Preparation of nursery beds (raised and flat beds) and sowing of seeds.
3. Raising of root stocks of different fruit plants like Mango, Citrus, Cashew etc.
4. Preparation of plant material for planting.
5. Hardening of plants in the nursery – different methods like reducing Irrigation, Shade, exposure for short periods to sun etc.
6. Study and practicing of different propagation methods by cutting.
7. Study and practicing of different propagation methods by layering.
8. Study and practicing of different propagation methods by grafting.
9. Study and practicing of different propagation methods by budding.
10. Study and practicing of different propagation methods by divisions.
11. Preparation of layout for commercial nurseries.
12. Visit to a commercial nursery in the locality.
13. Visit to tissue culture / biotechnology laboratories.
14. Study of plant propagation structures and equipment.
15. Use of different types of tools & implements in the nursery.
16. Application of nutrients and plant protection chemicals in the nursery.
THEORY:

1. Classification of Fruits

2. Mango: Introduction & History, Nutritive Value, Uses, Origin & Distribution Area and Production, Export Potential, Importing Countries, Important Species of Mango Production Technology: Climatic requirements – Temperature, rainfall and other requirements for optimum vegetative growth, flowering, and fruit development under North Indian and South Indian conditions Soil requirements

3. Mango Varieties: Indian and Exotic varieties – Varieties suitable for export, Commercial varieties – Table varieties, Juicy varieties, Table and Juicy Varieties, Pickle Varieties, Varieties suitable for Preservation, Early, Late and. Off-Season Varieties, Mono & Polyembryonic, Varieties suitable for different regions of A.P. (Rayalseema, Telangana and Coastal) and Varieties of North, South, East and West; Hybrids of Mango released for cultivational all over India.

4. Propagation: Commercial propagation by Epicotyl grafting, Veneer grafting planting Density; High Density Planting system. Nutritional and Irrigation requirement; Role of Major & Minor nutrients, Inter cultivation; Intercropping, Weed management.


7. Banana and Plantains: Economic importance – Nutritive value, Uses, Origin of various groups & Distribution, Area & Production; Genomic classification and Nomenclature; Taxonomic Classification: Musa acuminate, Musa bulbisiana Major genomic groups and Cultivars in the World and Hybrids.


11 Production Technology: Climatic & Soil requirements of important citrus groups Varieties: Citrus Indian and Exotic varieties of Sweet Oranges, Mandarins, Grape Fruit and Pummelo, Lemons, Limes Propagation: Seedling stocks, Root stocks tolerant to diseases, Stock & Scion relationship, methods of propagation -Bud Wood Certification – Virus free bud wood, Nucellar clones, Virus indicator species.

12 Planting Densities, Irrigation, Root Stocks, Age & Bearing Capacity; Nutrient management: Major & Minor nutrients, Deficiencies, Weed Management; Pruning of young, pre bearing plants, and bearing trees, Root pruning and Bahar Treatment (Ambebahar, Mrig Bahar and Hasth bahar)

13 Flowering: Factors effecting fruit set, Fruit drop and its control, Physiological Disorders like Granulation, and Rind pitting; Citrus Decline: Symptoms, Factors responsible and Control measures. Harvesting: Maturity Indices, Yield of fruits, Post Harvest Handling: Grading, Packing, Transport, Storage and Ripening.

14 Grapes: Economic importance, Nutritive value, Uses, Origin & Distribution, Area & Production; Genera; Vitis & Muscadinia, Species grown in different regions of the World; Varieties: Indian and Exotic Varieties–Seeded & Seedless Varieties, Coloured varieties, Varieties suitable for table, wine, Juice, Canning and raisin purpose.


16 Training: Purpose, systems of training (Bower, telephone system, Trellis system-T and Y, vertical cordon system – single & double, kniffin system, Gable system) Pruning: Objectives, Definitions of Cane, Spur, Soot, Fruiting Spur, Foundation Spur, / Renewal Spur, Long Spur, Medium Spur, Arms, Trunk, Suckers etc., Pruning for vegetative growth (summer) and for fruiting (winter), Level of pruning.

17 Improvement of yield through practices like girdling, pinching thinning of flowering and berry drop. Fruit set, Stenospermocarpy, Stages of berry growth; Use of plant growth regulators to induce 1) Seedlessness, 2) Improve quality and for 3) crop regulation. Maturity Standards, Harvesting & Yield, Grading, Packing, Storage and Ripening; Physiological Disorders: Blossom end rot, Inter-veinal chlorosis, Poor Bud Burst, flower and Berry drop, Barrenness of vine, Pink berry, Cracking of Rachies, shot berry, Hen & Chicken disorder.
18 Sapota: Economic Importance, Nutritive value, Origin & Distribution, Area & Production; Species & Types: Types based on growing habit (Erect, Drooping and Spreading), Varieties and hybrids; Production Technology: Climatic & Soil requirements; Propagation, Root Stocks, Planting Density, methods of irrigation, nutrient management, Interculture, weed management and inter-cropping, Maturity Indices, Harvest & Yield; Handling, Grading, Packing, Transport, Marketing, Ripening and Storage.

19 Guava: Economic Importance, Nutritive value, Origin & Distribution, Area & Production; Species & Varieties (Indian & Exotic), Hybrids; Production Technology: Soil & Climatic requirements, propagation by Vegetative methods (Air layering, Ground layering and Stooling); Planting, Planting density, Irrigation, Nutrient management, training and pruning. Bahar treatment (Ambe bahar, Mrig bahar and Hasta bahar), Flowering, Plant Growth Regulators for Fruit thinning, and Parthenocarpy; Maturity Indices, Harvesting & Yield, Packing, Transportation, and Storage.

20 Papaya: Economic Importance, Nutritive value, Origin & Distribution, Area & Production; Varieties: (Pusa varieties, Coimbatore varieties, Taiwan varieties etc.); Sex expression and Sex identification. Production Technology: Soil & Climatic requirements, Propagation, Planting, Irrigation & Nutrient management. Maturity indices, Harvesting, Yield and Storage. Latex extraction: Papain: Classification, uses, Factors effecting Papain Production, Suitable varieties for Papain, Extraction & Yield of Papain, Marketing & Prospects.

21 Pine Apple: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Varieties: Groups: Spanish, Abacaxi, Queen, Cayene, Maipore Production Technology: Soil & Climatic requirements; Propagation by shoot suckers, Ground suckers, slips, crowns, stumps, micro propagation, High Density Planting, Water and Nutrient management, Interculture, flowering and fruiting. Use of chemicals and plant growth regulators for improving the flowering and fruiting, Maturity indices, Harvesting for local market and Distant markets Yield, Post harvest handling and storage.


24 Custard Apple: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Annona squamosa, A. muricata, A. reticulate, A.cherimola, Atemoya Hybrid; Varieties & Groups – Green fruit & Red fruit; Production Technology: Soil and Climate; Propagation: Seed, Vegetative Planting, Planting density; Irrigation &
Nutrient management, Flowering time, Fruit Development, Stone Fruit formation and their control, Harvest, Yield, Storage.

25 Ber: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Spices & varieties; Adaptive features of Ber, Production technology: Soil & climatic requirements; Training and Pruning, irrigation and nutrient management; Flowering & fruit set, Fruit drop and its control, maturity indices, yield.

26 Fig: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Types & varieties (Capri fig, Adriatic fig, Smyrna fig and sanpedro fig) Production technology: Soil & climatic requirements; Training and Pruning, irrigation and nutrient management; Flowering & fruit set, caprification, maturity indices, yield. Problems like sun burn, fruit cracking and fruit drop.

27 Litchi: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Species & varieties: Exotic / Indian Varieties-Early, Mid-season and Late season varieties; Production technology: Soil and climatic requirements; propagation, Nutrient Management, Irrigation, Interculture, flowering and fruiting, fruit drop and its control; Maturity indices, Harvesting, yield, Post Harvest handling and Storage; Regulation of colour break in litchi, Physiological disorders: Fruit cracking.


29 Avocado: Economic Importance, Nutritie value, Origin & Distribution, Area & Production; Species and Varieties: Different Races-Mexican, Guatemalan and West Indian races, Cultivars of three races, production technology: Soil and Climatic requirements; propagation, density, planting, pruning; Irrigation, Nutrition, Flowering and Fruiting: Diurnally Synchronous Dichogamy; Maturity indices, Harvesting, Yield. Passion Fruit: Economic Importance, Nutritive value, Origin & Distribution, Area & Production; Species & Cultivars (Purple, Golden yellow, Hybrid (kavery), Noel’s special), Soil, Climate, Propagation, Irrigation, Flowering, Fruiting, fruit set, Harvesting indices and Harvesting, Yield

30 Durian, Bael, Carombola, Mangosteen: Economic Importance, Nutritive value, Origin & Distribution, Area Production; Important Species & Cultivars, Production technology, Harvesting.

31 Rain fed Horticulture: Scope and Importance of Arid Fruit Culture, Nutritional Value of Arid Fruits, Production from Arid Fruits, Present Status of Arid Fruit culture in India. Limitations of Arid Zones: Land use capability classes, saline soil and irrigation water, low and erratic rain fall and intense radiation.
Special Characteristics: of Fruit crops which make them suitable for Arid Zone- 1) Ber 2) Aonla 3) Annona 4) Jamun 5) Wood Apple 6) Pomegranate 7) Carissa 8) Date Palm 9) Phalsa 10) Fig 11) Bael 12) Tamarind

**PRACTICALS:**

1. Description and identification of varieties of Mango and Banana based on flower and Fruit morphology.
2. Description and identification of varieties of Grape and Citrus.
3. Description and identification of varieties of Papaya, Sapota, Guava and pine apple.
4. Description and identification of varieties of Avocado, Litchi, Jack fruit, passion fruit Carambola, Durian and Mangosteen.
5. Description and identification of varieties of Pomegranate, Ber and Aonla.
6. Description and identification of varieties of Annona, Jamun, Wood apple, Bael, Carissa, Fig, Phalsa, Date-Palm, Tamarind and West Indian Cherry.
8. Training and Pruning of Mango, Guava and Citrus.
9. Visit to commercial orchards.
11. Use of plastics in fruit production viz., in propagation, mulching, irrigation, packaging, storage etc.
12. Visit to commercial orchards and diagnosis of maladies (Nutrient deficiencies, Pest & Diseases, Physiological disorders etc.)
13. Manure & Fertilizer application including Bio-fertilizers in different fruit crops (Methods of application, calculation of the required Manure & Fertilizers based on the nutrient content).
14. Seed production in Papaya, latex extraction and preparation of crude papain.
15. Ripening of fruits, grading & packaging and production economics for tropical and sub-tropical fruits.
16. Visit to cold storage unit.
1. Definition of temperate region, climatic conditions of temperate zone, Classification of temperate fruits.


3. Manures and fertilizers and After care, Flowering, Induction of early flowering, use of growth regulators in flowering, Pre harvest drop, Blossom and fruit thinning.

4. Factors effecting colour development, Harvesting, Different maturity indices, Post-harvest handling, Grades followed in India, storage and physiological disorders of apple.

5. Pear: Introduction, centers of origin, and distribution, different species of pear, composition and uses, area, production, varieties, climate and soil requirements, root stocks, propagation, Training & pruning of pear

6. Manures and fertilizers, Intercropping, flowering and fruiting and use of growth regulators, harvesting, maturity indices, post-harvest handling and storage of Pear

7. Apricot: Introduction, origin, and distribution, varieties, Composition and uses, different species of Apricot, area, production, climate and soil requirements, root stocks, propagation, Training & pruning of young trees, bearing trees and rejuvenation of old Apricot trees.

8. Manures and fertilizers, Intercropping, flowering and different stages of stone fruit growth and stages of maturity, maturity indices, harvesting, post-harvest handling and storage and physiological disorders of Peach


10. Manures and fertilizers, flowering, pollination and fruit set, maturity indices, harvesting, post-harvest handling and storage of Apricot.

11. Plum: Introduction, origin, and distribution, varieties, composition and uses, difference between European plums and Japanese plums, Types of European plums, area, production, climate and soil requirements, root stocks, propagation, Manures and fertilizers, Training & pruning, flowering, pollination and fruit set, maturity indices, harvesting, post-harvest handling and storage of Plum.

12. Strawberry: Introduction, origin, and distribution, varieties, composition and uses, Ploidy series, climate and soil requirements, Vegetative propagation, rising of runners
Different systems of planting, Matted rows, spaced beds and Hill system Mulching, Flowering (June/Ever/day neutral bearers), pollination, defoliation and deblossoming operation, Fruit set, Harvesting and Post harvest management and Physiological disorder (Albinism) in Strawberry

Almond: Introduction, origin, and distribution, varieties, composition and uses, area, production, climate and soil requirements, root stocks, propagation, Manures and fertilizers, Training & pruning, flowering, pollination and fruit set, maturity indices, harvesting (mechanical), post-harvest handling and storage, Kernel use, shelling yield, grades of kernels for the international trade.

Introduction, origin, and distribution, composition and brief production technology of Minor temperate fruit and nut crops viz., cherry, walnut, persimmon, kiwi, queens land nut (Macadamia nut), pecan nut, hazel nut and chest nut.

Re-planting problems, rejuvenation and special production problems like pre-mature, leaf fall, unfruitfulness, alternate bearing, control of pre-harvest fruit drop, important insect pests and diseases and their control.

PRACTICALS:

1. Description and identification of varieties of apple,
2. Planting systems followed in Apple.
3. Root stock characteristics of Apple.
4. Description and identification of varieties of pear
5. Description and identification of varieties of peach,
6. Description and identification of varieties of plums
7. Use of growth regulators in flowering of Temperate fruit crops
8. Manuring and fertilization of Apple, Pear, Peach, and Plum
9. Description and identification of varieties of apricot, almond and Cherry
10. Description and identification of varieties of strawberry
11. Description and identification of varieties of Kiwi and persimmon
12. Description and identification of varieties of walnut and pecan nut
13. Description and identification of varieties of hazel nut, chest nut and queens land nut
14. Training and Pruning methods followed in apple and Pear
15. Training and Pruning methods followed in plum and peach
1 Definition of Orchard – Objectives of orchard management – Importance of Orchard management – Soil Management – Basic principles – Methods of soil management


3 Weed management in orchards – Cultural (mechanical) methods – Biological methods – Chemical methods – Guidelines for using Herbicides in orchards – Herbicides used for weed control in the orchards.


6 Plant Interaction – Types of Interactions in cropping systems – Competitive interaction – above ground and below ground – Complimentary Interactions–Annidation in space and time –Allelopathy–Types. Biological efficiency of cropping systems – Crop Equivalent Yield – Land equivalent Ratio – Cropping Intensity Index.


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THEORY:

1. Olericulture—definition—Area, Production and Productivity of Tropical and Sub-Tropical Vegetables in India—India’s position in the World Vegetable production, India’s contribution to Indian economy—Leading States in Vegetable area, production and Productivity—Export Potential of vegetables.

2. Importance of vegetables: Economic and nutritional importance of vegetables.

3. Classification of Vegetable Crops: 1) Botanical 2) Based on Hardiness 3) Parts Used 4) Method of culture 5) Season

4. Vegetable Gardening: Types of vegetables Gardens—Kitchen Garden, market garden, Truck Garden, Vegetable Forcing, Garden for Processing, Seed production garden and Floating Garden

5. Tomato (Botanical Name): Introduction, Origin, Area and Production, Composition and use, Pigmentation, Distribution and Export Potential of Tomato: Description of Cultivars (Indian/Exotic) Determinate, Semi-Determinate and Indeterminate types; Cultivars suitable for Hills and Cultivars suitable for Processing—Exotic Cultivars.


8. Physiological Disorders: Blossom end Rot, Cracking, Cat Face, Puffiness, Sun Scald, Gold Fleck, Blotchy ripening, Crease Stem, Internal Blackening, Lower Stem Swelling, Low Temperature Injury etc.

9. Off-Season Tomato Production; Value Addition—Economics.

10. Brinjal (Botanical Name): Introduction, Origin, Area and Production, nutritional Composition, Distribution and Export Potential of Brinjal; Flower types based on Style Length—cultivars.

11. Production Technology: Soil and Climate; Cultivation; Seed Rate, Seed Treatment and Raising of Nursery, Land Preparation, Transplanting, spacing, Irrigation, Manures and fertilizers-inter culture and rationing in Brinjal.
Effect of Growth Substances on Fruit set, Harvest Indices –Colour, Glossy Appearance, Calyx and Stem Ends; Yield, Grading and storage and Economics.

Chilli (Botanical Name): Introduction, Origin, Area and Production, Composition and Uses of chilli and bell pepper-Pigmentation and Pungency, Distribution and Export Potential of Chilli-Taxonomy-Cultivars.

Production Technology: Soil and Climate-Methods of raising the crop-Nursery Vs. Direct Sowing, Seed Rate-nursery techniques-Main field preparation-Spacing-Irrigation-nutrition-Fertilizers Scheduling, Bio-Fertilizers-Inter cultivation.

Effect of Growth Substances on Flowering, fruit set and fruit Maturity: Stage of maturity for harvesting – For Green Chilli and Dry Chilli, Harvesting and yield-drying and Storage; Value Addition & Economics.

Okra (Botanical Name): Introduction, Origin, Area and Production, nutritional composition and uses-Distribution and Export Potential of Okra-cultivars and hybrids.

Production Technology: Soil & climate; cultivation; land preparation, sowing season, seed rate, spacing, nutrition, irrigation and inter culture. Use of growth substances-stage of harvest, harvesting & yield, storage; economics and value addition.

Cucurbit: Introduction, Area and Production, Origin and distribution, composition and uses, characteristics of cucurbitaceous family-list of cultivated cucurbit (Botanical Names & common names) Bitter Principle-Flowering, Sex mechanisms sex expression-use of Plant Growth Regulators for Sex modification.


Cucurbit: Cultivation details of Coccinia & Chowchow- Production technology – soil and climate – cultivars – propagation and planting methods –spacing, irrigation,

23 Seedless watermelon production – River and cultivation of Cucurbits – Off-season production of Cucurbits

24 Legume vegetables:-

French Bean: (Botanical Name) Introduction, Origin, Area, Nutritive composition – Classification: According to Habit (pole, semi pole and bush types) – Production Technology: Climate and Soil-cultivars-Season-Seed Rate, Seed Inoculation, Spacing, Nutrition, Irrigation and Inter-cultivation; maturity standards, Harvesting, Yield, Storage & Economics.

25 Lab-Lab (Dolichos) bean (Botanical Name): Introduction, Origin, Area, Nutritive value and uses-cultivars (bush and pole types)-differentiate field beans and garden beans – cultivation: climate and soil, seeds and sowing, season, spacing, nutrient requirements, irrigation, intercropping; harvesting, yield.

26 Cluster Bean(Botanical Name): Introduction, Origin, Area, Nutritive value and industrial importance of guar gum-cultivars classification according to Branching, Presence / Absence of hair and Kind of Fruit-cultivation-climate and soil; seed rate sowing, spacing, nutrition, irrigation-stage of harvest based on the purposes, yield and storage and economics.

27 Vegetable Cow pea (Botanical Name): Introduction, Origin, Area, Nutritive value -cultivars –climate & soil, seed rate, spacing, nutrition, irrigation and inter culture-harvesting indices – harvesting & yield.

28 Leafy Vegetables: Importance of leafy vegetables and types of leafy vegetables


29 Basella (Botanical Name):Introduction, Origin, Area and Nutritive value -cultivars (Reddish stem type & commonly grown green types)-Soil and Climate; Propagation – Seed, stem cuttings, crop duration-seed rate, spacing, nutrition, and irrigation – harvesting and yield.

30 Portulaca (Botanical Name) :Introduction, Origin and Nutritive value -cultivars soil & climate - land preparation, sowing, seed rate, spacing, irrigation and nutrition –harvesting and yield.

31 Perennial Vegetables:

Curry Leaf (Botanical Name): Introduction, Origin Area and Nutritive value -cultivars soil & climate, cultivation - land preparation, nursery raising-sowing/ Planting, seed rate, spacing, Irrigation, nutrition –harvesting and yield.
Drumstick / Moringa (Botanical Name): Introduction, Origin, Composition of Pods, Leaves and uses of Moringa-cultivars-soil and climate; Propagation and planting methods-seed rate – field preparation-sowing/planting-nutrition, Irrigation and inter culture; pruning for extension of cropping season- harvesting and yield.

PRACTICALS:

1. Classification of vegetable crops
2. Nursery techniques for vegetable production and Hi-tech vegetable nursery production
3. Planning and layout of a kitchen garden
4. Identification and description of Solanaceous vegetable varieties
5. Methods of main field preparation and transplanting of nursery grown seedlings
6. Seed extraction methods in tropical and sub tropical vegetables
7. Nutritional deficiencies and physiological disorders in tropical and sub tropical vegetables.
8. Inter cultural and special cultural operations In vegetable plots.
11. Identification and description of varieties of cucurbits.
13. Visit to vegetable farmers fields
14. Post harvest handling of vegetables
15. Identification and description of varieties of Amaranthus, Drumstic and Curry leaf
16. Visit to vegetable markets for study of marketing problems
THEORY:

1. Area, Production and Productivity of temperate vegetables, potato and other tuber crops in India - economical, industrial nutritional importance of temperate vegetables, potato and tuber crops.

2. Cole crops:
   Cabbage (Botanical Name): Introduction, Origin, Area and Production, nutritional value, bitter principle, Distribution and Export Potential- Cultivars- classification based on shape, colour and crop duration. Soil and climate requirements.


5. Inter cultivation and blanching- Stage of maturity, Harvesting and Yield – post Harvest Handling and Storage- Physiological disorders and their control.


Bulb Crops:

Onion (Botanical Name): Introduction, Origin, history, Area, production and productivity – Distribution and Export Potential – nutritional value and pungency principle – Cultivars – Soil and climate requirements.


Garlic & Leek (Botanical Name): Introduction, Origin, Area and Production, nutritional value- Cultivars – Production Technology – Soil and climate- Seed Rate and sowing. Transplanting, spacing and Irrigation – Nutrition – Inter cultivation- Harvesting and Yield – Post harvest handling and Storage.

Salad crops:


Root crops:

Carrot (Botanical Name) : Introduction, Origin, Area, Production and productivity – nutritional value – pungency and pigmentation – Cultivars- classification of cultivars based on root shape and temperature response to flowering (Asiatic and European) – Production Technology – Soil and climate – seed rate, sowing and spacing, - Irrigation - - Nutrition – Inter culture – Harvesting and Yield – Post Harvest Handling and Storage. Physiological disorders (splitting, forking and cavity spot)

Radish (Botanical Name) : Introduction Origin, Area, Production and productivity – nutritional value- pungency and pigmentation – Cultivars – Asiatic and European ty0pes – production Technology – Soil and climate – seed rate, sowing and spacing, - Irrigation – Nutrition – Inter culture – Harvesting and Yield – Post Harvest Handling and storage.


Turnip( Botanical Name): Introduction, Origin, Area, Production and productivity – nutritional value – pungency and pigmentation – Cultivars – Asiatic and European

18 Legume vegetables:
Pea (Botanical Name): Introduction, Origin and taxonomy – Area, Production and productivity – nutritional value-botany – distinguishing characters – Cultivars classification of cultivars based on seed texture, height of plant of, maturity and use of pods.


21 Leafy vegetables:

22 Spinach(Botanical Name) : Introduction, Origin, nutritional value – botany-Cultivars – classification of cultivars based on seed type and leaf type- production Technology – Soil and climate – seed rate, sowing and spacing, Irrigation- Nutrition – Inter culture- Stage of maturity- Harvesting, Yield and storage.

23 Specialty vegetables:
Rhubarb, Asparagus and Globe artichoke (Botanical name) : Introduction, Origin, importance and nutritional value – Cultivars – production Technology – Soil and climate- propagation and planting methods – seed rate, sowing and spacing,- Irrigation – Nutrition- Inter culture- Stage of maturity – Harvesting, Yield and storage.

24 Potato :
Introduction, Origin, Area, Production, Productivity, history and distribution – role in Indian economy- importance and nutritional value- Cultivars- potato zones.
Production Technology – Soil and climate – Propagation and planting material
True potato seed (TPS) – seed rate – Main field preparation, sowing/planting and spacing – Irrigation – Nutrition – Inter culture.

Harvesting, curing and Yield – Post Harvest Handling and Storage - Physiological disorders- Production of certified seed – Suggestions to produce healthy seed in Indian plains.

Tuber crops:
Sweet potato (Botanical Name): Introduction, Origin, area and production nutritional value – Cultivars – Soil and climate – propagation and planting- seed rate and spacing, - Irrigation – Nutrition – Inter culture (turning of vines)- Harvesting, curing and yield – Post harvest handling and Storage


PRACTICALS:

1. Nursery bed preparation and management.
2. Identification and description of cabbage and cauliflower.
3. Identification and description of Knol-Khol, Sprouting broccoli and Brussels sprout.
4. Preparation of field, sowing/transplanting.
5. Identification and description of root crops.
6. Visit to farmer’s field.
7. Identification and description of potato.
8. Identification and description of bulb crops.
9. Visit to vegetable research station.
10. Identification and description of pea.
11. Identification and description of Tuber Crops.
12. Calculation of cost of cultivation for important vegetable crops and project preparation of commercial cultivation.
15. Visit to local vegetable markets.
16. Final practical examination.
VGSC-3.2.1   Seed Production of Vegetables, Tuber and Spice crops   3(2+1)

THEORY:

1. Introduction and History of seed industry in India.
2. Importance and scope of vegetable seed production in India.
3. Classification of vegetable crops based on pollination and reproduction behaviour.
5. Role of climatic factors (temp, humidity, light, wind velocity and wind direction) in vegetables seed production.
6. Principles of vegetable seed production – Genetic Principles (Maintenance of Genetic Purity by crop rotation, isolation, rouging, seed certification and grow out tests) – Agronomic Principles (area and land selection, source of seed, seed treatment and better agronomic practices).
7. Seed production of Solanaceous vegetables:
   Tomato: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage.
8. Brinjal: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage.
9. Chilli and Bell pepper: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage.
10. Seed production of cole crops:
    Cabbage: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage.
11. Cauliflower: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage.
12. Seed production of Root vegetables:
    Carrot: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage.
13. Radish: Climate, land requirements, season, planting time, nursery management,
seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

14. Beetroot: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

15. Seed production of Bulb vegetables:
Onion & Garlic: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

16. Garlic: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

17. Seed production of Cucurbits
Melons: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

18. Gourds: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

19. Radish: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

20. Sweet Potato: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

21. Tapioca: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

22. Seed production of Legumes
French bean: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

23. Dolichos bean: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage
24. Peas: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

25. Seed production of Okra: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

26. Seed production of Leafy vegetables:
   Amaranthus: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

27. Palak: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

28. Seed production of Spice vegetables:
   Coriander and Fenugreek: Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

29. Seed production of Major Spices: (Turmeric and Ginger): Climate, land requirements, season, planting time, nursery management, seed rate, flowering and seed setting, rouging, harvesting and threshing, seed extraction and seed storage

30. Seed germination and purity analysis

31. Field and seed certification standards

32. Seed legislation and seed laws
PRACTICALS:

1. Study of seed structure, color, size, shape and texture
2. Field inspection of seeds in vegetable crops
3. Practices of rouging in vegetable crops
4. Harvesting and seed extraction in vegetable crops
5. Germination and purity analysis in vegetable crops
6. Methods of seed production in solanaceous vegetables
7. Methods of seed production in cole crops
8. Methods of seed production in root vegetables
9. Methods of seed production in bulb crops
10. Methods of seed production in cucurbits
11. Methods of seed production in tuber vegetables
12. Methods of seed production in leafy vegetables
13. Methods of seed production in legume vegetables
14. Methods of seed production in spice vegetables
15. Visit to seed processing units
16. Visit to seed production farms
DEPARTMENT OF FLORICULTURE
AND LANDSCAPING

FCLS-1.3.1 Principles of Landscape Gardening 1(0+1)

1. Study of principles to be observed in preparation of landscape design & elements of landscape design.
2. Study of symbols, tools and implements used in landscape design.
3. Plant materials for landscaping and their identification i.e., annuals, herbaceous perennials, trees, Shrubs, Climbers, bulbous plants, cacti and succulents, aquatic plants, ground covers i.e., grasses etc, bamboos etc.
4. Study of various features of an ornamental garden with suitable plants and identification of plants for each feature.
5. Study of formal gardens i.e., Mughal, Persian, Italian and French gardens with their different features.
6. Study of informal gardens i.e., Japanese and English gardens with their different features; and wild, countryside.
7. Study of special type of gardens (Terrace garden and Rock garden).
8. Study of special type of gardens(Sunken garden and Bog or Marsh garden).
9. Visit to near by nurseries of ornamental plants.
10. Study of landscaping Highways, Railway stations, Bus terminus and Airports.
11. Study of landscaping cities, towns, country side, canals and along the bank of rivers.
12. Study of landscaping factories, places of historic importance, places of worship.
13. Study of Designing of conservatory and lath house. Materials required, requirement of plants i.e., light, shade, temperature, humidity etc.
15. Study of climatic factors (light, temperature, humidity fresh air and watering) on successful culture of indoor plants.
16. Visit to near by landscape gardens.
THEORY:


2. Definition of Floriculture – Scope and importance of floriculture industry in India – Present Status of floriculture in India – Area and Production of floricultural Products in India – International Scenario – Major exporters and importers in the world – Industrial importance via., - Cut flowers – Ornamental plants – Flowers seeds – Floral extracts – dry flowers and plants – other floricultural related services.


4&5. Garden components or features – Garden walls – Retaining wall – Fences and Gates – Steps – Garden Drives (Gravel and Asphalt) and Paths (Gravel, Brick, Grass, Stone, Crazy pavings) – Arches and Pergolas – Screens – Bridges – Outdoor garden rooms (Gazebos, garden pavilions, band stand, bower and thatched huts) – Garden components or features – Hedges and Edges – Flower bed – Borders – Carpet Bedding.


Oanamental and shady Trees – Definition – Classification based on purpose with suitable examples – Specimen trees – Shady trees – Flowering trees – Avenue or road side trees – Screening trees – Fragrant flowering trees – Pollution controlling trees – Selection of trees based on – Climatic – Soil – availability and Cost factors- Methods of planting – Time of planting – Manuring – Care and Maintenance – Planting Schemes for avenue planting – One kind of flowering tree on both sides – two kinds of lowering trees blooming at one time on both sides of road – Two kinds of flowering trees blooming at different time on both sides of road – shady trees only on both sides of road.


Land scaping – Educational Institutions (Schools and Colleges) – Importance – Need – Planting materials for different areas of institution – Land scaping – Country side and Village home – Land scaping – Railway stations and railway lines.


PRACTICALS:
1. Identification and description of annuals.
2. Identification of Herbaceous perennials.
3. Identification of climbers, creepers, foliage and flowering shrubs.
4. Identification of avenue trees, palms and ferns.
5. Identification of ornamental grasses cacti and succulents.
6. Visit to nearby landscape garden layout.
7. Study of planning, designing of gardens and layout.
8. Study of components of a garden and functional uses of plants in the landscape.
9. Study of planning and designing of house garden, roadside planting and avenues for new colonies, traffic islands.
10. Preparation of land for lawn and planting.
11. Study of the design of garden structures and layout of rockery.
12. Study of water garden, terrace garden and Japanese gardens, recreational and children’s corner.
13. Layout of terrarium, traffic islands, bottle garden and dish garden.
14. Flower arrangement, Bonsai practicing and training.
15. Visit to nearby gardens
16. Visit to nearby recreational and children’s corner.
1. Scope and importance of commercial floriculture in India. Present status, Future prospects and strategies needed for improvement. Area, production and exports.

2. Rose: Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation – Rootstocks, Stock scion compatibility, land preparation, planting

3. Manures and fertilizers, cultural operations (pruning, pinching and mulching) use of growth regulators, physiological disorders, harvesting, post harvest management, yield and rose bi-products – Loose flower production

4. Marigold: Introduction, origin and distribution, species and varieties, F1 Hybrids, climate and soil requirements, propagation, land preparation, planting

5. Manures and fertilizers, cultural operations, (pinching and disbudding) use of growth regulators, harvesting, post harvest management and yield.

6. Chrysanthemum: Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

7. Manures and fertilizers, cultural operations, (pinching and disbudding) use of growth regulators, harvesting, post harvest management and yield.

8. Carnation: Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

9. Manures and fertilizers, cultural operations, (pinching and disbudding) use of growth regulators, physiological disorders, harvesting, post harvest management and yield.

10. Gladiolus: Introduction, origin and distribution, classification of varieties, species and varieties, climate and soil requirements, propagation, land preparation, planting

11. Manures and fertilizers, cultural operations, use of growth regulators, physiological disorders, harvesting, post harvest management and yield.

12. Jasmine: Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

13. Manures and fertilizers, cultural operations, use of growth regulators, harvesting, post harvest management and yield.

14. Tuberose: Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

15. Manures and fertilizers, cultural operations, use of growth regulators, harvesting, post harvest management and yield.
16. **Dahlia:** Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

17. Manures and fertilizers, cultural operations, (pinching and disbudding) use of growth regulators, harvesting, post harvest management and yield.

18. **China aster:** Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

19. Manures and fertilizers, cultural operations, (pinching and disbudding) use of growth regulators, harvesting, post harvest management and yield.

20. **Crossandra:** Introduction, origin and distribution, species and varieties, climate and soil requirements, propagation, land preparation, planting

21. Manures and fertilizers, cultural operations, use of growth regulators, harvesting, post harvest management and yield.

22. **Bird of paradise:** Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

23. Manures and fertilizers, cultural operations, use of growth regulators, harvesting, post harvest management and yield.

24. **Anthurium:** Introduction, origin and distribution, classification, species and varieties, climate and shade requirements, growing media, propagation, systems of growing, planting

25. Fertigation, cultural operations, de-suckering, defoliation, use of growth regulators, physiological disorders, harvesting, grades, post harvest management and yield.

26. **Gerbera:** Introduction, origin and distribution, classification, species and varieties, climate and soil requirements, propagation, land preparation, planting

27. Manures and fertilizers, cultural operations, defoliation, soil loosening, shading, use of growth regulators, physiological disorders, harvesting, post harvest management and yield.

28. **Orchids:** Introduction, origin and distribution, classification, species and varieties, climate and growing medial requirements, propagation, orchidarium construction, planting

29. Manures and fertilizers, cultural operations, physiological disorders, use of growth regulators, harvesting, post harvest management and yield.

30. Growing of flowers under protected environments such as glass house, plastic house etc. Rose, Orchids, Anthurium, Carnation, Gerbera and cut flower type Chrysanthemums require special climatic conditions


PRACTICALS:

1. Propagation methods in chrysanthemum
2. Preparation of nursery bed for flower seeds sowing.
3. Identification of important flower crops and their varieties
4. Identification of important fillers and foliage plants.
5. Propagation of rose by cutting and budding
7. Visit to green house to study protected cultivation of carnation
8. Field visit to commercial flower growing area
9. Visit to green house to study protected cultivation of Gerbera
10. Training and Pruning of Roses in open and polyhouse
11. Visit to green house to study protected cultivation of Rose
12. Horticultural practices like Pinching and laying of supporting nets for Carnation under protected cultivation.
13. Study on drip irrigation, misting and Fertigation of flower crops under cover.
14. Study on the influence of PGR’s on important flower crops
15. Use of floral preservatives and other compounds for prolonging vase life of cut flowers.
SPMA – 2.4.1 Spices and Condiments

THEORY:

1. Introduction, history of spices, definition of spices and condiments, important spice crops of India (List of the crops with Common name, Botanical name and family) Importance, role of spices in human nutrition, Industry, Exports and Imports of spices in improving the national economy.

2. 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 like II SR Calicut ICAR, DCASD, Cochin, Spices Board Cochin.

3. Black Pepper – History, scope and Importance area and production, uses, export potential and its role in increasing the National Economy, Role of pepper export promo0tion council. Botany varieties, soil and intercrop and mixed crop. Propagation with seed, vegetative method – Cuttings, Rapid Multiplication Method.


5. Cardamom – History, Scope and importance area and production, uses, export potential, Botany, varieties, types of cardamom like, Malabar, Mysore and Vazukka soil and climate, selection of site and reparation, propagation lime seed (Primary and Secondary nurseries advantages and disadvantages) seed and vegetative method like suckers.

Ginger – Introduction, scope and importance, area and production, uses, export potential, Botany, varieties, soil and climate, propagation, preservation of seed rhizome, selection of land and preparation.

Ginger – Planting season, Seed rate, Spacing, Methods – bed system and ridge and furrow system seasons – Region wise Mulching, Systems of cultivation like rotations and mixed cropping, Irrigation, Nutrient Management


Clove – Introduction, History, scope importance, area and production, uses, export potential, Botany, varieties, Soils and Climate, Propagation by seed – Raising of the nursery, Planting, Weeding, Staking, Manuring, Intercultural, Irrigation, Pruning, Harvesting, curing and Processing like preparation of clove to the market, Grading, packing and storage, value added products like clove bud oil, clove stem oil, clove leaf oil, clove root oil, oil of mother clove.

Nutmeg – History, Importance, Area, Production, Uses, Botany, varieties, Export value, Propagation – Nursery techniques, Soil and Climate, Planting, Cropping System like mixed cropping, Manuring, Weeding, Intercultural, Constraints like sex determination and improvement in Nutmeg Cultivation, Harvesting, Post Harvest Technology, Grading and Packing, value added products like oil of the flowers.


All Spice and Curry Leaf (In brief) – Introduction, Area and Production, Uses, Export value, Soil and Climate, Propagation like Seed and Vegetative Method – Budding, approach Grafting in Allspice and Seed in Curry leaf, Planting, Weeding, Manuring, Harvesting, Post Harvest Technology like Drying and Curing and value added products like Berry oil, Leaf oil, Oleo resin in oil spice and Volatile oil and Dehydrated leaves in Curry leaf.
14&15 Coriander, Fenugreek, fennel, cumin – History, Importance, Area and production, uses, Botany, Varieties, Soil and Climate, Sowing, Seasons seed rate, Spacing, Irrigation, Weeding, Intercultural, Harvest Management like Cleaning and Drying value added products like, whole seed, Ground form, Volatile oil Oleoresin, Dal in coriander etc

16 Vanilla – History, Importance, Area and Production, Export Value, Uses, Botany, Varieties, constraints of production, Propagation by Cuttings Soil and Climate, Land preparation, Staking, Planting, Manuring, Flowering and Pollination Hand Pollination, Harvesting, Curing and processing and types of vanilla like Mexican vanilla, Bourbon vanilla, Indonesian vanilla value added products like vanilla pods, vanilla essens, vanilla sugar, vanilla oleoresins Grading, Packing, Storage.

PRACTICALS

1 Identification of Spices and Condiments. Preparation and Submission of minimum of 30 specimen of Spices and Condiments.

2 Seed treatment, Sowing layout and Planting Method of Spices and Condiments

3&4 Raising of crops of spices and condiments.

5&6 Propagation methods and role of growth regulators in spices and condiments.

7&8 Identification of varieties of spices and condiments.

9 Important operations followed in spices like manuring, use of weedicides and earthing up operations.

10 Training and Pruning in Spices and Condiments.

11 Economics of cultivation in Spices and Condiments.

12 Curing, Processing and Grading of Spices and Condiments.

13 Methods of extraction of essential oils and oleoresins in Spices and Condiments.

14&15 Visits to Commercial Spice Gardens & Plantations and Processing Units.

16 Visit to essential oil extraction units.
THEORY:

1. Plantation crops History, scope and importance
   COCONUT
   Introduction, Scope and importance, area and production, products/ by products, uses – The wet meat or kernel, Coconut flour, Edible copra, Coconut oil, coir and coconut fibre, Coconut leaves, Varieties- Tall x dwarf hybrids (TxD), Dwarf x tall hybrids (DxT), Tall x tall hybrids (T x T).

2. COCONUT:
   Soil, Climate, Propagation – Seed propagation, Selection of seed nuts, Selection of mother palm, Collection of seed nuts, Nursery – site selection and preparation, Planting of seed nuts, Management of nursery, selection of seedling for planting.

3. COCONUT
   Preparation of pits and planting, Irrigation, Manuring and fertilization, Foliar diagnosis as an index for fertilizer requirement, Methods of application of fertilizers, weeding.

4. COCONUT
   Coconut based cropping system, Inter and multiple cropping, multi storied cropping, Shedding of buttons, immature nuts, production of barren nuts and their control, Harvesting, preparation of cup and ball copra, Yield, Storage, Deficiency disorders – Crown choke.

5. ARECANUT
   Introduction, Scoope and importance, area and production, uses, varieties, Soil, Climate, Nursery raising techniques- Selection of mother palms, Seed nut selection, Primary and secondary nurseries – selection of nursery plant material.

6. ARECANUT
   Establishment of plantation – Spacing, Season of planting, Plantation management – Inter Cultural operations- Manuring, Irrigation, weeding.

7. ARECANUT
   Multiple cropping- Intercropping, Mixed cropping, Multi storied cropping, Harvesting- processing- Dried ripe nuts, Kempedike, Chali and Kalipak, Scented supari, Colour development on chewing, Alternative uses

8. OIL PALM
   Introduction, Area and production, uses, products/ byproducts, varieties, seed propagation, Commercial Nursery – Selection, Climate – Sunshine and Temperature requirement – Oilpalm growing areas.
OIL PALM
Soil – Types of soils for oil palm growing regions, Spacing, Planting, Irrigation, Manuring, Weeding and Mulching

OIL PALM
Harvesting and yield, Processing – Extraction of oil from Mesocarp and kernel.

PALMYRAH
Introduction, Area and production Products/ byproducts from palmyrah palm – Neera, Varieties – Black skin fruit, Male & female palms differentiation, Soil and Climate, Propagation – Raising Nursery.

PALMYRAH

COCOA
Introduction, Area and production, origin & distribution, uses – Cocoa products/ Byproducts – cacao liquor or cocoa mass, Cocoa powder, Cocoa butter, chocolate, varieties, Climate, Soil.

COCOA
Propagation – Mother tree selection, Seed and Vegetative propagation, Cuttings, preparation of land, provision of Shade, Spacing, planting-Cocoa under Natural Shade, Cocoa under Artificial Shade, Intercropping.

COCOA
Irrigation, Manuring, weeding, types of branching, training and pruning, Harvesting, Preparation of cocoa to the market.

COCOA
Processing 1) Burrow method 2) Heap method 3) Basket Fermentation 4) Tray fermentation 5) Box fermentation, End point of fermentation. Drying- Sun drying, Artificial drying, Storage of Kernels.

CASHEW NUT
Introduction, Area and production, by products – uses, Climate, Soils, varieties/hybrids, Propagation – Vegetative propagation, Epicotyl grafting and Cuttings.

CASHEW NUT
Planting, Branching Pattern, Irrigation, weeding, Manuring, Nutrient deficiency symptoms of major nutrients.

CASHEW NUT
Training and pruning, Rajuvenation, flowering – Season, type of flowers, pollination, Fruit and Nut development, Fruit drop – control, Harvesting, Yield.
20 CASHEW NUT
Processing Methods – Karnataka (Manglore) method, Tamilnadu (Panruti) method, Kerala (Quilon) method etc., CNSL extraction, Grading, packing.

21 COFFEE
Introduction, Area, Origin and distribution, Production, Export, Soil, Climate, types-differences – Arabica/robusta, branching – climatological differences, Varieties, propagation, Raising nurseries.

22 COFFEE
Preparation of main field and planting, Type of shades, Provision of shade, Temporary shade Advantages of shade, Disadvantages of shade, shade Trees – their characteristics, Temporary shade and Permanent shade.

23 COFFEE
Irrigation, Manuring, Training and pruning – Rajuvenation pruning, Inter cultural practices, Digging, Scuffling or soil stirring, Trenching, Mulching, Weeding, Liming, Flowering- season of flowering, Fruit set and control of premature fruit drop, Bean disorders.

24 COFFEE
Cropping Pattern and harvest – types of harvest, Processing – Preparation of parchment coffee, Cherry coffee, Types of beans – Elephant bean, Pea berry, Yield, storage.

25 TEA
Introduction, Origin and Distribution, Area and Production, Role of tea industry in Indian economy, Export, Soil, Location and Climate, Varieties, Propagation-Vegetative propagation, Source of propagation materials.

26 TEA
Method of planting and bush population, planting season, Mulching, weeding, Shade and its management, Types of Branching, Pruning – First year pruning, Second year pruning, Third year pruning.

27 TEA

28 TEA
Leaf plucking, Yield of leaves, Manufacturing of tea – Blended tea, Green Tea, Oolong tea, Grading, Packing.

29 RUBBER
Introduction, Origin and distribution, Area and production, Demand potential, Climate and soil, Varieties & Types, Propagation- Seeds, Vegetative methods, Bud
wood nursery for stump planting, Basket plants, Planting – season, spacing, manuring, Cover crops, Irrigation, Weeding.

30 Types of Planting material, Improved clones, Polyclonal seed garden, Planting – Seed at stake planting, Stump planting, Basket plants, Planting- season, spacing, manuring, Cover crops, Irrigation, weeding.

31 RUBBER
Types of rubber trees- Immature rubber trees, under tapping, Tapping – tapping systems, puncture tapping, slaughter tapping, use of growth regulates for latex flow, rain guarding, latex collection, yield of latex.

32 RUBBER
Processing of rubber latex – Marketable forms – Processing steps – Smoked rubber, sheet rubber, storage – marketing.

PRACTICALS:

1. Description and identification of Coconut, Areca nut & Oil palm varieties/ Hybrids
2. Description and identification of Cacao, Cashew nut varieties/ Hybrids.
3. Selection of mother palm, seed nuts and planting of seed nuts in the nursery of Coconut and Areca nut – selection criteria for planting seedlings.
4. Layout and planting of Coconut, Areca nut and Oil palm.
5. Identification of branching pattern in Cashew Nut & Cacao.
6. Description and identification of branching pattern in Coffee.
7. Methods of Processing of Coffee beans
8. Methods of Processing of Tea.
10. Working out of economics and project preparation for Coconut, Areca nut plantations.
11. Working out of economics and project preparation for Oilpalm, Cashew nut plantations.
12. Working out of economics and project preparation for Tea and Coffee plantations.
14-16. Visit to Commercial plantations and processing centers.
THEORY:

1. Introduction
   History, importance, present status (export & import), future prospects and constraints in the cultivation of Medicinal crops

2. ALOE
   Importance and uses, origin and distribution, description of plant, species and varieties, soil, climate, land preparation, propagation crop duration, spacing & planting, manuring, irrigation, intercultivation, harvesting, yield and chemical composition.

3. ASWAGANDHA
   Importance and uses, origin and distribution, description of plant, varieties, soil, climate, propagation manures, fertilizers and inter cultivation

4. ASWAGANDHA
   Harvesting, crop duration, method of harvesting drying, grading and yield, chemical constituents.

5. BELLADONA
   Importance and uses, origin and distribution, description of plant, varieties, soil and climate, land preparation, propagation, spacing, fertilizer application, irrigation, intercultivation, harvesting, drying and yield.

6. CINCHONA
   Importance and uses, origin and distribution of species, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, weeding, cover cropping, staking, harvesting – method of harvesting and yield of bark.

7. COLEUS
   Importance and uses, origin and distribution, botany, varieties, soil and climate, propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield of tubers.

8. DIOSCOREA
   Importance and uses, origin and distribution botany species, varieties, soil, climate requirements of various species, propagation

9. DIOSCOREA
   Field preparation, spacing, planting, staking, manures & fertilizers, irrigation, interculture & inter cropping, duration of the crop, harvesting, yield & marketing.

10. ISABGOL
    Importance and uses, origin distribution area, production, description of plant, varieties, soil, climate propagation, manures & fertilizers, irrigation, harvesting, yield, chemical composition.
11 **KALMEGH**
Importance and uses, origin and distribution botany, soil, climate propagation, manures & fertilizers, irrigation, harvesting & yield, chemical composition.

12 **LONG PEPPER**
Importance and uses, origin and distribution botany, wild species and varieties, soil, climate land preparation, propagation, spacing & planting, manures & fertilizers, irrigation, interculture, mulching, harvesting, drying & yield, grading.

13 **POPPY**
Importance and uses, origin and distribution botany, varieties, soil, climate, propagation spacing, manures & fertilizers, irrigation, interculture and weeding flowering and fruit – set, lancing and latex collection, processing, harvesting of seeds, yield of crude opium and seed, chemical composition.

14. **PERIWINKLE**
Importance and uses, origin and distribution botany types and varieties, soil, climate propagation spacing, planting, manures & fertilizers, irrigation, weed control, interculture, mulching, harvesting & yield.

15 **RAUVOLFIA**
Importance and uses, origin and distribution botany varieties, soil, climate propagation spacing, planting, manuring, irrigation, weeding, harvesting, root yield.

16. **SENNNA**
Importance and uses, origin and distribution, botany varieties, soil, climate land preparation propagation, sowing, manures and fertilizers, crop rotation and intercropping, irrigation, weeding and interculture, harvesting, drying & storage, yield.

17. **STEROID – BEARING SOLANUM**
Importance and uses, distribution botany varieties, soil, climate land preparation, propagation nursery raising and transplanting, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield.

18 **SWEET FLAG**
Importance and uses, origin and distribution botany species and varieties, soil, climate planting season, land preparation propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting & yield.

19 **PYRETHRUM**
Importance and uses, origin and distribution botany, types and varieties, soil, climate season, land preparation propagation, planting, and fertilizers, irrigation, harvesting, drying yield of flowers and pyrethrin content, extraction and storage.
GLORY LILY, GUGGAL, LIQUORICE, HONEY PLANT, BETELVINE, DATURA
Common name, botanical name, family economic part and uses.

INTRODUCTION
History, importance, present status (export & import), future prospects, opportunities and constraints in the cultivation of aromatic plants.

EXTRACTION METHODS
Extraction methods for essential oil crops – distillation methodology and advantages and disadvantages of water distillation, water & steam distillation, steam distillation.

COMMINUTION
Distillation process, 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

AMBRETTE (MUSK)
Importance and uses, origin, distribution, botany, soil, climate, land preparation, propagation, sowing, manures and fertilizers, irrigation, harvesting & yield

BURSERA (Indian Lavender Tree)
Importance and uses, botany, varieties, soil, climate propagation, planting, pruning and training, manures and fertilizers, irrigation, inter cropping, harvesting, yield.

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

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

GERANIUM
Importance and uses, origin, distribution, botany, varieties, soil, climate, propagation, spacing, planting and after care, manures and fertilizers, harvesting & yield.

KHUS GRASS & PALMAROSA
Importance and uses, origin, distribution, botany, types and varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting & yield.

MINT
Importance and uses, distribution, description of species of mint, varieties, chemical
composition and uses, seasons, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting & yield.

31  OCIMUM SPECIES
Importance and uses, origin, distribution, botany, varieties, soil, climate, season, propagation, cultivation details, harvesting & yield.

32  LAVENDER, LEMON, SCENTED GUM & DAVANA PATCHOULI
Common name, botanical name, family economic par and uses.

PRACTICALS:

1 & 2  Collection of locally available medicinal plants, plant description and preparation of herbarium – two classes.

3 & 4  Collection of locally available aromatic plants, plant description and preparation of herbarium – two classes

5 & 6  Propagation and nursery techniques for important aromatic crops – two classes

7 & 8  Propagation techniques for important medicinal plants.

9  Important cultural aspects and harvesting techniques for important medicinal plants.

10  Drying, curing and primary processing for important medicinal plants

11  Harvesting techniques for important aromatic crops

12  Extraction of aromatic oil through steam distillation process at field level, parts of steam distillation unit, principle of distillation process. Hydro distillation of aromatic oil in the laboratory.

13  Visit to Ayurvedic pharmacy

14  Visit to commercial perfumery industry

15  Visit to CIMAP or any other research institute working on medicinal and aromatic plants

16  Visit to commercial farms.
DEPARTMENT OF POST-HARVEST TECHNOLOGY

PHTH -151 Fundamentals of Food Technology 2(1+1)

THEORY:

1. Food – its importance for health. Definition of food, Food technology, Food science. Abbreviations, Institutes and head quarters.
2. Functions of foods.
3. Food grouping (Basic IV, V, VII) and classification of food based on nutritional contribution.
4. Balanced diets for different age groups.
5. Physico–chemical properties of foods.
8. Processing of legumes & pulses – germination, fermentation etc.— effect on nutritive value.
11. Processing of meat and meat products – effect on nutritive value.
12. Processing of fish & poultry and egg – effect on nutritive value.
13. Sugar processing, Browning reactions – enzymatic & non-enzymatic
15. Food additives
PRACTICALS:

1. Weighment and measurement of food ingredients using standard cups and measures.
2. Microscopic examination of cereal starches.
3. Malting of cereals.
4. Effect of cooking on volume and weight of cereals (gelatinization).
5. Cooking of legumes and pulses using different methods – effect of volume and weight.
7. Determination of edible portion of fruits and vegetables.
8. Browning reactions in fruits and vegetables.
10. Cooking of meat and meat products using various methods – effect on volume and weight.
11. Cooking of egg using different methods.
12. Preparation with milk – curdling of milk, thickening etc.
13. Determination of different stages in sugar cookery.
15&16 Microwave cooking – effect on cooking time and quality.
PHTH-3.5.1 Post harvest Management of Horticultural crops

THEORY:

1 & 2 Importance of post harvest technology of horticultural crops
Importance of fruits and vegetables – Nutritional aspects. National Economy, Area and production of fruits and vegetables in India and Andhra Pradesh, extent PHT losses, factors affecting for post harvest losses – (A) primary causes (i) Mechanical injury (ii) Pathological action (iii) Environmental factors (B) Secondary causes: Storage and marketing facilities. Control of post harvest losses – cultural operation, harvesting and filed handling, packing house, transportation, creation of cold storage and processing of fruits and vegetables, Research and Development needs.

3, 4 & 5 Maturity indices:
Definition of maturity, methods to determine maturity – visual means, physical methods, chemical methods, computation, physiological methods – Maturity indices for fruits – banana, grapes, sweet orange, mango, papaya, pineapple and guava. Maturity indices for vegetable – tomato, Brinjal, peas, okra, baggage, cauliflower, cucumber, beans, onion, watermelon and musk lemon.

6, 7 & 8 Harvesting:

9 & 10 Grading:

11 Harvesting handling and grading of cut flowers

12 & 13 Pre-harvest factors – Environmental factors, (a) light, (b) temperature (c) wind (d) rainfall. Cultural operations: Variety, topography of orchard, soil conditions, root stock, water, natural management, training and punning and harvesting types.
14, 15 & 16 Factors responsible for deterioration of Horticulture produce

17 & 18 Physiological and Biochemical changes: Physiological – Softening, Physiological loss in weight (PLW), texture, respiration and transpiration, Bio-chemical changes – Change in carbohydrates, organic acids, pigments, phenolic compounds, flavouring compounds, enzyme activity.

19 Hastening ripening – Ethylene and ethylene releasing compounds, smoke, alcohols, Fatty acid. Delaying ripening – 2, 4D, 2,4,5T and 2,4,5 TP.

20 Post harvesting treatments – Washing, use of growth regulators, hot water dip, fungicidal treatment, in-package treatment, waxing and irradiation.

21 Quality parameters and Specifications: Mango, banana, citrus, grapes, tomato, cucumber, beans and okra

22 Structure of fruits and vegetables.
Protective tissue, Ground system, Vascular system and textural characteristics.

23 & 24 Methods of storage for local market and export
(A) Traditional storage: (Local market) On site storage (in-situ); clamp storage; cellars / underground storage, Evaporative cool storage, hypobaric storage. (B) improved storage methods (Export): Refrigerator storage; Modified atmospheric packaging, silicon membreance technology, Controlled atmospheric (CA) storage.

25 Type of packaging:
Groups of packaging materials (A) Shipping containers – (i) Wooden containers (ii) Bag / Textile (ii) metal (iv) paper (B) Retail containers
Packing methods:
Individual fruit packing, Bulk packing, MAP, Packing with divisions, Consumer size packing

26 & 27 New innovation in packing materials
A. Active packaging: major active packaging systems –
28 & 29 Types of containers and Cushioning materials
Typing containers –
A) Paper board and fibre board: Advantages and Disadvantages (B) Plastics: Advantages and Disadvantages (i) Poly styrene (ii) Polyvinyl Chloride (PVC) (iii) Polyvinylidedene chloride (PVDC) (iv) Polyethylene (v) Polypropylene (C) Rigid plastic containers: Cushioning material: Paper waste, paddy straw, banana leaf etc.

30 Vacuum packaging and shrink films: Definition and uses.

31 Grape guard packing treatments: Types of grape guards (i) Slow release type (ii) Quick release type

32 Mode of transport: By road (i) Truck or Railway wagon, (ii) Sea or waterway by ship or barges and (iii) by air craft.

PRACTICALS:

1 Practice in judging the maturity of various horticultrual produce
2 Determination of physiological loss in weight and quality
3 Grading of horticultrual produce
4&5 Post-harvest treatment of horticultrual crops, physical and chemical methods.
6 Packing studies in fruits, vegetables by using different packing material
7 Packing studies in plantation crops and cut flowers by using different packing material
8 Methods of storage
9&10 Post harvest disorders in horticultrual crops
11 Identification of storage pests and diseases
12-16 Visit to markets, packing houses and cold storages
1. Importance and scope of fruit and vegetable preservation industry in India. Losses in Post Harvest operations

2 & 3 Principles and method of preservation:
Preservation by Asepsis, High Temperature, low temperature, chemicals Drying, filtration, carbonation, sugar salt, fermentation, acids, oil and spices, antibiotics, irradiation

4 & 5 Canning and Bottling of fruits and vegetables
Principles and process of canning and bottling
General considerations in Establishing a commercial fruit and vegetable cannery

6 Causes for spoilage of canned foods
a) Spoilage due to physical and chemical changes
b) Microbial spoilage
c) Discolouration of fruit and canned products

7 & 8 Unfermented fruit beverages:
Preparation and preservation of unfermented fruit beverages juices, RTS, Nectar, cordial, squash, syrup, fruit juice concentrate, crush
Fermented fruit beverage: Different types of Wines

9 Jams, jellies and Marmalades – Procedure for preparation
Jams: Problems of Jam production
Jelly: Important considerations in jelly making and problems of jelly preparations.
Marmalade: Jelly Marmalade and jam Marmalade

10 Preservation by sugar: Candies, Crystallised fruits, Preserves procedure for preparation
Important considerations and problems in preparations

11 Preservation by salt: Pickles
Procedure for preparation

12 Chutneys and Sauces/ketchups
Procedure for preparation
Problems in the preparation of sauces and ketchups

13 Tomato processing:

14 Mushroom processing
Different sps of mushrooms including poisonous sps
Preservation by Freezing
Methods of Freezing
Changes during Freezing and Storage of Frozen food

Food laws:
Fruit Product order
Statutory provisions of quality control of India
Food Standardization and Regulatory agencies in India

PRACTICALS:

1 & 2 Identification of equipment used in processing industry
3 Estimation of TSS
4 Estimation of reducing and Non reducing sugars
5 Estimation of Ascorbic acid
6 Estimation of Titrable acidity
7 & 8 Canning of Fruits and vegetables
9 Preparation of syrups and brines
10 Preparation of Jams
11 – 14 Preparation of Jellies and marmalades
15-16 Preparation of RTS, Cordials, Squash and syrup
17-18 Preparation of Candies and preserves
19-20 Preparation of Chutneys
20-21 Preparation of Pickles (Hot and sweet)
22-23 Preparation of Sauces
24-25 Preparation of Pickles
26-27 Dehydration of Fruits and vegetables
28-29 Refrigeration and Freezing
30-32 Visit to Processing units
THEORY:

1. Important characters of Phylum Arthropoda, relationship of Class Insecta with other Arthropods (Class: Onychophora, Crustacea, Arachnida, Chilopoda and Diplopoda)
2. Economic importance of Class Insecta.
3. Dominance of insects in Animal Kingdom.
4. Definition, divisions, history and scope of entomology.
5. Cuticle: Its structure and function, process of moulting.
7. Types of insect antenna and legs.
8. Wings: Venation, cross veins, margin and angles, areas of wing.
9. Types of insect wings, types of wing coupling mechanism.
10. Metamorphosis, types of metamorphosis in insects (Ametabola, Hemimetabola, Paurometabola, Holometabola, Hypermetabola), types of larvae and pupae
11. Types of insect head, sutures and scelerites of head, tentorium
12. Types of insect mouth parts: Biting and chewing type, Piercing and sucking (bug type and mosquito type), Rasp ing and sucking type, Sponging type and Siphon ing type.
14. Excretory system in insects: Organs involved (Malphigian tubules, integument, tracheal system etc.,) accessory organs of excretion (nephrocytes, fat bodies, labial glands etc.) process of excretion and osmoregulation, functions of Malphigian tubules, cryptonephry.
17. Female reproductive system-structure, physiology of sperm production, different types of reproduction in insects.
18. Male reproductive system – structure, physiology of sperm production, different types of reproduction in insects.
20. Structure of insect nervous system: Central nervous system, Visceral nervous system and Peripheral nervous system.
22. Classification of respiratory system on the basis of functional spiracles. Respiration in aquatic insects.
23. Postembryonic development, eclosion in insects.
24. Classification of insects up to orders and families of economic importance.
25. Study of order and family characters of Orthoptera (Acrididae), Dictyoptera (Blattidae, Mantidae)
26. Isoptera (Termitidae), Thysanoptera (Thripidae), Hemiptera (Pentatomidae, Tingidae, Miridae) Homoptera (Cicadellidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae).
27. Lepidoptera (Noctuidae, Sphingidae, Pyralidae, Hesperidae, Papilionidae, Arctidae, Gelechiidae, Lymantriidae, Cochlididae).
28. Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Scarabaeidae, Apoinidae)
29. Hymenoptera (Tenthridinidae, Trichogrammatidae, Formicidae, Apidae, Ichneumonidae, Braconidae, Chalcididae)
30. Diptera (Cecidomyiidae, Trypetidae Tachinidae, Agromyzidae)
32. Plant mites: Morphological features, important families with examples.
PRACTICALS:

1. Methods of collection and preservation of insects including immature stages.
2. External features of grasshopper / Blister beetle.
3. Types of insect antennae and legs
4. Types of mouth parts.
5. Types of wings and wing coupling apparatus.
6. Types of larvae and pupae
7. Dissection of digestive system in insects (Grasshopper)
8. Dissection of male and female reproductive systems in insects (Grasshopper)
9. Study of characteristics or orders Orthoptera and Dictyoptera and their families.
10. Study of characteristics or orders Isoptera and Thysanoptera and their families.
11. Study of characteristics or order Hemiptera and its families.
12. Study of characteristics or order Lepidoptera and its families.
13. Study of characteristics or order Lepidoptera and its families.
14. Study of characteristics or order Coleoptera and its families.
15. Study of characteristics or order Hymenoptera and its families.
16. Study of characteristics or order Diptera and its families.
PRACTICALS:

1. History and importance of phytonematology
2 & 3. Study of general characters of plant parasitic nematodes
4 & 5. Classification of nematodes and their description
6. Methods of sampling and extraction of nematodes from soil
7. Extraction of nematodes from plant parts. Killing and fixing of nematodes
8. Preparation of temporary and permanent mounts
9. Symptoms of damage by nematodes in vegetable crops
10. Symptoms of damage by nematodes in fruit crops
11. Symptoms of damage by nematodes in flowers and ornamental crops
12. Symptoms of damage by nematodes in spices, plantation crops
13. Field visit to collect nematode damaged plant parts. Staining of nematodes in roots.
14. Recording of data and other nematode damaged plant parts. Staining of nematodes in roots.
15. Management of plant parasitic nematodes.
16. Role of nematodes in disease complex
1 IPM – Introduction, definition, causes of pest outbreak
2 Categories of pests, pest surveillance, pest forecasting
3 Concepts of IPM, components of IPM, phases of IMP
5 Cultural control
6 Physical control
7 Mechanical control
8 Host plant resistance (antixenosis, antibiosis, tolerance)
9 Legislative control (plant quarantine)
10 Chemical control – Classification of insecticides
11 Insecticidal formulations
12 Application techniques for insecticides
13& 14 Biological control – Parasitoids, predators, athogens (bacteria, fungi, viruses and entomopathogenic nematods)
15& 16 Other methods – antifeedants, attractants, repellents, sex pheromones, genetic control, chemosterilants, insects growth regulators (chitin synthesis inhibitors, juvenile hormone, anti juvenile hormone, precocenes)
17 TROPICAL FRUITS
Mango: Hoppers, red banded caterpillar, nut weevil, stem borer, leaf webber, mealy bug, oriental fruit fly, leaf gall midges, thrips
18 Guava: Tea mosquito bug, fruit fly, fruit borer, mealy scale, bark eating caterpillar. Sapota: Leaf webber, bud borer, fruit fly.
19 Cashew: Cashew shoot and root borer, shoot and blossom webber, tea mosquito bug, thrips, leaf miner, fruit borer
20 Ber: Ber fruit fly, fruit borer
Banana: Rhizome weevil, pseudostem borer, aphid
Papaya: Mealy bug, spiraling white fly
21 Pomegranate: Pomegranate butterfly, fruit sucking moths
Wood apple: Castor shoot and fruit borer
Custard apple : Mealy bug  
Tamarind : Fruit borer  

22 SUBTROPICAL FRUITS  
Grapavine : Flea beetle, thrips, stem girdler, mealy bug, stem bore, 2 spotted spider mite  

23 Citrus : Citrus butterfly, Fruit sucking moths, citrus leaf miner, psylla, white fly, black fly, mangu mite.  

24 Litchi : Fruit borer, leaf miner, rust mite  

25 TEMPERATE FRUITS  
Apple : Sanjose scale, woolly aphid, cottony cushion scale, codling moth, tent caterpillar, gypsy moth, European red mite.  

26 Peach : Leaf curl aphid, borer  
Plum : Weevil,  
Apricot : Chalcid  

27 PLANTATION CROPS  
Coconut & Oil palm : Black headed caterpillar, rhinoceros beetle, red palm weevil, Eriophid mite, coconut scale  

28 Tea : Tea mosquito bug, thrips, mite complex (red spider mite, yellow mite, pink mite, purple mite, scarlet mite)  
Coffee : Green scales, white borer, red borer, shot hole borer, berry borer  

29 Arecanut : Scales, mites, thrips, nymphalid butterfly  
Cocoa : Tea mosquito bug, chaffer beetles  
Rubber : Bark caterpillar, scales  

30 MEDICINAL AND AROMATIC PLANTS  
Cinchona : Root grub, bugs  
Neem : Root grub, slug caterpillar, mired bug, mealy bug, tea mosquito bug  
Crotalaria : Sun hemp hairy caterpillar  
Cinnamon : Leaf eating caterpillar, Jumping bug  
Camphor : Leaf roller, mealy bug, scales  

31 Mint : Leaf roller, hairy caterpillars, termites, pyralid moth  
Datura : Spotted borer, thrips  
Opium : Cutworm, capsule borer, weevil  
Bellodona : Cut worm, potato beetle, flea beetle  
Dioscorea : Aphids, red spider mites  

32 Insecticide residues problem n fruit, plantation, medicinal and aromatic plants and their tolerance limits.
**PRACTICALS**

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<td>14</td>
<td>Identification of insects pests attacking stored fruits, Plantation, medicinal and aromatic crops and their processed products.</td>
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<tr>
<td>15</td>
<td>Study of bird pests of horticultural crops and their management</td>
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<tr>
<td>16</td>
<td>Study of rodent pests of horticultural crops and their management</td>
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</tbody>
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ENTO-3.6.1 Insect Pests of Vegetable, Ornamental and Spice Crops

THEORY:

1. Economic importance of insects in vegetable, ornamental and spice crops – their pest surveillance, ecology and management.

2. Distribution, host range, bio-economy, nature and symptoms of damage and integrated management of important insect pests affecting VEGETABLES
   Brinjal: Shoot and fruit borer, stem borer, Epilachna beetle, leaf hoppers, aphids, lacewing bug, mealy bugs, leaf webber


4. Tomato: Fruit borer, Serpentine leaf miner, White fly, Brinjal stem borer

5. Cucurbits: Fruit files, Pumpkin beetles, Aphids, Sake guard semilooper, pumpkin leaf caterpillar, Coccinia gall fly, Serpentine leaf miner

6,7. Crucifers: Diamond back moth, Cabbage head borer, Cabbage leaf webber, Cabbage semilooper, Painted bug, Aphids, Cabbage butterfly, Tobacco caterpillar

8. Carrot and turnip: Pea leaf miner, Flea beetle, Carrot rust fly Sugarbeet & Beetroot: Beet leaf miner, Web worm

9. Potato: Potato tuber moth, black cut worm, bihar hairy caterpillar, Epilachna beetle, Golden cyst nematode

10. Sweet Potato: Sweet potato weevil, Vine borer, Sweet potato hopper, Tortoise beetle
    Colacasia: Flea beetle, Grass hopper

11. Yams: Yam beetles, Saw fly, Leaf eating caterpillars, Scale insects
    Curry leaf: Psylid bug, Citrus butterfly, bark borer

12. Moringa: Hairy caterpillar, Bud worm, Bud midge, Leaf caterpillar, Scale, Pod fly, Bark caterpillar

13. Leafy vegetables:
    Amaranthus: Amaranthus caterpillar, Leaf webber, Stem weevil, Palak & Spinach: Leaf eating caterpillar, Aphids.

    Beans: Gram pod borer, Flower webber, Bean aphid, Leaf hopper, White fly, Blister beetle
ORNAMENTALS
Rose: Rose aphid, Thrips, Scales, Leaf cutter bee, Tomato fruit borer

Chrysanthemum: Black aphid, Composite thrips, Leaf folder, Tomato fruit borer, Leaf miner

Jasmine: Bud worm, Gallery worm, Blossom midge, Eriophyid mite, Jasmine thrips, Stink bug.

Marigold: Tomato fruit borer, Leaf hopper, Hairy caterpillar, Tarnished plant bug, Red spider mite.

Pests of cutflowers: Lily leaf caterpillar, Gladiolus thrips, Carnation totrix moth, Tuberose bulb mite, Gerbera mite, Bird of paradise scale, Dahlia aphid, Orchid weevil, Orchid bulb mite and orchid fly, Tulip bulb aphid, Green peach aphid in anthurium.

Pests of indoor plants: Aphids, Mealy bugs, White fly, Scale, Red spider mite

SPICES
Pepper: Pollu beetle, top shoot borer, berry gall midge, hard scales, soft scale, two tailed mealy bug, white fly, wild silkmoth

Cardamom: Cardamom aphid, Cardamom thrips, Castor capsule borer, Early capsule borers, Rhizome weevil, shoot fly, Cardamom hairy caterpillars

Chillies: Chilli thrips, Fruit borers, Green peach aphid, Fruit bug, cotton white fly, Lucerne caterpillar, Termite.

Coriander and cumin: Mealy plum aphid, Coriander sphid, Cotton white fly, Tobacco caterpillar

Mint: Leaf roler, Lace wing bug, potato cut worm, Lucerne caterpillar, Semilooper

Fenugreek: Lucerne caterpillar

Onion, Garlic: Onion fly, ear wig, onion thrips, tomato fruit borer, tobacco caterpillar, cutworms

Turmeric and Ginger: Rhizome maggots, Rhizome scales, Castor capsule borer, shoot borer

Important storage insect pests of vegetable and ornamental crops

Important storage insect pests of spice crops, processed vegetables and their management.

Insecticidal residue problems in vegetables and ornamental crops, tolerance limits.
PRACTICALS:

1. Identification of insect pests of Brinjal and their damage symptoms.
2. Identification of insect pests of bhendi and tomato and their damage symptoms.
3. Identification of insect pests of cucurbits and their damage symptoms.
4. Identification of insect pests of crucifers and their damage symptoms.
5. Identification of insect pests of potato, sweet potato, sugarbeet and beetroot and their damage symptoms.
6. Identification of insect pests of moringa, spinach and amaranthus and their damage symptoms.
7. Identification of insect pests of rose and chrysanthemum and their damage symptoms.
8. Identification of insect pests of peas an beans and their damage symptoms.
10. Identification of insect pests of crossandra and marigold and their damage symptoms.
11. Identification of insect pests of cutflowers and their damage symptoms.
12. Identification of insect pests of pepper and cardamom and their damage symptoms.
13. Identification of insect pests of chillies and their damage symptoms.
15. Identification of insect pests of onion and garlic and their damage symptoms.
16. Identification of insect pests of attacking vegetable, ornamental and spice crops and processed vegetables and their management.
1. Importance and history of bee keeping, apiculture and apiary, different species of honey bees – rock bee, little bee, Indian bee, European bee / Italian been and Dammar bee.

2. Different castes of honey bees, biology, their duties, morphological differences, caste determination, communication in bees.

3. Bee colony maintenance – bee colony activities – starting of new colony – location site, transferring a colony, replacement of queen, combining colonies, swarming, swarm prevention, colony management in different seasons, been pasturage.

4. Types of bee hives, their description. Equipment and accessories for apiary – comb foundation sheet, dummy division board, queen excluder, drone trap, swarm trap, been brush, smoker, decapping knife, honey extractor.

5. Bee products: Honey extraction, honey composition and value, test of pure honey, been wax and its uses.


7. SERICULTURE
   Importance, history and development in India, silk worms – kinds and their hosts distribution, life cycles in brief, silk glands.

8. MORICULTURE – Mulberry varieties, package of practices, pests and diseases and their management.

9. Mulberry silkworm – morphological features, rearing house and equipments – rearing stands, ant wells, rearing trays, paraffin paper, chop sticks, feathers, leaf chamber, chopping board, knives and mats, cleaning nets, mountages (chandrikes) disinfection and hygiene.

10. Silk worm rearing – young age / chawki rearing and old age rearing of silk worms – procurement of quality seeds, quality of food, shape and size of leaves, preparation of feed bed, bed cleaning, spacing, mounting, care during cocoon spinning, harvesting of cocoons.

11. Silk worm egg/ seed production (Grainage technology) – mother moth examination, diapause of eggs, artificial breaking of diapause- acid treatment, chilling, packing and transportation of eggs, incubation and black boxing of eggs. Commercial, physical characters of cocoons – colour, shape, hardiness, shell ratio, length of filament, denier, floss and raw silk per cent, reelability fo cocoons.
12. Post Harvest processing of cocoons- stifling, cocoon boiling, brushing, reeling, re-reeling, finishing, testing.


14. LAC CULTURE: Introduction, history and importance of lac, lac growing areas in India, Lac insect, biology, behaviour, its strains (Kusumi & Rangeeni), Aghani, Tethwi, Katki and Baisakhi crops production.

15. Lac cultivation, food plants, propagation of lac insects, harvesting of lac, pruning of host trees, enemies / predators of lac insects

16. Lac extraction – production of shellac. Other by products: Molemma, Kiri, Passewas

PRACTICALS:

1. Study of important species of honey bees.
2. Seasonal management and colony maintenance of bees
3. Study of different bee hives and apiculture equipments.
4. Handling of bee hives and honey extraction
5. Study of pests and diseases of honey bees.
6. Establishment of mulberry garden, planting methods under irrigated and rain fed conditions
7. Maintenance of mulberry garden – pruning, fertilization, irrigation and leaf harvest
8. Mulberry pests and diseases and their management and nutritional disorder.
9. Study of different kinds of silk worms
10. Sericulture equipments for silk worm rearing
11. Mulberry silkworm – rearing room requirements
12. Rearing of silkworms – chawki rearing
13. Rearing of silkworms – late age silkworm rearing and study of mountages
14. Study of silk worm pests and diseases and their management.
15. Study of lac insects
16. Lac extraction – production of shellac.
THEORY:

1, 2, 3 Introduction to Plant Pathology – Definition and objectives of Plant Pathology – Different kinds of Plant Pathology viz., fungi, bacteria, viruses, viroids, fastidious vascular bacteria (RLOs), Phytoplasmas (MOLs), Spiroplasmas, algae, protozoa, nematodes-Economic importance of plant diseases in terms of losses caused and socio-economic charges specifying plant disease epiphytofies (late bright of potato, brown spot of rice, coffee rust, southern corn blight, sigatoka, disease of banana). History of plant pathology contributions of Micheli, Tillet, Prevost, Persoon, Fries, Anton de Bary and his students (Woronin, Befeld, Millarded, Marshal ward) Buffer, Mundkur, Tirumalachar, Subramanian.

4, 5, 6 Terms and concepts used in Plant Pathology – disease disorder, pathogen, parasite, pathogenisity, casual organism, pathogenesis, sing, symptom, syndrome, biotroph, hemibiotroph / neerotroph, inoculum, inoculum potential, infection, incubation period, pre-disposition, hypersensitivity, disease triangle and disease pyramid. Classification of plant diseases based on cause (parasitic and non parasitic diseases), occurrence (endemic, epidemic, sporadic and pandemic) and symptoms (necrotic, hyperplastic and hypoplastic diseases)


13, 14, 15 History of phytoplasmas – contributions of Doi et al and Ishiie et al. Classification and general characters of phytoplasmas, common disease (as per yellow, sesame phyllody, potato wilt’s, bromm, little leaf of bringal, etc) and
transmission – contributions of Rickets – Fastidious vascular bacteria (RLOs) – important characters of fastidious vascular bacteria– examples of disease caused by phloem limited and xylem limited bacteria. Tropanosomatid flagellates (flagellate protozoa). Classification important characters. Phytomonas sp. and disease caused by them. Algae – classification, important characters. Cephalecuors sp and diseases caused by them. Flowering parasites, classification and important characters partial and complete parasites on stem and root.

16, 17 Environmental factors that causes plant diseases (non-plastic causes) light, low temp, drought, mineral deficiency (Fe,Mg,Ca,Zn), perbidude / Pesticide injury with examples of diseases.

18, 19 Survival of plant pathogens – Kinds of inoculum produced by different plant pathogens with examples. Pattern of survival

a) infected host (main host, alternate host, collateral host)

b) saprophytic survival outside the host (soil and rock in habitants, rhizosphere colonizers)

c) dormant spores structures (seed borne, soil borne, borne on infected plant parts – Dispersal of plant pathogens.

d) Autonomous dispersal (soil, seed, plant parts and plant organs)

e) Passive dispersal viz., water, members of animal kingdom (man, insets, nematodes, animals and birds), fungi and phanerogams.

20,21,22 Phenomenon of infection – process of infection – pre-penetration and post penetration – pre-penetration in fungi (spore germination, perm fube, formation of specialized structures like appressorium, houstoria, rhizomorphs), bacteria and viruses-indirect penetration through wounds or natural openings like stomata, hydathodes and lenticels. Dietc penetration through plant surface (epidermis or cuticle) by chemical or mechanical. Post penetration – colorization of the host.


25-30 Principles and methods of plant disease management, general principles of plant disease management

(1) Avoidance of the pathogen (selection of pathogen free material and seed, selection of field, choice of time of sowing, disease escaping varieties)

(2) Eradication-inspection and certification (plant quarantine with examples)
(3) Cultural practices (d) Biological control (important fungal and bacterial Bio-control agents) (e) physical methods (soil solarization and hot water treatment)

(4) Protection-classification of fungicides Based on chemical nature (commonly used fungicides, bactericides and nematicides), mode of action and general use

(5) Host plant resistance (immunization)-definition – importance and advantages of resistant varieties.

31, 32 Integrated plant disease management – concept – importance and advantages and some examples.

**PRACTICALS:**

1. Familiarity with general plant pathological laboratory and equipments
2. Preparation of culture media for fungi (PDA) and bacteria (NA)
3. Isolation of fungal and bacterial plant pathogens.
4. Study of Oomycetes – fungi
5. Study of Zygomycotina– fungi
6. Study of Ascomycotina – fungi
7. Study of Basidiomycotina – fungi
8. Study of Deuteromycotina – fungi
9. Study of Deuteromycotina – fungi
10. Study of diseases symptoms and signs of important horticultural crops, phaenerogamic parasites, non parasitic diseases.
11. Preparation of fungicides – Bordeaux mixture, Chaubattia paste, Cheshunt compound and calculations.
12. Study of non-systemic and systemic group of fungicides and calculations related to fungicide concentrations (Copper, Sulphur, Heteroclic – nitrogenous compounds, other systemic fungicides etc.,)
13. Demonstration of virus transmission
14&15 Methods of application of fungicides, demonstration of seed treatment, soil application, foliar spray and post-harvest treatment of fruits.
16. Semester final practical examination
PRACTICALS:

1. General introduction scope of mushroom production in India. Different types of mushrooms nutritive value. Button mushrooms (Agaricus sp.) Oyster mushroom (Pleurotus sp.) paddy straw mushroom (Volvariella sp.) milky mushrooms (Calocybe indica) Black mushroom (Auricularia sp.), shitake mushroom (Lentinus edodes) medical mushroom (Ganoderma lucidum) their identification and uses. Identification of poisonous and edible mushrooms.

2 & 3 Equipment and Sterilization techniques for preparation of culture media (PDA, oat meal agar etc.)

4 & 5 Isolation of mother culture – Mother spawn preparation, inoculation and multiplication of spawn

6 Cultivation of Oyster mushroom, Spawn running Cropping Harvesting and Packaging.

7 Cultivation of Volvariella sp. Milky mushroom Cropping and Harvesting.

8 Production of spawn Cultivation methods of White button mushroom preparation and compost and casing soil, bed preparation and harvesting

9&10 Major diseases, Pests, Nematodes of mushrooms – Symptoms, etiology and their management.

11 Mushroom Preservation, Drying, Canning, Recipes and value added products post harvest technology.

12 Survey, collection and identification of mushrooms in the natural ecosystem.

13 Economics of mushroom cultivation

14 Visit to Commercial Production Units of mushroom production

15 Visit to Small Scale Units of mushroom production

16 Examination.


19,20 & 21 Custard apple 1.anthracnose, 2.Glomerella fruit rots,
   Anola    1.Rust, 2.Anthracnose
   Peach    1. Leaf Curl, 2.Rust, 3.Scab, 4.List of minor diseases
   Almond, Pear List of important diseases
   Plum
   Jack fruit 1.Die back 2.Rhizopus Fruit rot
   Areca nut 1. Fruit rot/Mahali/ Koleroga
   2. Foot rot/ Ganoderma root rot
24 Coffee 1.Rust, 2. Black rot,
   Tea      1. Blister blight
   Rubber: 1.Root rot, 2. Powdery mildew
   Pepper   1. Phytophthora foot rot, 2. Anthracnose/pollu
28 Neem      1. Phoma twig blight
   Senna     1. Damping off 2. Leaf Spot
29,30 & 31 Integrated management of post harvest diseases of fruits with special emphasis on Mango, Sweet Orange, Pomegranate, Apple, Grape and Banana.
PRACTICALS:

Study of Symptoms, etiology host-parasite relationship and specific management measures of the following crop diseases.

1. Diseases of Mango
2. Diseases of Citrus
3. Diseases of Grapevine
4. Diseases of Banana
5. Field Visit
6. Diseases of Guava and Sapota
7. Diseases of Papaya and Pomegranate
8. Diseases of Peach, Pear, Plum and Almond
9. Diseases of Ber, fig and Phalsa
10. Field Visit
11. Diseases of Apple, custard apple, Cashew, Jack, fruit and pine apple
12. Diseases of Coconut, arecanut, oilpalm and cocoa
13. Diseases of Betelvine, Pepper and Rubber
14. Diseases of medicinal and aromatic plants
15. Diseases of Coffee and tea
16. Field visit

Note: Student should submit 40 specimens during the semester
THEORY:

1. Crop - Diseases
   Tomato

2. Tomato

3. Brinjal

4. Chillies & Green pepper

5. Chillies & Green pepper

Bhendi

6. Crucifers (Cabbage, Cauliflower, Knol-Kohl, Brussels Sprout, Raddish)

7. Crucifers (Cabbage, Cauliflower, Knol-Kohl, Brussels Sprout, Raddish)

8. Peas

9. Peas:

Beans

10. Beans
11 Beet root

12 Potato

13 Cucurbits

14 Carrot

15 Colocasia
1. Phytophthora blight 2. Pythium rot
Sweet potato

16 Amaranthus, Spinach, Sorrel, Portulaca
Fenugreek

17 Basella
1. Cercospora leaf spot
Hibiscus
1. Root and stem rot 2. Leaf spot
Lettuce
Moringa
1. Twig canker

18 Onion & Garlic

19 Ginger
1. Phyllosticta Leaf spot 2. Rhizome rot or soft rot (Pythium) 3. Banded leaf / sheath blight and leaf blight 4. Bacterial wilt
Turmeric
1. Taphrina leaf blotch 2. Anthracnose or leaf spot 3. Rhizome Rot or Root Rot (Pythium) 4. Rhizome rot (Fusarium)

Clove

Cinnamon
1. Bark canker 2. Leaf spot and die back

Nutmeg
1. Die back and fruit rot 2. Wilt 3. Leaf spot

Cardamom
Large cardamom – 1. Foorkey disease 2. Chirkey disease

Coriander
1. Powdery mildew 2. Stem Gall

Curry leaf

Cumin

Rose

Jasmine

Crosandra

Chrysanthemum

Tuberosa
1. Alternaria leaf spot 2. Macrophema leaf spot

Marigold

Asters

28 Gladiolus
1. Wilt / Yellow / brown rot / dry rot 2. Corm rot (several fungi) 3. Leaf spot and corm scab 4. Mosaic

29 Gerbera

30 Carnation

31 Orchids

32 Postharvest diseases
Listing of various post harvest diseases along with pathogens in the above crops and general management practices for post harvest diseases with examples.

**PRACTICALS:**
1 Diseases of Tomato
2 Diseases of Brinjal
3 Diseases of Chillies / Capsicum
4 Diseases of Bhendi
5 Diseases of Cabbage & Cauliflower
6 Diseases of Peas and Beans
7 Diseases of Beet root
8 Diseases of Potato & Cucurbits
9 Filed visit
10 Diseases of Carrot, Colocasia, Spinach and Sweet potato
11 Diseases of Onion, Garlic and Ginger
12 Diseases of Turmeric and other species
13 Diseases of Rose
14 Diseases of jasmine and other ornamental crops
15&16 Field visits
1. Introduction and Definitions of Cytology, Genetics, Cytogenetics, Plant Breeding, Interrelationships among Cytology, Genetics, Plant Breeding and also with other branches of science.


3. Golgi complex-Lysosomes – Microbodies – Microtubules and microfilaments, Ribosomes


5. Morphology of chromosomes – Shape, size and number of chromosomes – structure of the chromosome – Euchromatin and heterochromatin.


7. DNA and its structure – Watson and Crick model Function and types.


9. Structure of RNA messenger RNA, ribosomal RNA and transfer RNA.

10. Genetic code – outline of protein synthesis, Transcription and translation


15. Crossing over – Mechanism of crossing over – Factors effecting crossing over – Crossing over at 4 strand stage – Cytological proof of crossing over – significance in Plant Breeding.


21. Qualitative and quantitative characters – definition – monogenic and polygenic inheritance and their differences – Multiple factor hypothesis.

22. Cytoplasmic inheritance – definition – Eg. 4 ‘O’ clock lant – characteristics of extrachromosomal inheritance.


25. Detection of mutations in plants – Importance of mutation in plant breeding programmes. Xenia and metaxenia – Molecular basis of mutations.

26. Structural Chromosomal aberrations – Breakage – Fusion – Bridge cycle – Deletions (Deficiency), duplications and their significance in Plant Breeding

27. Inversions – Pericentric Inversions ans paracentric inversions – Inversions as cross over suppressors.


31. Evolution of crop species (Eg. Wheat, cotton, Triticale, Brassica, Tobacco etc.)

PRACTICALS:

1. Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives ad stains for light microscopy.
2. Cytological techniques.
5. Monohybrid ratio and its modifications.
6. Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis.
7. Trihybrid ratio
8. Chi-square analysis
10. Complementary factors
11. Supplementary factors.
12. Duplicate factors.
14. Linkage – Two point test cross.
15. Linkage – Three point test cross.
16. Induction of polyploidy using colchicines and induction of chromosomal aberrations using chemicals
Principles of Plant Breeding

THEORY:

1. Definition, Aim, Objectives and Scope of Plant Breeding
3. Modes of reproduction – Asexual reproduction, sexual reproduction, Genetic consequences and its significance in Plant Breeding
4. Modes of pollination, Genetic consequences – cultivated crops with the botanical names belonging to self-pollinated, cross-pollinated crops and often cross-pollinated crops. Differences between self-pollinated and cross-pollinated.
5. Plant genetic resources – genetic erosion, gene banks, gene sanctuaries, germplasm and its maintenance
7. Purpose of plant introduction – Genetic erosion, gene banks, gene sanctuaries and its maintenance
12. Biometrics – Definition, components of genetic variation i.e., additive, dominance and epistasis and their differentiation
13. Hybridization – Aims and objectives, different types of hybridization and prerequisites and procedures and techniques
16 Backcross method of breeding, its requirements and application, procedure for transfer of single dominant gene and transfer of single recessive gene.

17 Merits, demerits and achievements of backcross breeding – Comparison between pedigree and backcross method – Multilane concept – Its definition and uses

18 Incompatibility and its classification – Genetic basis of incompatibility – Heteromorphic, homomorphic, gametophytic and sporophytic system of incompatibility.

19 Male sterility- different types – Genetic, Cytoplasmic and Cytoplasmic genetic male sterility. Its inheritance and maintenance.

20 Utilization of male sterile lines in hybrid seed production – Their limitation, advantages and disadvantages

21 Hardy Weinberg Law- Factors disturbing equilibrium in populations

22 Heterosis & inbreeding depression – Manifestation of heterosis – Genetical, physiological and biochemical causes of heterosis

23 Concepts and hypothesis of genetical causes of heterosis in self, cross- pollinated crops

24 Inbreeding depression – Effects of inbreeding in different crops – Procedure for development of inbred lines and their evaluation.

25 Exploitation of heterosis – History of Hybrid varieties- Important steps in production of single and double cross hybrids – Brief idea of hybrids in Maize, Bajra, Sunflower, Rice, Forage crops

26 Synthetics and composites – Production procedures, Merits, demerits and achievements comparison- between Synthetics and composites

27 Recurrent selection- Different types- Detailed procedure of simple recurrent selection and brief description of other recurrent selection methods

28 Methods of breeding for vegetatively propagated crops, clones, genetic variation within clone, clonal degeneration characteristic features of asexually propagated crops and clones – Methods of improvement of clonal crops, clonal selection, hybridization, problems in breeding of clonal crops, Merits, demerits and achievements of clonal selection.

29 Mutation breeding – Spontaneous and induced mutation – Mutagens

30 Procedure of mutation breeding for oligogenic and polygenic characters – Limitations and achievements

31 Wide hybridization – Barriers in distant hybridization –

32 Techniques to overcome sterility in wide hybridization – Application, limitations and achievements
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<tr>
<td>1</td>
<td>Botanical description and floral biology</td>
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<td>2</td>
<td>Study of megasporogenesis and microsporogenesis</td>
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<td>Fertilization and life cycle of an angiospermic plant</td>
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<td>Plant Breeder’s kit</td>
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<td>Hybridization techniques and precautions to be taken, floral morphology,</td>
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<td>selfing, emasculation and crossing techniques in Horticulture crops like</td>
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<td>7</td>
<td>Handling of segregating generations in pedigree methods</td>
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<td>Development of hybrids(one line, two line and three line breeding)</td>
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<td>Field lay our of experiments,. Field trials maintenance of records and</td>
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<td>12</td>
<td>Calculation of Heterosis, Heterobeltiosis and Standard heterosis</td>
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<td>Calculation inbreeding depression</td>
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GPBR-2.8.2 Breeding of fruit, Plantation and Ornamental Crops

THEORY:

1. History and improvement of ornamental Crops
2. History of Breeding Horticultural crops and achievements
3. Breeding objectives, and methods of different Horticultural crops, important concepts of Breeding ornamental crops.
4. Breeding objectives and Breeding Methods of Chrysanthemum and achievements.
5. Breeding objectives and Breeding Methods of Rose and achievements
6. Breeding objectives and breeding Methods of gaillardia. And achievements
7. Breeding objectives and Breeding Methods of gerbera and achievements
8. Breeding objectives and Breeding Methods of Marigold and achievements
10. Varieties development of important Ornamentals
13. History Breeding objectives, Methods for Mango and achievements
14. History Breeding objectives, Methods for guava and achievements
15. History Breeding objectives, Methods for custard apple and achievements
16. History Breeding objectives, Methods for banana and achievements
17. Breeding objectives and Methods for Papaya
18. Breeding objectives and methods for Amla
19. Breeding objectives and methods of pomegranate and achievements
20. History of clove, clonal selection importance in Horticulture Crops
21. History of mutation importance of bud mutations in Horticultural crops, fruits and ornaments
22. Importance of mutations, mutagens types of mutagens chemical mutagens and irradiations
23. Application of mutation, mutagens in Horticultural crop and achievements
24. History, and development of hybrids, different breeding methods used in fruit crops.
25. Breeding methods and objectives in developing hybrid water melon and achievements
26. Breeding methods and objectives in developing hybrid musk melon and achievements
27. History and importance of plantation crops.
Breeding methods and objectives for development of tea and achievements

Breeding methods and objectives for development of coffee and achievements

Breeding methods and objectives for development of clonal and achievements

Breeding methods clonal selection for varieties and hybrid clonal selection for hybrid clone.

Pure line selection, mass selection, pedigree selection, back cross breeding procedures.

PRACTICALS:

1. Sefling, emasculation and crossing techniques
2. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Rose.
3. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Rose.
4. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Gaillardia.
5. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Gerbera.
7. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Mango.
11. Working out phenotypic coefficient of variability, genotypic coefficient of variability, Heritability and genetic advance.
12. Working out phenotypic coefficient of variability, genotypic coefficient of variability, Heritability and genetic advance.
13. Preparation and use of chemicals mutagens.
14. Preparation and use of physical mutagens.
15. Maintenance of breeding records.
3.8.1  Breeding Vegetable, Tuber and Spice crop  
THEORY:

1. Classification of plants, Botanical description, Floral biology, Emasculation and Pollination techniques in important Horticulture crops
2. Breeding objectives and importance of breeding self and cross pollinated crops
3. Breeding objectives and importance of breeding vegetative propagated crops
5. Domestication – selection under domestication – types of selection patterns of evolution in crop plants
8. Polyploidy-Auto and Allo polyploidy-Their applications and limitations in crop improvement.
12. Origin and distribution of species, wild relatives and forms of Tomato
13. Breeding objectives and procedures / methods for development of Tomato
14. Hybrids and varieties in Tomato
15. Breeding objectives and procedures / methods for development of hybrids / varieties in Brinjal
16. Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Bhendi
Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Capsicum

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Chilli

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cucurbits (Cucumbers)

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cucurbits (Gourds)

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cucurbits (Melons).

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cabbage

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cauliflower

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Tuber crops – Potato

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Tuber crops – Potato

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Carrot

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Radish

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Spice crops – Ginger

Origin and distribution of spices, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Turmeric

Genotype X Environment interaction

Breeding for Quality Improvement (general)

Breeding for Quality Improvement (horticultural crops)
PRACTICALS:

1. Selfing, emasculation and hybridization techniques.
2. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Tomato
3. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Brinjal
4. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Bhendi
5. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Chilli
6. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Cucubits
7. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Cucubits
8. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Cucubits
9. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Potato
10. Methods for creation of variability in Turmeric
11. Methods for creation of variability in Ginger
12. Calculation of Heterosis, Heterobettiosis and Standard Heterosis
13. Calculation of inbreeding depression
14. Calculation of General coming ability, specific combing ability, variances and effects
15. Calculation of General coming ability, specific combing ability, variances and effects
16. Stability analysis
1. Definitions of Plant Biotechnology, terminology associated with biotechnology, Plant tissue culture and plant genetic engineering, major concepts and importance.

2&3. Origin and history of plant tissue culture and plant genetic engineering.

4. Scope and importance of biotechnology in crop improvement International Organizations involved in biotechnology.

5. Techniques of Invitro cultures – micropropagation – different stages involved in clonal or micropropagation – meristem cultures – production of virus free plants advantages and problems associated with micropropagation – application of plant tissue culture in crop improvement. Micropropagation research in India.

6. Applications and limitations of Ovule and Ovary culture.

7. Somaclonal variation – basis of somaclonal variation – Achievements gametoclonal variation


13. Transgenic plants – applications in crop improvement and limitations.


16. Marker assisted selection and its application in crop improvement.
PRACTICALS:


2. Nutritional requirements of invitro culture, media composition-types of media – solid and liquid media – Advantages and disadvantage.

3. Various sterilization techniques used in Plant Biotechnology – wet heat-dry heat- U.V.Chemical – filtration-advantages and disadvantages


11. Genomic and cDNA libraries – detection of a gene in a library, colony hybridization


14&15 DNA based / molecular markers – definition – RFLP, AFLP, RAPD and SSRs – importance and application.

THEORY:

1. Introduction to Seed production – concept of seed technology – seed quality – definitions of seed technology – objectives / goals of seed technology – importance of seed production.

2. Seed policy-seed demand forecasting and planning for certified, foundation and breeder seed production

3. Deterioration of crop varieties – Definition – Manifestations of seed deterioration – Factors affecting deterioration and their control


5. Different classes of seed – production of nucleus, breeder seed, foundation and certified seed.

6. Maintenance and multiplication of pre-release and newly released variety in self & cross pollinated crops.

7. Foundation and certified seed production in Chilli, Bhendi and Brinjal (varieties and hybrids)

8. Seed certification, phases of certification – General seed certification standards – Procedure for Seed certification, field inspection and field counts etc.

9. Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and Seed Testing Laboratories

10. Duties and powers of Seed Inspectors, Offences and penalties, Seed Control order – 1983, Seed Act, 2000 and other issues related to seed quality regulation


15. Seed Treatment – Importance and types of seed treatment, equipment used for seed treatment (Slurry and Mist – O – matic treater)

16. Seed packing and Seed storage – Stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage. Equipment and accessories used for seed packing and quality control in storage.

PRACTICALS:

1. Location of important research stations and seed production farms
2. Seed sampling principles and procedures.
3. Purity analysis in different crops.
4. Purity analysis in different crops
5. Germination analysis in different crops
6. Germination analysis in different crops
7. Moisture estimation in different crops
8. Moisture estimation in different crops
9. Seed viability test
10. Seed vigour test
12. Filed inspection – walking pattern and seed standards
13. Study of seed production plots – hybrids seed production plots of vegetables crops
14. Study of seed production plots – hybrids seed production plots of vegetables crops
15. Electrophoresis for identification of varieties
16. Planting ratios, isolation distance, rouging, etc., in seed production
1. Introduction: Soil and soil components – mineral matter, organic matter, water and air. Definition of soil and various concepts of soil, branches of soil science.

2. Rocks – Classification of rocks based on mode of origin – igneous rocks, sedimentary rocks, and metamorphic rocks. Classification of rocks based on silica content.


Soil reaction – pH scale – influence of soil pH on nutrient availability – buffering capacity of soils.


PRACTICALS:

1. Methods of chemical analysis principles, techniques and calculations
2. Preparation of standard solutions (molar, normal, ppm and percentage) and standardization of sulphuric acid.
3. Collection of soil samples
4. Description of soil profile in the field.
5. Determination of mechanical composition of soil using Bouyoucos Hydrometer
6. Determination of soil bulk density particle density.
7. Determination of bulk moisture content by gravimetric method and by Tensiometer method.
8. Determination of soil colour using Munsell colour chart.
11. Determination of carbonates and bicarbonates in soil water extract.
12. Determination of chlorides in soil water extract.
13. Estimation of Ca and Mg in soil water extract.
15. Introduction to Flamphotometry and estimation of K and Na in soil water extract.
THEORY:

1. Introduction, definition of weed, beneficial and harmful effects of weeds.

2. Classification of weeds—classification based on morphology, life cycle, habitat, origin, association, special features with examples.


4. Weed Biology—characteristic features of weeds—weed ecology—persistence of weeds—climatic—edaphic (soil) and biotic factor—crop weed association with some important crops like rice, maize, wheat, jowar, pulses, groundnut, sugarcane, cotton and tobacco.

5. Crop—weed competition—principles—critical period of crop—weed competition—Allelopathy


8&9. Herbicides—definition, advantages and limitations of herbicide usage in India—classification of herbicides based on chemical nature, time and method of application and type of formulation.

10. Nomenclature of herbicides—commonly available herbicides in India—Adjuvants—definition, their use in herbicide application (1) Surfactants; (2) Stabilizing Agents; (3) Solvents; (4) Humicants; (5) Stickers; (6) Activators; (7) Compatibility agents; (8) Drift control agents.


14 Weed management in orchards: Mango, cashewnut, citrus, banana, guava, sapota, grape Weed management in plantation crops: Coconut, oil palm Weed management in spices: Ginger, turmeric & chillies

15 Weed management in nurseries, in Lawns, in flowering plants(Rose, Jasmine and Chrysanthemum)

16 Weed management in green houses – Problematic weeds – nutsedge, Bermuda grass, Parthenium and their control.

PRACTICALS:

1. Identification of weeds
2. Survey of weeds in crop fields and other habitats
3. Herbarium preparation of weeds
5. Herbicide label information
6. Computation of herbicide doses
7. Study of herbicide application equipment
8. Calibration of herbicide application equipment
9. Application of herbicides by different methods for effective weed control
10. Nomenclature of herbicides and preparation of a list of commonly available herbicides
11. Study of phytotoxicity symptoms of herbicides in different crops
12. Biology and control of parasitic weeds
13. Economic of weed control practices
14. Visit to non cropped areas and orchards
15. Visit to problem areas and farmers field.


6 Factors affecting phosphate fixation in soil – Methods to reduce phosphate fixation. (Organic matter additions, placement of P fertilizers etc.) – Quantity and intensity parameters – Functions – deficiency symptoms – Corrective measures – Toxicity symptoms


8 Calcium – sources and content – forms of calcium in soil, factors affecting the availability of calcium in soil – Functions – Deficiency symptoms – Corrective measures.

9 Magnesium – Sources – Content – Forms of magnesium in soils. Factors affecting availability of magnesium. Functions – Deficiency symptoms – Corrective measures


Zinc: Contents – Forms in soils- Critical limits in soils and plants, factors affecting availability of zinc – Functions – Deficiency symptoms corrective measures

Copper and Iron – Content – Forms in soils – Critical limits in soils and plants. Factors affecting its availability – Functions – Deficiency symptoms – Corrective measures. Toxicity symptoms


Boron: Content – forms in soil – Critical limits in soils and plants. Factors affecting its availability – Functions – Deficiency symptoms – Corrective measures


Plant analysis - Rapid tissue tests – DRIS – Indicator plants. Biological methods of soil fertility evaluation: Microbiological and pot culture methods. (Mentioning of methods names only)

Soil test based fertilizers recommendation: Critical nutrient concept (Cate and Nelson) – Critical levels of nutrients in soils. Use of empirical equations for scheduling fertilizers P dosage to crops.

Problems Soils: Definition – Classification – Acid, Saline, Saline Sodic – Sodic and Calcareous soils characteristics – Formation and Nutrient availability in problem soils.

Reclamation of problematic soils – Mechanical, Chemical and Biological methods. Lime requirement – Different liming materials – Organic amendments – FYM, compost, pressmud, problems associated with over liming. Gypsum requirement – Classification of crops based on their tolerance to salts.

Irrigation water: Quality of irrigation water – Classification based on EC, SAR, RSC and Boron content. Indian standards for water quality. Use of saline waters in agriculture


Land capability classification – Limitations – Sub classes – Units
Soil classification – Early system of soil classification – Soil taxonomy – Advantages – Salient features – Nomenclature at different category

Diagnostic horizons – Epipedons and Endpedons

Formative elements and keys to soil orders – Salient features of soil orders

Aerial photography – Types – Uses. Interpretation – Advantages and disadvantages

Remote Sensing – Indian Space Programme – Features of IRS series

Application of Remote Sensing Techniques in Horticulture

Soils of India – Characteristics – Equivalent taxonomy units

Soils of Andhra Pradesh – Characteristics – Equivalent taxonomy units

PRACTICALS:

1. Determination of available nitrogen in soils by alkaline permanganate method
2. Determination of organic carbon content by Walkley and Black method
3. Determination of available phosphorus in soils by Olsen’s method
4. Determination of available potassium in soils by NH4 OAc method and sulphur by palaskar method
5. Determination of DTPA extractable zinc in soil (optional)
6. Collection of irrigation water sample and determination of pH and EC in irrigation water.
7. Determination of carbonates and bicarbonates and chlorides in irrigation water by acid – base neutralization
8. Determination of Ca and Ca + Mg in irrigation water by EDTA method
9. Determination of sodium and potassium in irrigation water
10. Quick tests and interpretation of soil test and irrigation water analysis data
11. Determination of lime requirement of acid soil
12. Determination of gypsum requirement of alkali soils
13. Collection and processing of plant samples for analysis
14. Determination of nitrogen in plant samples
15. Determination of phosphorus in plant samples
16. Determination of potassium in plant samples
Organic Farming in Horticultural Crops


8. Recycling of organic residues - Soil improvement though application of organic amendments

9. Integrated diseases and pest management – Definition – Pest management methods – Physical methods: manipulation of temperature, moisture, light and air. Mechanical methods: Mechanical destruction (manual or mechanical), mechanical exclusion, light and pheromone traps

10. Cultural methods – Field and plant sanitation, tillage operations, planting time, seed rate, spacing, crop rotation, trap cropping, growing of barrier crops, intercropping, bird perches, water and nutrient management

11. Biological methods – Bio-pesticides – advantages – Predators, Parasitoids, Pathogens – Bacterial insecticides, viral insecticides, fungal insecticides

12. Botanicals – Pyrethrum, neem seed kernel extract neem seed powder, soluble neem formulations, oils, soaps, oil cakes
Weed management – Preventive methods – Physical/ Mechanical: Tillage, stale seed bed, hand weeding, mowing, flooding, mulching, burning, dredging and chaining, soil solarization, Cultural methods: Smother crops, cover crops, crop rotation, plant density, sowing, nutrient and water management – Biological methods – Criteria for a bioagent – Kinds of bioagents – insects, plant competitive plants – Allelopathy – IWM

Quality consideration, certification, labeling and accreditation processors
Marketing, exports, International and national policies in promotion of organic farming

PRACTICALS:

1 Organic nursery raising (vegetables and ornamentals)
2 Layout and sowing of vegetables by students under organic farming concept.
3 Recording germination percentage, gap filling and thinning operations in individual plots.
4 Vermicompost making.
5 Methods of composting crop residues and organic wastes.
6 Applications of bio-pesticides in plots (Trichocard, BT, NPV).
7 Biofertilizers production techniques and its application.
8 Inter cultivation and other operations in vegetables.
9&10 Preparation of neem products and study of other botanicals for pest and disease control.
11 Recording yield attributes and yield.
12 Study of quality parameters of organic products.
13 Harvesting of vegetables in plots.
14 Visit to organic farms.
15 Grading and packing of fruits and vegetables in plots.
16 Post harvest management of vegetables.
ASSC-3.9.1 Introduction to major field crops

THEORY:

1. Classification and distribution of field crops, definitions and concept of multiple cropping, mixed cropping intercropping, relay and alley cropping, sustainable agriculture


nutrient (gypsum application, importance of Ca and S nutrition), water and weed management-crop rotations-harvesting and storage -yield attributed and yield

10 Mustard and Gingelly: Origin-area and production-climate and soils – varieties – tillage-seeds and seeding-nutrient, water and weed management-crop rotations-harvesting and storage -yield attributed and yield

11 Sunflower and Safflower: Origin-area and production-climate and soils – varieties – tillage-seeds and seeding-nutrient, water and weed management-crop rotations-harvesting threshing and processing-yield attributed and yield


14 Fodder crop-quality characteristics of an ideal forage-Berseem, Lucerne and Stylosanthes-soils and seed bed preparation-varieties for AP-seed and seeding-nutrient and water management-time and method of harvesting -yield on wet and dry weight basis

15 Paras grass, Napier grass and Anjan grass: soils and seed bed preparation – varieties for AP - seed and seeding-nutrient, water management-time and method of harvesting -yield on wet and dry weight basis

16 Green manure crops – Daincha, sunnhemp and pillipesara: seed rate and seeding – nutrient management – harvesting
**PRACTICALS:**

1. Allotment of individual field for land preparation and sowing of crop
2. Calculation of seed rate and fertilizer requirement
3. Thinning, weeding, gap filling and recording germination percentage
4. Identification of crops, crop seeds and fodder crops
5. Rhizobium inoculation and seed treatment
6. Preparation of cropping scheme to suit different farming systems
7. Visit to wetland farm. Observation on resources allocation, recycling of inputs and economics
8. Visit to dryland farm. Observation on resources allocation, recycling of inputs and economics
9. Visit to garden land farm. Observation on resources allocation, recycling of inputs and economics
10. Time and methods of fertilizer application
11. Study of Agronomic characters of pulses
12. Study of Agronomic character of cereals
13. Study of Agronomic characters of oilseeds and fodder crops
14. Harvesting of crops in individual fields
15. Participation in post harvest operations and recording yield
16. Visit to forage production farm to study the ongoing experiments
ASSC-3.9.2 Manures, Fertilizers and Nutrient Management 2(1+1)

THEORY:

1. Introduction: Definition and differences of manures and fertilizers – Classification of manures (Bulky and concentrated) and fertilizers (NPK complex & Micronutrients) with suitable examples – Importance of manures in soil fertility management


5. Definitions of penning, sewage, sullage, sludge and poudrette. Concentrated organic manures–blood meal, bone meal, horn meal, meat meal, fish meal, guano & oil cakes. (Castor & Neem)

6. Commercial fertilizers: Nitrogenous fertilizers-Manufacturing of ammonia-Manufacturing process and properties of nitrogenous fertilizers used in India-Ammonium sulphate

7. Manufacturing process and Important properties of CAN and Urea. Slow releasing N fertilizers


10. Secondary and Micronutrients: Conditions leading to deficiencies, importance of use different sources of secondary and micronutrient and their contents. Mode of action of ‘S’ fertilizers in soils

11. Compound and complex fertilizers Used in India – MAP, DAP, UAP, APS, APP, Nitro phosphates and NPK complexes – manufacturing process and properties.

12. Mixed or bulk blended fertilizers: Dry and wet processes of mixing – advantages and disadvantages of mixed fertilizers over straight fertilizers. Physical and
chemical problems associated in their preparation, compatibility of fertilizers.


Integrated Nutrient Management (INM):

For Agricultural and Horticultural Crops – Need, components, nutrient gains, constraints and prospects of adopting INM.

Quality Control of Fertilizers: FCO 1957, its importance and regulations, Specification and standards for important chemical fertilizers-Urea, SSP, MOP, DAP and Zinc sulphate

PRACTICALS:

1. Sampling of organic manures and fertilizers for chemical analysis
2. Physical properties of manure and fertilizers
3. Quick tests for identification of important fertilizers
4. Detection of adulteration in fertilizers
5. Estimation of ammonical nitrogen in ammonical fertilizer (Ammonium sulphate)
6. Estimation of nitrate nitrogen and ammonical nitrogen (Ammonium nitrate)
7. Estimation of total nitrogen in urea
8. Estimation of total nitrogen in farm yard manure
9. Estimation of water soluble P2O5 in SSP
10. Estimation of potassium in MOP/SOP
11. Estimation of Zn in zinc sulphate
12. Determination of Ca in SSP or Lime
13. Determination of S in SSP or gypsum
14. Working out quantities and doses of fertilizers for application to the field
15. Visit to fertilizer testing laboratory
16. Visit to vermicompost unit
ASSC-3.9.3  Introduction to Agricultural Meteorology and Water Management in Horticultural crops

THEORY:

1. Introduction – definitions of meteorology, climatology, agricultural meteorology – Scope and practical utility of agricultural meteorology
2. Composition and structure of atmosphere, Definitions of weather and climate, aspects involved in weather and climate
4. Low air temperature and plant injury; high air temperature and plant injury – Soil temperature – Factors affecting soil temperature
5. Solar radiation – Definition, introduction of electro-magnetic spectrum and functions of light, solar constant, net radiation, black body radiation, emissivity, absorptivity, reflectivity, transmissivity and albedo
6. Physiological response of different bands of incident radiation; factors affecting the distribution of solar radiation within the plant canopy
8. Atmospheric Humidity and its expression; saturation; effects of humidity on crops.
9. Evaporation and transpiration, definitions – Factors affecting rate of evaporation and transpiration
10. Monsoons – Definition, origin of South West and North East monsoons and their occurrence – their impact on farm operations
11. Rainfall – Types of rainfall – Clouds, classification of clouds and the characteristics of different forms of clouds
13. Precipitation and condensation – definition, different forms of precipitations and condensations – Artificial rain making
15. Weather forecasting – Applications and utility – Synoptic charts, reports and symbols
Remote sensing – definition, introduction, application in Horticulture, Climate change: causes, effects of climate change, global warming

Importance of water – definition – functions of water in plants and effect of moisture stress on crop growth – water resources in India – Irrigation development in India and A.P. before and after independence.

Soil water relations – Importance of soil, plant water relationship (SPAC) physical properties of soils influencing water relations – texture – structure and depth, particle density, bulk density and pore space in relation to moisture retention, movement and availability


Measurement of soil moisture: direct and indirect methods – Gravimetric, volumetric, infrared, and spirit burning, Tensiometer and resistant blocks, pressure plate and pressure membrane apparatus – relative merits and demerits. Movement of water and distribution of moisture in soil – Infiltration, Percolation, permeability and seepage

Rooting characteristics, plant structure and root development, Effective root zone depth – moisture extraction pattern

Evapo-transpiration (ET) – evaporation, transpiration and factors influencing evapo-transpiration – measurement of ET through Lysimeters, Evaporimeters

Measurement of PET – empirical methods – Blaney Criddle, modified Penman method, Radiation method and pan evaporation methods – Procedure, their merits and demerits

Crop coefficient (Kc) – definition crop coefficient curve – crop coefficients for different stages of horticultural crops – critical stages of horticultural crop growths for irrigation

Water requirement, factors influencing water requirement and water requirement for important horticultural crops

Irrigation scheduling – Approaches – Soil (Feel and appearance, gravimetric, soil moisture tension) plant (leaf temperature leaf water potential, visual plant symptoms, stomatal resistance) and climatological approach – PET method – Lysimeters – IW/CPE method and pan evaporation, Water budgeting (soil moisture balance method)

Drip irrigation – components – advantages and disadvantages – installation and maintenance of drip system (clogging problems) – types of drip irrigation methods

Sprinkler irrigation – components – advantages and disadvantages – system layout

Fertigation methods – merits and demerits


Water management in horticultural crops – mango, citrus, grapes, coconut, guava, tomato, chillies, onion, turmeric, Brinjal, gourds, water melon and musk melon

PRACTICALS:

1. Visit to meteorological observatory, calculation of time
2. Visit to IMD meteorological observatory – layout plan of standard meteorological observatory
3. Recording of air and soil temperature
4. Measurement of radiation and components
5. Measurement of rainfall – different types of rain gauges
6. Measurement of wind speed, direction and atmospheric humidity
7. Recording evaporation
8. Synoptic charts and weather reports, symbols
9. Determination of soil moisture content by gravimetric and volumetric method
10. Installation and working of Tensiometer
11. Estimation of soil moisture constants – filed capacity by filed method
12. Estimation of PWP by filed method
13. Scheduling of irrigation using IW/CPE method
14. Calculation of irrigation water needs
15. Layout of surface methods of irrigation
16. Layout and components of sprinkler irrigation, drip irrigation – clogging problems
THEORY:

1. Introduction – definition of forests and forestry – branches of forestry – history of forests in India and A.P. present status and role of forests in Indian farming systems.

2. Agroforestry – Definition, Objectives and Potential – Role of Trees in Agroforestry systems


4. Intercropping, cover cropping, wind breaks and shelter belts – orientation, design and choice of species for wind breaks.


6. Agri-horticultural systems for irrigated and dry lands, pre-bearing an dbearing orchards.

7. Tree-crop interactions in Agroforestry systems – above and below ground interactions for light, water and nutrients.

8. Canopy managements of tree species – copping, pollarding and lopping – Alley cropping – Application of tree prunings as mulch – advantages – time of application and release of nutrients.

9. Nutrient cycling in agroforestry systems.


11. Silvi-pasture / hort-pastoral systems – Establishment of legume and grass pastures

12. Planning for Agroforestry – constaints – Diagnosis and Design methodology

13. Evaluation of Agroforestry systems – productivity, sustainability and adaptability


15. Cultivation of teak, eucalypts and populous spp.

16. Cultivation of bamboo, tamarind and neem.
PRACTICALS:

1. Identification of multipurpose tree species and their seeds – Collection of Herbaria
2. Nursery practices and raising of seedlings of species like Morus alba (Mulberry), Aucia catechu, Acacia nilotica, Dalbergia sissoo and Subabul.
3. Seed viability tests.
4. Seed treatment for removing dormancy.
6. Calculation of tree volume and canopy measurement.
7. Visit to Agroforestry fields.
8. Visit to study mango based cropping systems
9. Study of ber based cropping systems.
10. Study coconut based cropping system
11. Identification of Pasture specie and their seeds
12. Visit to social forestry nurseries
13. Visit to industrial plantations and shelter belts
14. Productivity evaluation of Agroforestry systems
15. Rapid measurement of farmers need for green manure green fodder, and fuel wood in selected villages.
16. Economics and marketing of products raised in Agroforestry systems.
11 Introduction – Definition of Crop Physiology – Importance in Horticulture
2 Seed Physiology – Seed structures – Development of embryo, endosperm, Perisperm and seed coat – Morphological, physiological and biochemical changes during seed development
3 Seed Physiology (continued) – Physiological Maturity – Morphological and Physiological Changes associated with physiological maturity in crops with examples – Harvestable Maturity – Seed viability and vigour – Factors affecting seed viability and vigour
4 Seed Physiology (continued) – Methods of testing seed viability and vigour – Germination – Utilization of seed reserves (carbohydrates, fats and proteins) during seed germination
5 Seed Physiology (continued) – Morphological, physiological and Biochemical changes during seed germination – Factors affecting seed germination
6 Water relations in plants – Role of water in plant metabolism – Water uptake (passive and active) and transport – Water potential and its components.
7 Methods of measurement of water potential in plants
8 Water uptake (passive and active) and transport – Ascent of sap – Soil, plant, atmosphere continuum
10 Plant Nutrition – Criteria of essentiality – Classification based on uptake and biochemical function – Mechanism of absorption of plant nutrients
11 Physiological roles of plant nutrients – Deficiency and Toxicity symptoms of plant nutrients – Amelioration
12 Photosynthesis – Importance – Chloroplast, structure and function – Light reactions – “Z” scheme of electron transport – Cyclic, Non-cyclic, Pseudo-cyclic Photophosphorylation
13 Photosynthesis (continued) – Dark reactions – C3, C4 and CAM pathways – Significance and Differences
Photorespiration and its significance – Factors affecting Photosynthesis, light, CO2, temperature and water – Methods of measurement of Photosynthesis

Respiration and its significance – Glycolysis, TCA cycle, ETS, Pentose Phosphate Pathway – Inter relationship of various pathways in plant metabolism

Seed Dormancy – Definition – Types of seed dormancy – Advantages and disadvantages of seed dormancy – Causes and remedial measures of seed dormancy with examples

PRACTICALS:

1. Preparation of solutions
2. Seed imbibition
3. Optimum conditions for seed germination
4. Tests of seed viability and vigour
5. Measurement of root pressure of seedling
6. Measurement of water status in leaves, stem, roots
7. Measurement of transpiration by photometer method
8. Measurement of Stomatal frequency and index.
9. Measurement of Photosynthesis by Hill reaction
10. Measurement of absorption spectrum of chloroplastic pigments and fluorescence
11. Separation of chlorophylls, carotenoids and xanthophylls by chemical method
12. Leaf anatomy of C3 and C4 plants
13. Measurement of Respiration
14. Breaking dormancy by chemical method and by mechanical method
15. Study of seed germination in different fruit and vegetable crops
16. Important physiological disorders in different fruit and vegetable crops and their remedial measures through application of nutrients and others method.


Development of Microbiology; Agricultural Microbiology, Industrial Microbiology, Medical Microbiology, Exo Microbiology, Geo. Microbiology, Pollution Microbiology, Aero Microbiology, Microbial Biotechnology

Microbial Groups and their distribution: Algae fungi protozoa and bacteria

The bright field microscope, simple staining and differential staining

Differences between prokaryotic and eukaryotic cells prokaryotic cell structure and function

Types of culture media, synthetic and non synthetic media, liquid and solid media, simple and enriched differential selective and minimal media

Nutritional groups of Bacteria, Phototrophs, Chemotrophs, Autotrophs and Heterotrophs, Parasites and Saprophytes.

Microbial growth, normal growth curve of bacteria yeast and mold growth, growth measurement

General properties of viruses and bacteriophages

Structure of T2 phage lytic and lysogenic cycles. Viroids prions

General principles of bacterial genetics variation, adaptation, mutation and recombination

Gene expression – Replication, transcription, translation, genetic ode operon concept

Microbial association: Symbiosis, antibiosis, mutualism, commensalism, parasitism, and synergism

Microbial inoculants, biofertilizers microbial bio pesticides microbial agents for control of plant diseases.

Biodegradation, biogas production, composting of agricultural residues
PRACTICALS:

1. Introduction – Safety measures in microbiology laboratory
2. Aseptic Techniques in culturing microbes
3. Observation of Microorganisms – Algae
4. Observation of – Fungi
5. Observation of – Bacteria, Gram Staining
6. Methods of Sterilization of liquids, glassware and microbial cultures
7. Nutrient Agar Preparation
8. Methods of culturing liquid and solid microbial cultures
9. Purification of Bacterial Culture
10. Agar slopes and their use.
11. Streak Plate method of Isolation of Bacteria
12. Pour Plate method
13. Spread plate method
14. Turbidometric estimation of Microbial growth
15. Microbial Inoculants
**THEORY:**

1. Definition of growth and development, distinguish between them, components of growth and development: Cell division, Cell Enlargement and Cell Differentiation.

2. Photosynthetic productivity; Leaf Area Index (LAI) & Optimum Leaf Index in Horticultural Crops; Canopy Development


4. Growth Analysis – Growth Parameters Absolute Growth Rate (AGR) LAI, Specific Leaf Area (SLA), Specific Leaf Weight (SLW), Leaf Area Rates (LAR) Net Assimilation Rate (NAR), Relative Growth Rate (RGR), Crop Growth Rate (CGR) and Harvest Index (HI).


6. Gibberellins-History, Basic – Functions of Gibberellins, Biosynthesis of Gibberellins, Role of Gibberellins in Propagation (Seed dormancy), Bud Dormancy, Increase in Plant Height, Flowering, Fruit Setting, Fruit/Berry Development, Fruit Drop and Fruit Ripening / Degreening and other roles.

7. Cytokinins-History & Basic Functions, Biosynthesis, Role of cytokinins in various plant parameters; Growth Inhibitors and Growth Retardants & their role.


9. Ethylene – History & Basic Functions, Biosynthesis, Role of Ethylene in various plant parameters.

10. Flowering factors effecting flowering – Developmental, Environmental, Growth Rate Flowering Physiology: Growth, Flower movements and pollenphysiology, out crossing, substance regulating flowering – Gibberellins, Auxins, other chemical regulators Nature of flowering stimulus.

11. Photoperiodism and Flowering: Definition of photoperiodism. Classification of plants according to light requirements (photoperiod) – short day plants (examples) long day plants (examples) nd day neutral plants (examples); Importance of Dark period; photoperiodic stimulus.
12 Vernalization: Definition, cold treatments and flowering, Examples for Vernalization in Horticulture, site of Vernalization, Mechanism-De-Vernalization, source and translocation of floral stimulus – Florigen concept – physiological concept or reality. Vernalization and photoperiodic response, substitution of GA to Vernalization, other factors modifying vernalization.


Pruning – When to Prune – Effect on Growth, Effect on Fruit – Spur, Effect on Fruit Bud Formation, Effect on Yield-effect on size, color, quality of fruits; Physiological Aspects of Pruning – Apical Dominance – Photosynthesis – Canopy Structure, Effective Leaf Area, Source – Sink Relationship.


15 Bud Dormancy: What is Bud Dormancy, Factors responsible for Bud Dormancy, Photoperiodism and Bud Dormancy, Perception of Light Stimulus, Dormancy Inducing Hormones-Dormancy of Potato Tuber Buds, Growth inhibiting Substances – Compounds breaking Bud Dormancy – Induction of Bud Dormancy, Removal of Bud Dormancy and Dormancy in various organs.

16 Fruit setting: Fading of flowers, factors responsible for fruit set, growth relation, parthenocarpy, limitations of fruit setting; fruit growth; fruit growth rates, mobilization fruit size (role of seeds, growth substances); Ripening: changes with ripening, respiratory climacteric, role of ethylene, climacteric fruits & non climacteric fruits.
PRACTICALS:

1. Preparation of herbarium for monocarpic, polycarpic, determinate and indeterminate growth types.
2. Estimation of photosynthetic potential of horticultural crops.
3. Estimate of leaf area of by various methods in different horticultural crops.
4. Estimate of different growth analysis parameters in horticultural crops.
5. Bioassay of plant hormones-Auxins
6. Bioassay of plant hormones –Gibberellins
8. Identification of synthetic plant hormones and growth retardants.
9. Preparation of hormonal solutions and application to different types of cuttings for inducing rooting.
10. Preparation of hormonal solutions and application to different fruits for promoting ripening.
11. Preparation of hormonal solutions and application to different fruits and vegetable crops to control flower and fruit drop.
12. Rapid tissue test
13. Study of various kinds of seed dormancy in different fruit and vegetable crops.
14. Effect of water stress (PEG 6000) on plant growth and development
15. Study of seed temperature and light on growth and development.
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<td>Carbohydrates: occurrences, classification and structures</td>
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<td>Physical and chemical properties of carbohydrates, isomerism, optical activity,</td>
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<td>Reducing property, reactions with acids and alkali, ozone formation</td>
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<td>Lipids: classification, functions importance of fatty acids and triglycerides, essential fatty acids</td>
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<td>Physical and chemical properties of fatty acids, like specification, hydrogenation, iodine number, and acid number.</td>
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<td>Rancidity, phospholipids, types and importance</td>
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<td>Plant pigments: Structure and function of chlorophyll and carotenoids, sterols</td>
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<td>Basic structure, role of brassinosteroles in plants.</td>
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<td>Proteins: amino acids structures and classification.</td>
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<td>Essential amino acids, properties of amino acids, colour reactions, amphoteric nature, isomerism</td>
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<td>Peptides – oligopeptides, functions, cyclic and acyclic peptides malformin, gramicidine and glutathione, insulin</td>
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<td>Properties – U.V absorption, immunological properties.</td>
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<td>Structure of proteins, primary secondary, tertiary and quaternary. Reactions of proteins</td>
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<td>Properties – U.V absorption, immunological properties, denaturation and solubility.</td>
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<td>Purification techniques like salting out salting in, gel filtration and ion exchange chromatography</td>
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<td>Enzymes: Properties of enzymes, mode of enzyme activity</td>
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<td>Classification of enzymes, measurement of enzyme activity</td>
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<td>Co – factors and coenzymes. Vitamins and minerals as co-enzymes / cofactors</td>
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<td>Factors affecting enzyme action and enzyme inhibition</td>
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<td>23</td>
<td>Immobilization of enzymes and industrial uses of enzymes.</td>
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Nucleic acids – functions, structures of purines and pyrimidine bases, nucleotides, nucleosides

Structure of DNA, types of DNAs,

Types of RNAs, structures of RNAs, packing of DNA into chromosome.

Flow of genetic information, Replication

Transcription Post transcriptional changes, inhibitors of transcription, genetic code

Translation, post translational modifications, inhibitors

Metabolism: carbohydrates metabolism, glycolysis, and TCA cycle

Metabolism of lipids: oxidation of fatty acids and biosynthesis of fatty acids, triacylglycerides

Electron transport chain and Bioenergetics of glucose and fatty acids

PRACTICALS

1 Preparation of standard solutions and reagents
2 Carbohydrates Qualitative reactions
3 Estimation of starch
4 Estimation of reducing and non reducing sugars from fruits
5 Reactions of amino acids
6 Estimation of proteins by lowery method
7 Estimation of free fatty acids
8 Determination of iodine number of vegetable oils
9 Estimation of Ascorbic acid
10 Paper chromatography
11 Thin layer chromatography
12 Isolation of DNA from onions
13 Electrophoresis of pigments extracted from flowers
14 Extraction of oil from oil seeds
15 Enzyme induction
16 Enzyme inhibition, kinetics data processing
1 & 2 Economics – Nature meaning, Definitions, subject matter of Economics – Basic terms and concepts I economics

3 Divisions of economics, economic systems approaches to study economics – goods, services classification of goods.

4 Consumption – theory of consumer behaviour, laws of consumption

5 Utility – Meaning, characteristics of utility – forms of utility.

6 Wants-their characteristics and classification, utility and its measurement, cardinal and ordinal

7 Law of Diminishing marginal utility – Assumptions of law, explanation, limitations of the law, importance

8 Law of equimarginal utility – meaning assumptions, explanation of the law, practical importance, limitations, in difference curve and its properties.

9 Engel’s law of family expenditure – Consumer’s surplus – meaning Assumptions, explanation, difficulties in measuring consumer’s surplus, importance.

10 Consumer equilibrium

11 Demand-meaning, definition, types of demand, income demand, price demand, cross demand.

12 Demand schedule, demand curve, law of demand – contraction and extension, increase and decrease in demand

13 Elasticity of demand- meaning elastic and inelastic demand, kinds of elasticity of demand, perfectly elastic, perfectly inelastic, relatively elastic, unitary elastic demand.

14 Price elasticity, income elasticity and cross elasticity of demand, practical importance of elasticity of demand

15 Price determination and forecasting under various market structures

16 Supply – meaning definition, law of supply, supply schedule, supply curve

17 Increase & decrease in supply, contraction and extension of supply, factors affecting supply.
18 Elasticity of supply, kinds of elasticity of supply – perfectly elastic perfectly inelastic elastic, inelastic and unitary elasticity factors affecting elasticity of supply

19 & 20 Markets – definition, functions of markets, essentials of market, classification of markets, conditions of perfect, markets, conditions of imperfect market.

21 Characteristics of perfect competitions and imperfect competition.

22 Characteristics of monopoly – oligopoly, duopoly

23 Characteristics of oligopoly – perfect and imperfect

24 Characteristics of imperfect competition markets

25 Factors of production – land and its characteristics, labour division of labour

26&27 Theories of population – Daltons formula

28 Capital and its characteristics – classification and capital formation

29&30 Enterprises –forms of business organization –merits and demerits

31 Distribution – Theory of rent, wage & profit

32 Interest – pure interest, gross interest, net interest, liquidity preference theory, profit – true profit, gross profit, net profit
ESSS 1.11.2 STRUCTURAL GRAMMAR AND SPOKEN ENGLISH

THEORY:

Structural Grammar
1 Introduction to parts of speech and identification of parts of speech in a sentence.
2 Structure of verb in English
3 Tense usage – present tense, past tense and future tense
4 Active voice and passive voice

Spoken English
5 Dyadic communication: Face to Face conversation & Telephonic conversation.
6 Interviews: types of interview questions, Physical makeup and manners, Educational qualifications experience etc.
7 Dictation and Instruction
8 Stress and Intonation

Comprehension
9 & 10 Experiment and Experience
11 & 12 The year 2050 – Reflections of a Futurist

Writing skills
13 Letter writing: official and personal
14 Job Applications with RESUME
15 Report writing: Definition, Types of reports
16 Scientific and Technical report writing
PRACTICALS:

Structural Grammar:
1. Change of voice – in affirmative sentences, when a transitive verb has two objects, factitive verb is changed from active to passive choice, voice of verb in interrogative sentences - Exercises
2. Tenses usage: Present tense
3. Past tense and
4. Future tense-Exercises on the uses of tenses
5. Structure of verb: five verb patterns
   a) Subject + verb + direct object (e.g.: 1. Rama likes coffee 2. She can drive a car)
   b) Subject + verb + indirect object + direct object (eg. Her mother told her a story)
   c) Subject + verb + direct object + Preposition + Prepositional object (e.g. They told ‘the news to every body in the village)
   d) Subject + verb + (not) + to-infinitive, etc (eg. He has refused to help us)
   e) Subject + verb + noun or pronoun + present participle (eg. I found her working in the kitchen 2. She kept us waiting)
6. Vocabulary: Synonyms – Exercises
7. Antonyms – Exercises

Spoken English:
8. Conversation practice (at the Doctor, at the Restaurant, at the Market yard)
9. Stress and Intonation – Practice with Spoken English audio cassettes from CIEFL
10. Correct use of Prepositions, verbs followed by prepositions – Exercises
11. Conjunctions, coordinating conjunctions, subordinating conjunctions and correlative conjunctions – Exercises on correct use of conjunctions

Presentation Skills:
12. Presentation of reports orally regulating speech-physical appearance – body language posture – eye contact – voice – audience – preparation of visual aids – one presentation by individual on the given topic related to Horticulture like fruit preservation techniques, developing new technologies in Horticulture, use of Bio-fertilizers etc.
13. Group discussions: group dynamics, purpose, and organization of group discussions in practical classes as well as in practical examination
14. Mock interviews: conducting mock interviews along with role plays as interviewer and interviewee for practice
15. Evaluation sheet and its importance
16. Feed back and Semester Final Practical examination
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<td>Linear Regression – Fitting of linear regression lines</td>
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<td>Introduction to WINDOWS – Features, Desktop and its Elements</td>
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MSOFFICE: Components – MS Word, MSEXCEL, MSACCESS AND MSPOWERPOINT

MSWORD - Creation of Document and Features of Word- Processing
MSWORD – Creation of Tables and Printing of a Document
MSEXCEL – Concept of Electronic Spreadsheets, Features of MSEXCEL
MSEXCEL – Features for Computing – Inbuilt Statistical Functions, Use of Formula Bar
POWERPOINT – Concept, Preparation and Presentation of Slides
POWERPOINT – Setting of Slide Show
Introduction to Internet – Basic Concepts
Introduction to WWW – Basic concepts

PRACTICALS:

1. Construction of Frequency Distribution Table and Frequency Curves
2. Computation of Arithmetic Mean, Median and Mode for grouped and un-grouped Data
3. Computation of Standard Deviation and Coefficient of Variation for grouped and un-grouped Data
4. Standard Normal Distribution(Z) test for one sample with Population Standard Deviation known and unknown
5. Standard Normal Distribution(Z) test for two samples(Equality of Means) with Population Standard Deviation known and unknown
6. Students ‘t’ test for one sample and two samples (Equality of Means)
7. Paired t- test for two samples(Equality of Means) and F- test for two samples(Equality of Variances)
8. Chi square test for 2 x 2 contingency table with Yates correction
9. Calculation of Coefficient of Correlation and its testing
10. Fitting of simple Linear Regression Equations – Y on X and X on Y
11. Analysis of Completely Randomized Design
12. Analysis of Randomized Block Design
13. Analysis of Latin Square Design
14. MS Word - Creation of Document, Editing, Formatting and Saving
15. MS Excel – Creation of Spreadsheets, Editing, Formatting and Saving
16. MS Excel – Use of Inbuilt Statistical Functions and Formula Bar
17. MS Power Point - Creation and Presentation of Slides and Slide Show
ESSC-2.11.2 Fundamentals of Extension Education 2(1+1)

THEORY:

1. Education – Formal, Informal, Non-Formal
2. Extension Education – origin of Extension, Meaning, Definition, Concept, Objectives, Scope, Functions and principles.
3. Teaching – Learning process: Meaning of Teaching and Learning, Learning situation and Learning experience
5. Audio-Visual aids – Meaning, Importance, classification and selection
6. a) Rural development – Meaning, Definition, Genesis and objectives
   b) Sociology and Rural sociology, importance & Rural society in Extension Education, Characteristics of Indian Rural Society.
7. Educational psychology – Meaning importance, intelligence, personality, perception, emotions, frustration.
8. Transfer of Technology Programmes
   I) KVK   II) TAR – IVLP   III) Board Based Extension Approach IV) ATIC
9. I) APMIP   II) DWACRA   III) ANTWA   IV) DAATTC
10. Extension Reforms – ATMA, SREP Motivating a farming community farm women and Rural youth.
12. Evaluation – Meaning, Importance, degrees and methods
13. Participatory Rural Appraisal- Meaning, Components, Principles, Approaches and different tools of PRA.
14. Leadership – Meaning, Classification of leaders, Selection of leaders, Roles, Training of leaders.
PRACTICALS:

1, 2 & 3 Visit to the villages to study the structure, functions, linkages and programmes
4 Visit to Horticulture Department
5, 6 & 7 Planting and preparation of posters, charts, Flash cards, OHP – transparencies
8 & 9 Planning and preparation of News story, success story, leaflet and folder
10 & 11 Planning and preparation of a script for Radio and Television.
12 Identification of Local Leaders to study their role in extension work.
13 & 14 Practicing PRA techniques and preparation of village development plan.
15 & 16 Evaluation of some selected extension programmes
1. Farm Management—meaning, scope, definitions, objectives, its relationship with other sciences, farm management decisions

2 & 3 Economic principles applied to farm management – law of diminishing returns, definitions, reasons for the operation of the law of diminishing returns in agriculture, horticulture, factor-product relationship, 3 stages of production function, economics of scale, returns to scale.


8 Principle of equi-marginal returns-allocation of resources, opportunity cost principle, minimum loss principle.

9 Principle of comparative advantage—absolute advantage, relative advantage, decision making using the principle.

10 Time comparison principle—time value of money, compounding, discounting. Decision making under risk and uncertainty

11 & 12 Theory of costs—cost concepts, fixed cost, variable costs, total costs, Average variable cost, average fixed cost, average cost, marginal cost, total revenue, average revenue, marginal revenue, break even analysis.

13 Cost of cultivation (cost A1, A2, B1, B2, C1 & C2) Income measures—farm business income, family labour income, net income and farm investment income.

14 & 15 Types of farming—specialized, diversified, mixed, dry farming, types of farm business organization—peasant, co-operative, capitalistic, state, collective farming.

16 Farm planning—characteristics and limitations, budgeting—partial, complete, steps in farm planning and budgeting

17 Farm records—benefits, limitations, various farm records maintained on the farm

18 Management—introduction, concept, scope and nature of management, various functions of management.

19&20 Operations Management—overview, functions, interrelationship with 5 P’s of management, scheduling of operations, plant and plant layout, inspection & quality management.
21 & 22 Materials management—overview, objectives, scope, concept, need for inventory and its control.

23 & 24 Marketing management—definition, functions, components of marketing mix (4 P’s), product, price, promotion, place, product life cycle.

25 Personnel Management—concept & role, basic functions of HR managers (selection, retention, incentives, training & development, evaluation etc.,)

26 Financial Management—Financial statement, brief introduction to final accounts (Trading account, profit and loss account and balance sheet)

27 Financial analysis/ratio analysis—brief introduction to liquidity, leverage activity and profitability ratios.

28 Capital budgeting—meaning, evaluation of capital budgeting proposals, traditional methods (payback period, accounting rate of return), discounted cash flow methods (NPV, IRR, CB ratio or profitability index)

29&30 Project Management—meaning, scope, steps in project preparation and management, various evaluation measures.

31&32 WTO—GATT—origin, history, Agreement on Agriculture (AOA)—market access, export subsidies, domestic support, TRIPS, SPS & TBT, anti dumping, Impact of WTO on Indian Agriculture / Horticulture sector
ESSC-3.11.2 Communication Skills and Entrepreneurship development 2(1+1)

THEORY:

1. Communication skills – Listening, note taking, writing skills, presentation skills – oral impromptu and public speaking: reading and comprehension
2. Entrepreneurship; concept, entrepreneurial and managerial characteristics, functions of entrepreneur and types of entrepreneurs
3. Horti-Entrepreneurship – concept, nature and importance for sustainable livelihoods
4. Motivation and entrepreneurship development
5. Managing an enterprise; importance of planning, budgeting, monitoring, evaluation and follow up.
6. Managing competition
7. Entrepreneurship development programmes
8. Generation, incubation and commercialization of ideas and innovations
9. Govt. schemes and incentives for promotion of entrepreneurship & Govt. policy on small and medium enterprises. SMEs/ SSIs
10. Export, import policies relevant to horticulture sector
11. Venture capital, contract farming and joint ventures, public private partnerships
12. Overview of Horti input industries, characteristics of Indian horticultural processing and export industry
13. Social responsibility of Business, Morals ethics in enterprise management, SWOT analysis
14. Project meaning, importance, components and preparation

PRACTICALS:

1. Field visit to successful Enterprise – study of Characteristics of successful; entrepreneurs – case study
2. Communication skills – listening, writing and presentation skills – oral impromptu and public speaking; reading and comprehension and presentations by students.
3. Development of small horti business proposals and presentations
4. Visit to public private (small, medium & big) Horticultural Enterprises both small and big, visit to pack houses for grading, processing and packing
5. Visit to Horticlins and Hort-business centers (public & private)
6. SWOT analysis of selected enterprise
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<td>Natural resources: Definition of Renewable and non renewable resources. Water, land, food and energy resources</td>
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<td>Forest resources – types and functions. Causes and consequences of deforestation, carbon trading.</td>
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<td>Ecosystem: Definition, concept, structure and functions of an ecosystem. Food chain – Producers, consumers, detritivores and decomposers.</td>
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<td>Environmental pollution: Point and non-point sources. Sources, effects and control of air and noise pollution.</td>
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<td>Sources, effects and control of soil pollution with reference to horticultural crops. Biomagnifications</td>
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<td>Sources, effects and control of water pollution, Eutrophication</td>
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<td>Causes of environmental degradation with reference to socio economic factors</td>
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<td>Sources and effects of solid waste, hazardous wastes, horticultural and industrial wastes and their management.</td>
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<td>Climate change: Global warming – causes signs and impacts; Smog; Ozone layer depletion; Acid rain and its effects</td>
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<td>Forest conservation ct. The wildlife protection Act. Introduction to Environmental Impact Assessment</td>
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<td>15</td>
<td>International conferences, conventions and summits – major achievements in relation to environment. Institutions and people in environment.</td>
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PRACTICALS:

1. Collection, processing and storage of waste water samples
2. Determination of chemical oxygen demand (COD) in waste water sample.
3. Estimation of dissolved oxygen and BOD in waste water sample.
4. Determination of total dissolved solids (TDS) in waste water samples.
5 & 6 Analysis of temporary and total hardness of water sample by titration
7, 8 & 9 Analysis of waste water / sludge for heavy metals
10. Determination of sound level by using sound level meter
11. Estimation of respirable and non-respirable dust in the air by using dust sampler
12. Assessment of chlorophyll content of affected horticultural crops
13. Visit to an ecosystem
14. Visit to recycling units of horticultural wastes/ processing industry
15. Visit to social service Organization / Environmental education centre/ in situ or ex-situ conservation centre.
16. Visit to a local polluted site – Observation and remedial measures.
THEORY:

1. Farm power – Sources of farm power, merits and demerits of different forms of power.
2. & 3. Farm mechanization – Benefits, Constraints, Scope, Limitation etc.
4. IC Engines – Classification, components and their functions.
6. Comparison of diesel engine with spark ignition engine, comparison of four stoke and two stoke engine.
11. Ignition system – Battery ignition system, functions of spark plug, distributor, ignition coil and condenser, storage battery and its maintenance.
13. Lubrication system – Purpose of lubrication, types of lubricants, lubrication systems – splash system, forced feed system, combination of splash and forced feed system. Functions of oil filters.
14. Power transmission system – Functions of clutch, gearbox, differential unit and final drive.
23. Intercultural implements: hoes and weeder.
24 Tractor mounted equipment for land development and soil conservation – functions of bund former, Ridger, and leveling blade.

25 & 26 Sowing equipment: Seed cum fertilizer drill – types, Functions – metering mechanism, functional components, calibration and numerical problems. potato planter and seedling transplanter.

27&28 Harvesting equipment – Sickles, Potato diggers, Fruit pluckers, tapioca puller and hoists.

29 Grafting, pruning and training tools and equipment

30,31&32 Plant protection equipment – Types of sprayers – knapsack sprayer, hand compression hand compression sprayer. Foot sprayer and power sprayer, care and maintenance of sprayers Dusters.

PRACTICAL:

1 Study of I.C. engines (2 stroke and 4 stroke)
2 Study of tractor drawn primary tillage implements.
3 Study of tractor drawn secondary tillage implements.
4 Study of seed cum fertilizer drills.
5 Study of potato planter.
6 & 7 Study of operation and maintenance of tractor and power tiller.
8 to 10 Learning of tractor and power tiller.
11 & 12 Study of sprayers Dismantling and assembling, maintenance of sprayers – Knap sack hand operated and power sprayer. Hand compression sprayer, Foot sprayer, Thaiwan sprayer and Tractor mounted sprayer.
13 Visit to NPPTI/ Service centre.
14 Study of harvesting equipment – Potato diggers, Fruit plucks, tapioca puller and hoists.
15 Visit to Implements manufacturing unit.
16 Visit to Tractor service centre.
EXPERIENTIAL LEARNING PROGRAMME

ELP-401 Nursery Production and Management 15(5+10)

THEORY:

1-2 Project preparation – Aim of the project, objective etc.,

3-4 Nursery Registration and Act – Importance of Nursery registration, procedures for Nursery Registration and Nursery Registration Act

5 Different types of nurseries – fruit nursery, vegetable nursery and flower nursery

6 Certification of bud wood and mother block

7-9 Nursery establishment – pre – requisites, factors affecting nursery, establishment of a commercial nursery – Parts of a nursery.

10-12 Different types of plant propagation structures and equipments-greenhouse, hotbeds, cold frames, mist chambers, net houses, lath houses etc.,

13-14 Media for propagation – Characteristics of an ideal medium, criteria for selection of a medium. Characteristics of a commonly used media

15 Different types of nursery beds – their advantages and disadvantages

16-17 Seed propagation of vegetables, flowers and root stocks in fruits.

18-20 Propagation by specialized plant parts (bulbs, corms, rhizomes, runners etc.)

21-22 Nursery management – Seed sowing, transplanting, nutrients, insect-pest and diseases management in nursery

23-24 Propagation by cuttings-hard wood stem cuttings, soft wood stem cuttings, semi-hard wood cuttings, herbaceous cuttings, leaf cuttings. Leaf bud cuttings and root cuttings (with suitable examples for fruits and flowers)

25-26 Factors affecting rooting of cuttings

27-28 Propagation by layering – different types of layering (Ground and air layering)

29-31 Propagation by graftingdifferent types of grafting (inarching, veneer grafting, wedge, whip)

32-33 Mother plant selection and characteristics of a good root stock

34 Rootstocks for different fruit trees

35 Establishment of progeny block

36-37 Identification of mother plants and maintenance of bud wood bank

38-39 Graft incompatibility studies – rectification of graft incompatibility

40 Different types of manures and fertilizers used in nursery
Different types of manures and fertilizers used in nursery
Techniques and environment management for large scale production (Shade nets)
Study of different types of budding methods
Micro-propagation techniques their advantages and disadvantages
Hardening of seedlings
Packing of nursery plants for transport – different types of packing materials used.
Testing of nursery soil and water of salts, pH, EC etc.,
Use of plant growth regulators in nurseries
Use of chemicals in plant propagation
Role of plastics in plant propagation
Irrigation management – Drip and Sprinkler irrigation
Disease and pest management in nurseries
Visit to local commercial fruit nurseries
Working out economics
PRACTICALS:

1. Orientation and preparation of inventory
2. Establishing mother plant block of fruit and ornamental plants
3. Preparation of growth regulators for propagation and treatment hormonal powders, solutions and paste preparation
4. Seed propagation and raising of root stocks through seeds collection of seeds and their processing, treatment of seeds: scarification and stratification and testing of seed viability
5. Seed Propagation – Preparation of raised beds and sowing, seed sowing in portraies and preparation of media and potting mixtures
6. Visit to specialized structures used in commercial propagation viz., poly house, mist house, shade house, poly tunnel etc.,
7. Preparation of different types of cutting Hardwood cuttings, Semi hardwood and soft wood cuttings and Leaf cuttings – leaf bud, leaf blade, leaf margin and leaf vein cutting
8. Propagation of plants using specialized structures Tubers-tuberous roots-bulb, sucker, rhizomes and Dormancy breaking techniques in bulbs, tubers and corms.
9. Methods of layering in ornamental and fruit crops Girding, GR application and tying etc.,
10. Selection of scion for grafting and pre-curing and preparation of root stocks for grafting
11. Practicing grafting methods – approach, veneer, wedge, saddle, side, whip, whip and tongue
13. Preparation of grafts / budded plants / layers of horticultural crops and maintenance. Preparation of media for micro propagation, preparation of explants and inoculation, preparation of aseptic cultures for propagation of fruit, rooting of plantlets and hardening
14. Visit to commercial nurseries and tissue culture labs preparation of project proposal for establishing a commercial nursery Report writing
ELP-401 Nursery Production and Management
Supporting Dept. Entomology

THEORY:

1. Management of pests in nurseries of Solanaceous crops insect pests and nematodes, cultural, mechanical and chemical control soil treatment and seed treatment
2. Management of pests in nurseries in cruciferous crops cultural and chemical treat
3 & 4 Insect pests on fruit crop nurseries like mango, coconut, guava etc cashew nut and their management
5. Management of insect pests attacking ornamental crop nurseries

PRACTICALS:

1. Identification of insects and damage symptoms of important pests of Mango nursery and their management
2. Identification of insects and damage symptoms of important pests of Citrus nursery and their management
3. Identification of insects and damage symptoms of important pests of Grape / Guava nursery and their management
4. Identification of insects and damage symptoms of important pests of Custard apple, Sapota nursery and their management
5. Identification of insects and damage symptoms of important pests of Coconut / Oil palm nursery and their management
6. Identification of insects and damage symptoms of important pests of Tomato, Brinjal, Chilli, Crucifers nursery and their management
7. Identification of insects and damage symptoms of important pests of Onion, Turmeric nursery and their management
8. Identification of insects and damage symptoms of important pests of Rose and their management
9. Identification of insects and damage symptoms of important pests of Chrysanthemum, Jasmine nursery and their management
10. Identification of insects and damage symptoms of important pests of important pests of Marigold, Crossandra other cut flowers nursery and their management
ELP-401 Nursery Production and Management
Supporting Dept. Pathology

THEORY:

1 & 2 Nursery diseases of fruit crops and their control
3 & 4 Nursery diseases of vegetable crops and their control
5 Nursery diseases of ornamental crops and their control

PRACTICALS:

1. Methods of sterilization of nursery beds and other material used in nursery production
2. Major chemicals used for control of plant pathogens, their formulations and preparation of spray solutions.
3. Various methods of seed/plant propagation material treatments to control plant pathogens.
4. Diagnose the important nursery diseases of Mango and their control
5. Diagnose the important nursery diseases of Citrus and their control
6. Diagnose the important nursery diseases of Grape, Guava, Custard apple, Sapota and their control
7. Diagnose the important nursery diseases of Banana, cocnut, oilpalm and their control
8. Diagnose the important nursery diseases of Tomato, Brinjal, chilli, crucifers, other vegetable crops and their control
9. Diagnose the important nursery diseases of Rose, Chrysanthemum, Jasmine and their control
10. Diagnose the important nursery diseases of Marigold, Crossandra other cut flowers and their control
ELP-401 Nursery Production and Management
Supporting Dept. Economics

THEORY:

1. Preparation of a project on a commercial vegetable nursery production and management
2. Preparation of a project on a commercial flower nursery production and management
3. Preparation of a project on a commercial fruit nursery production and management
4. Study of various costs and returns and working out of economics of a commercial vegetables and flowers nursery production and management
5. Study of various costs and returns and working out of economics of a commercial fruit nursery production and management

PRACTICALS:

1. Visit to a commercial Tomato nursery farm – collection of data on costs and returns of production and management and working out the economics.
2. Visit to a commercial chilles nursery farm – collection of data on costs and returns of production and management and working out the economics.
3. Visit to a commercial Brinjal nursery farm – collection of data on costs and returns of production and management and working out the economics.
4. Visit to a commercial Rose nursery farm – collection of data on costs and returns of production and management and working out the economics.
5. Visit to a commercial Lilly nursery farm – collection of data on costs and returns of production and management and working out the economics.
6. Visit to a commercial Jasmine and Crossandra nursery farm – collection of data on costs and returns of production and management and working out the economics.
7. Visit to a commercial Mango nursery farm – collection of data on costs and returns of production and management and working out the economics.
8. Visit to a commercial Guava nursery farm – collection of data on costs and returns of production and management and working out the economics.
9. Visit to a commercial Sapota nursery farm – collection of data on costs and returns of production and management and working out the economics.
THEORY:

1-2 Importance of protected cultivation of different horticultural crops. Benefits and limitations of polyhouse cultivation – Area under poly house cultivation in India and Andhra Pradesh

3-6 Study of media – Media components – Organic, soilless media. Synthetic media and their characteristics – Preparation of different media mixtures for polyhouse cultivated Horticultural crops

7-8 Study of solarization – Fumigation of different media – chemicals used and methods of fumigation of media

9-10 Preparation of beds – Techniques – Dimensions for bed preparation for different horticultural crops

11-13 Erection of supports. Netting arrangements for crops like carnation. Fixing of supporting wires / nets for training of capsicum, tomato and cucumber

14-15 Method of raising seedlings / plant material, study of different giffy bags – propagation methods.

16-26 Study of production techniques of polyhouse grown crops like carnation, roses, gerbera, chrysanthemum, orchids, anthurium and gladiolus

27-33 Study of polyhouse grown vegetables like tomato, capsicum and cucumber

34-35 Study of special horticultural practices like pinching, deshooting – Deleafing, disbudding – Bending – etc. in polyhouse grown crops

36-38 Study of fertigation / nutrigaiton / Types of soluble fertilizers and their composition. Preparation of stock solutions. Methods of fertigation

39-42 Physiological disorders of polyhouse grown flowers and vegetables.

43-45 Harvesting Techniques – Methods and stage of harvesting depending on purpose method of handling and storage techniques of polyhouse grown crops.

46-47 Study of pre-cooling – Grading – Study of packing material – Packing techniques – Cold chain techniques.

PRACTICALS:

1-5 Study of different media organic – soilless – synthetic media. Preparation of different media mixtures for cultivation of Roses, Caranation, Chrysanthemum, Gerbera, Anthurium and Orchids.

6-10 Study of solarization – fumigation of polyhouses – methods of fumigation

11-15 Preparation of beds for growing cut flower crops and vegetables in polyhouses

16-20 Fixing of supports – trellises, arrangement of net supports – study of different types of nets. Materials used for preparation of nets

21-25 Preparation of seed beds – poly trays – for raising nursery seedlings of capsicum, cucumber and tomato

26-30 Study of jiffy bags – propagation techniques of Roses, Gerbera, Carnation, Orchid Anthuriums and Chrysanthemum

Study of corms and carmelis. Dormancy breaking techniques of Gladiolus

31-35 Study of climate management techniques – practices to manipulate the climate in polyhouses

36-45 Addition of manures of fertilizers – planting techniques of cut flower crops and vegetables

46-50 Practice of special horticultural techniques like pinching, disbudding – deshooting – deleafing in cut flowers and vegetables

57-60 Training and pruning techniques in cut flower crops and vegetables

61-65 Study of fertigation techniques – Identification of different soluble fertilizers and their composition.

66-70 Preparation of stock solutions. Practice fertigation in polyhouse grown crops

71-75 Visit to commercial polyhouses around colleges

76-80 Study of pollination techniques – Different methods of pollination – practice pollination in capsicum and tomato

81-85 Study of harvesting techniques for different purposes in cut flowers and vegetables.

90-93 Study of grading – precooling – holding solutions for enhancement of vase life.

94-100 Study of different types of packaging materials, storage methods – visit to cold storages and commercial markets
ELP-402  Protected Cultivation of High Value Horticultural Crops
Supporting Dept: Entomology

THEORY:

1-3 Study of different pests of polyhouse grown flower and vegetable crops like
Carnation – Roses, Gerbera, Anthurium, Orchids, Galdiolus and Chrysanthemum
– Tomato, Capsicum and Cucumber

4-5 Study of IPM – preparation of insecticide solution – and their calculation

PRACTICALS:

1 Importance of IPM in Horticultural crops
2 Study on tools of Integrated Pest Management
3 Different types of chemicals (pesticides) and their classification
4 Study on different types Sprayers and Dusters
5 Calculation of insecticide and their compatible studies
6 Preparation of Neem Seed Kernal extracts management of Termites, Nematodes (NSKE) in Horticultural crops, Importance Aflotoxin and its management

7&8 Identification of pests, symptoms and nature of damage of pests attacking on
following crops. Tomato and Capsicum, Cucumber

9&10 Ornamental crops – Roses, Carnation, Chrysanthemum, Gerbera, Orchids, Anthurium and Gladiolus – Management of pests in ornamental crops
ELP-402  Protected Cultivation of High Value Horticultural Crops
Supporting Dept: Plant Pathology

THEORY:

1  Diseases of Roses & Chrysanthemum
2  Diseases of Carnation & Gerbera, Gladiolus
3  Diseases of Anthurium & Orchids
4  Diseases of Tomato & Capsicum
5  Diseases of Cucumber

PRACTICALS:

1  Methods of soil sterilization for protected cultivation
2  Difficult methods of seed / planting material treatments
3  Diagnosis & management of diseases of Roses & Chrysanthemum
4  Diagnosis & management of diseases of Carnation, Gerbera & Gladiolus
5  Filed visit to commercial cultivation units
6  Diagnosis & management of Anthurium & Orchids
7  Diagnosis & management of diseases of Tomato
8  Field visit to commercial cultivation units
9  Diagnosis & management of diseases of Capsicum
10 Diagnosis & management of diseases of Cucumber
ELP-402  Protected Cultivation of High Value Horticultural Crops
Supporting Dept: Economics

THEORY:

1-2 Study of Non-recurring – Recurring costs for cultivation of Horticultural crops in polyhouses

ELP-403 Floriculture and Landscape Gardening 15(5+10)

THEORY:

1-2 Importance of floriculture and landscape (Loose and cut flowers) its significance, area and production of flower crops

3-4 Study on land selection criteria for flower crops

5-6 Preparation of layout plan, soil and water analysis for raising flower crops

7-9 Selection of seed material, viability tests, nursery techniques. Precaution for successful raising of nursery

10-12 Study of production techniques for rose, classification, different rootstocks and their description

13-14 Importance, advantages and disadvantages of training and pruning rose in the open field

15-18 Study of harvesting stages, post harvest management (Field heat, pulsing, holding solutions), grading and package of roses

19-21 Study on importance of chrysanthemums, use as loose and cut flowers, production technology, including the nutrition and role of PGR’s

22-23 Propagation techniques of chrysanthemum. Selection and preparation of chrysanthemum cuttings for nursery raising and methods of raising nursery

24-25 Preparation of layout plan and planting of chrysanthemum. Identification and description of spray and standard chrysanthemums


28-30 Production techniques for marigold (Tagetes erecta, Tagetes petula) Nursery raising, importance of pinching and other horticultural practices for marigold. Role of PGR’s in marigold production

31-32 Production techniques for china aster, nutrition, horticultural practices, stage of harvest and post harvest techniques for china aster

33-34 Study of bulbs and corm material for tuberose and gladiolus production

35-37 Methods for breaking dormancy for gladiolus corms and cormels. Study of mother and finger bulbs in tuberose. Study of single and double flower varieties of tuberose

38-39 Production technology of gladiolus. Study of different gladiolus varieties, spike harvesting techniques, extending the vaselife of spikes. Grading and packing of spikes
40-41 Production techniques for tuberose, nutrition management. Planting techniques of bulbs and bulbils

42 Study of export standards for different flower crops

43-44 Planning and designing and site analysis for landscape

45-46 Styles of gardening

46-47 Study of different ornamentals (Annuals, shrubs, climbers and trees etc) for landscape

48-49 Lawn making, different lawn grasses, methods of lawn making and lawn management

50 Study of foliage and filler plant material

PRACTICALS:

1-2 Land selection, layout plans for flower crops

2-3 Soil and water analysis test for raising flower crops

3-4 Nursery preparation and management for flower crops including poly trays, plug trays etc.

4-5 Identification of different root stocks for rose

5-7 Practice of different propagation techniques for rose

8-9 Practice of different pruning methods for rose

10-11 Horticultural practices for standard rose production in open field

12-13 Practice on stage of harvest of roses for different purposes

13-14 Practicals on Grading and Packaging techniques, and post harvest management of rose flowers using different floral preservatives

15-18 Practice on different propagation techniques of chrysanthemum (division, suckers, cuttings etc) Identification of stage of chrysanthemum nursery for planting.

19-20 Field planting of chrysanthemum and experiential learning of production technology (nutrition, irrigation, weeding etc)

21-23 Identification of different types of chrysanthemum

Identification of different cultivars of chrysanthemum

24-26 Practice on different horticultural practices for chrysanthemum flower regulation by use of plant growth regulators

27-28 Seed germination test for marigold (African and French marigold)
29-31 Nursery raising technique for African and French marigold. Stage of planting nursery and nursery transplantation of marigold in plots

32-34 Practical experience on impact of pinching marigold plants

35-37 Field site experience on production of marigold

38-40 Identification of different flower crops seed material

41-42 Identification of corm and cormels of gladiolus

Impact of growth regulators on dormancy breaking of gladiolus

43-45 Identification of corm and cormels of different gladiolus varieties

46-47 Identification of tuberose bulbs and selection of suitable bulbs for production of flowers.

48-49 Field experience for identification of single and double tuberose flowers

50-51 Nursery production of china aster

52-55 Planting of china aster seedlings. Application of manures and fertilizers to china aster

56-58 Field observation for days taken for flower initiation and interval of china aster flowering

59-62 Visit to different flower growing areas

63-66 Study of harvesting techniques for different field grown flowers

67-69 Grading and Packing techniques for different field grown flowers

70-74 Identification of different floral preservatives. Preparation of stock solution for floral preservatives. Holding solution for extending shelf life of loose and cut flowers

75-77 Site analysis for landscape gardening

78-80 Planning and designing for landscape

81-83 Identification of different flowering and foliage shrubs for landscape

84-85 Identification of different foliage and flowering climbers for arches and pergolas

86-87 Identification of ornamentals for topiary and practice of topiary work

88-91 Identification of annuals flowering seed. Techniques of annual nursery raising in beds, plug trays and jiffy bags

92-93 Different perennial trees for avenues and high ways

94-95 Identification of different lawn grass species

96-97 Practical training on different methods of lawn making (sprigs, plugs etc)

98 Rolling and mowing of lawn, clippings removal

99-100 Visit to different private and public parks
ELP-402  Protected Cultivation of High Value Horticultural Crops
Supporting Dept: Engineering

THEORY:

1-3  Study of different types of Polyhouses based on shape, size, style and cladding material.
Components of naturally ventilated and fan and pad system of polyhouses and their study.

4  Development of Irrigation, Sprinkler and Fogging system – Types of their benefits and limitations.

5  Maintenance and Management of different Lighting Systems of Polyhouses

PRACTICALS:

1-3  Design of fan and pad system of cooling – convection tube cooling – using NAGMA standards

4-6  Practical on fertigation equipment

7-9  Study of drip equipment – design calculation of pump capacity, their maintenance

10  Computer control system for automation of irrigation
ELP-403 Floriculture and Landscape Gardening
Supporting Dept: Entomology

THEORY:
1-3 Insect pests of flower crops and their management
4 Insect pests of annuals and their management
5 Insect pests of lawns, ornamentals and perennials and their management

PRACTICALS:
1-2 Identification of insect pests of Rose and their damage symptoms
3-4 Identification of insect pests of Chrysanthemum and their damage symptoms
5-6 Identification of insect pests of marigold and aster and their damage symptoms
7 Identification of insect and damage symptoms of important pests of Tuberose, Gladiolus
8-9 Identification of insect pests of ornamental and damage symptoms
10 Identification of insect pests of lawn and damage symptoms
ELP-403 Floriculture and Landscape Gardening
Supporting Dept: Engineering

THEORY:

1-2 Land surveying – leveling instruments – dumpy level, total station level, simple earth work calculations.


PRACTICALS:

1 Measurement of distance – methods – pacing – chain survey etc. chain surveying – equipment – chain tap, ranging rods cross staff, optical square etc.

2 Triangulation survey – chain tap, ranging rods cross staff, optical square etc.

3 Plotting – calculation of area survey

4 Study of leveling equipment

5 Leveling terminology

6 Leveling methods – profile leveling – simple leveling – differential leveling

7-9 Methods of land grading

10 Land grading equipment
ELP-403  Floriculture and Landscape Gardening
Supporting Dept: Economics

THEORY:

1. Marketing of flowers – different channels – for different – important flowers
2. Price spread of important flowers – market cost – market margins – supply chain management
3. Storage facilities available for different flowers for better supply chain management.
4. Cost of production for different flowers
5. Preparation of project report for different flowers crops

PRACTICALS:

1. Study of different supply chains for different flowers
2. Study of loose flowers potential in Andhra Pradesh
3. Study of flower gardens management
4-5 Visit to local flower market
6. To workout cost of commercial flowers
7. To workout IRR
8. To workout BC Ratio
9. To workout Net worth Analysis
10. Post harvest package practices
THEORY:

1 Importance of experiential learning in the field of post harvest technology and value addition of horticultural crops viz., fruits, vegetables, flowers, medicinal, spices and plantation crops.


3 Principles and steps involved in post harvest handling of horticultural produce – washing – pre-cooling viz., hydro cooling, vacuum cooling, forced air cooling and contact icing – sorting & grading – benefits of grading – types of grading – colour grading and grading for size – methods of grading – hand grading, machine sizing-sizing by weight, diameter etc.

4 Grading of fruits: mango, sweet orange, acid lime, mandarin, papaya, pineapple, grapes, banana, guava etc; grading of vegetables: tomato, okra, cabbage, cauliflower, cucumber, onion, Brinjal, potato etc. grading of cut flower – rose, carnation, gerbera, gladiolus.

5-6 Grading of medicinal plants, spice, aromatic crops and plantation crops

7-8 Post harvest treatments: curing, degreening, quailing, use of growth regulators, hot water dip, vapour heat treatment, fungicidal treatment, waxing, irradiation, in package treatment.

Hastening ripening: ethylene and ethylene releasing compounds, smoke, alcohol, fatty acid.

Delayed ripening: use of growth regulators viz., 2, 4-D, 2,4,5-T, 2,4,5-TP, GA & BA.

12-13 Special packaging system – modified atmospheric packaging system
   a. oxygen scavenging system
   b. moisture absorbing and controlling system
   c. Co2 generating system absorbents
   d. Ethanol generators
   e. Ethylene absorbents
   f. Edible coatings
   g. Bio packaging

Vacuum packaging, use of shrink films grape guard packing treatment:
   a. slow release type
   b. quick release type

14, 15 Different packing materials for fresh fruit, vegetables, flowers, medicinal plants, spices, plantation crops, specific packaging for export of mango, banana, citrus, grape etc., vegetables – tomato okra, fresh beans, cabbage, cauliflower, potato, chilli, onion, Brinjal etc., rose, gladiolus, carnation, gerbera, tuberose etc.

16-17 Packaging for medicinal plants, spices, plantation crops

18-19 Cushioning materials – mode of action – purpose of use – characteristics – various kinds of cushioning material – airbags, bubble films, rubberized fibre cushioning, plastic foam cushioning materials, polystyrene (PS), polyurethane (PU), air cellular cushioning, foam in place, polyethylene foam, loose fill packing, korrvu packaging, tissue paper, buffered tissue, acid free tissue, paper waste, paddy straw, banana leaf etc.

20-21 Methods of storage – storage in pits, barns, cellars, clamp storage – on site storage (in site), hypobaric storage, evaporative cool storage (low cost storage) improved storage methods: refrigerated storage, silicon membrane technology, controlled atmospheric storage – protocols of cold chain techniques for fresh produce.


23-25 Integrated post harvest management in important horticultural crops like mango, banana, citrus, grape, Sapota, papaya, pomegranate, tomato, chilli, okra, gourds, rose, gladiolus, carnation, chrysanthemum, tuberose, gerbera etc.

of irradiation – packaging material for irradiated food – practical applications of food irradiation in crops viz., potato, onion, cocoa beans, dates, mangoes & spices etc. beneficial aspects of food irradiation – radappertization of fruits, vegetables and their products.


Concentration – methods of concentration of different horticultural produce – intermediate moisture foods (IMF) – effect of concentration and drying on over all quality of different products – nutritional status of dried and concentrated horticultural produce.

Processing technique for fruit pulp preparation – fresh fruit pulp, frozen fruit pulp, pulp preserved by heat treatment, pulp preserved by sulphur dioxide, pulp preparation from dried fruits.

Modern processing techniques for jam making – jelly making-theories of gel formation – steps involved in preparation and processing of jellies.

32 Canning – considerations for setting up of a cannery – containers – lacquered cans, acid resistant lacquer, sulphur resistant lacquer manufacture of cans – can sizes – canning techniques for fruits and vegetables.

33-34 Fruit juices and juice beverages – types – RTS, fruits juice blends, fruit juice concentrate – Processing techniques.

Fruit juice powder, fruit squashes, fruit appetizer, fruit juice cordial, syrups/sharbat, carbonated beverages, vegetable juice / beverages – packing material and methods.

Processing techniques for preserve, candies, crystallized fruits and vegetables, bar & toffee – Packing of the finished product.

35 Steeping preservation of fruits and vegetables – Uses – Precautions for preparation

Lactic acid fermented beverages – lactic acid bacteria and fermented foods – lactic acid fermentation and preservation – antimicrobial substances produced by lactic acid fermentation, quality assurance and significance of lactic fermented beverages – processing technology of lactic fermented beverages production.

Vinegar – composition and production – uses of vinegar, vinegar in food processing – types and composition of vinegar – nutritional, therapeutic and quality significance, microbiology and biochemistry of vinegar production, general methods of vinegar production – quick and modern processes unit operations for the preparation of vinegar from different horticultural produce.

Fermentative utilization of waste from food processing industry – food processing wastes available in India – characteristics of food industry wastes – standards for waste water disposal set up by environmental protection agency – preparation of fermented edible products viz., single cell proteins, animal feed, apple, mango, citrus pomace etc., potato and sweet potato peels; food additives viz., microbial flavours and gums, vitamins, organic compounds, biogas production.

Chutney and sauces – classification – effect on nutritive value and vitamin stability in processed products – processing technique for chutneys and sauces.

Types of pickles – preservation principles – biochemical changes during lactic acid fermentation – horticultural produce undergoing lactic acid fermentation – factors affecting bacterial growth, ingredients with anti microbial properties – containers used for pickling – methods and recipes of different pickles – pickles prepared in brine and vinegar – lactic acid fermented pickles viz., sauerkraut, kimchi, dill pickles, olive pickles; pickles in oil; keeping quality and nutritive value of fermented vegetables – safety of fermented vegetables.


Minimal processing of Horticultural produce – Methods & techniques
PRACTICALS:

1-2 Harvest systems and handling during harvest of horticultural produce for fresh market and processing
3-4 Perception of quality – obtaining total quality in horticultural produce
5-6 Methods of quality evaluation of fresh horticultural produce
7-10 Visit to different fruit and vegetable gardens meant for processing
11-14 Visit to different fruit and vegetable gardens meant for fresh market
15-16 Visit to a packing house – preparation of the horticultural produce for the fresh market
17-18 Visit to different storage systems – storage of fresh produce
19-20 Transportation of fresh horticultural produce
21-22 Visit to vegetables and fruit markets to study the causes of post harvest losses
23-25 Visit to fresh fruit and vegetables packing house to study the post harvest practices followed for export purpose
26-27 Study of FPO licensing procedure for processing units, specification for processed products, food grades, standards, laws and regulations followed by processing units
28-31 HACCP systems for fruits & vegetables cultivation food safety & quality, HACCP principles, preparing for a HACCP study, hazard analysis, identifying critical point (CCPS) and good manufacturing practices (GHPS), verification, record keeping and review.
32-35 Methods of quality evaluation of processed horticultural produce, keeping quality, nutritional quality and biochemical changes etc.
36-37 Visit to different quality control laboratories working under different factories of fresh and processed horticultural produce
38 Study on packing practices
39-42 Production planning – Quality assurance – raw materials, processing, packing and storage, testing ingredients and products etc.
43 Applying advanced instrumental methods mealiness in fruit – sensory evaluation and customer expectations – use of advanced methods for detection
44 Selection of site for establishment of commercial processing unit
45 Auxillary raw materials used in fruits & vegetables processing
46-47 Improving the nutritional quality of processed fruit and vegetables: the behavior of nutrients minerals, antioxidants – vitamins, lycopene and other carotene, during processing.
48-49 Visit to a dehydration unit to observe the chain of operations performed in preparation of dehydrated product

50-51 Visit to a distillery unit to study the operational procedure followed for preparation of fermented products from various horticultural produce

52-53 Visit to an essential oil extraction unit from different aromatic, spice and plantation crops

54-55 Visit to coffee and rubber processing unit

56-57 Visit to medicinal plants processing unit – extract of alkaloids etc.,

58-59 Study on maintenance of quality control, evaluation and assurance of processed products in various processing units

60 Visit to APEDA, Hyderabad

61-64 Processing for drying/dehydrated horticultural produce

65-68 Processing for juice, squash, nectar, cordial syrup/sherbath and other beverages from different horticultural produce

69-72 Dehydration of horticultural produce: methods of drying – sun drying, osmotic dehydration, freeze drying etc., types of dryers; tunnel dryer, belt dryer, vacuum dryer, drum dryer, spray in heated air etc. for preparation of flakes, chips, powders concentration etc.

73-76 Processing for canning of horticultural produce

77-78 Technologies, equipment and buildings for medium scale processing and storage / packing of shredded sauerkraut

79-82 Preparation of jam, jellies, marmalade, preserve, candy, glazed and crystallized fruits and vegetables.

83-86 Preparation of fermented beverages, vinegar etc.,

87-88 Preparation of toffee, bar, chavanprash etc.

89 Preparation of fruit based alcoholic beverages – wine, vermouth, brandy, fortified wine etc.,

90 Preparation of lactic acid fermented beverages

91 Processing technique for chutneys and sauces

92,93 Minimal processing of fresh fruit & vegetables – quality changes in minimally processed fruits & vegetables – raw material: various steps involved in processing.

94-95 Food processing factory wastes and their utilization

96-98 Visit to food irradiation unit – irradiation procedures for horticultural produce

99-100 Preparation of bottled fruits, fruit leathers and fruit cheese puree, papain, pectin, spirits.
ELP-404  Post harvest technology and value addition of Horticultural crops  
Supporting Dept: Entomology

**THEORY:**

1. Storage insect pests of fruits, vegetables and ornamental crops
2. Storage insect pests of spice crops, medicinal and aromatic crops
3. Stored product insect pests of dried fruits and processed foods
4-5 Post harvest insect disinfection treatments – physical treatments – high & low temperature, controlled atmosphere, ionizing radiation, radio frequency microwave dielectric heating & chemical treatments.

**PRACTICALS:**

1. Low temperature treatments for post harvest insect control
2. High temperature treatments for post harvest insect control
3. Controlled atmosphere – (low oxygen & high Co2) for post harvest insect control
4. Controlled atmosphere – vacuum or low pressure for post harvest insect control
5. Ionizing radiation (r-rays high energy electrons and x-rays) treatments for post harvest insect control
6. Radio frequency treatments for post harvest insect control
7. Microwave radiation treatments for post harvest insect control
8. Dielectric heating treatments for post harvest insect control
9. Post harvest insect disinfection treatments for cut flowers
10. Chemical treatments for post harvest insect control
ELP-404 Post harvest technology and value addition of Horticultural crops
Supporting Dept: Engineering

THEORY:

1. Fruits and vegetables cleaning – Machinery for cleaning of fruits and vegetables, care and maintenance
2. Grading – Methods of grading, equipment for grading of fruits and vegetables, care and maintenance
3. Size reduction – Equipment for size reduction of fruits and vegetables, care and maintenance
4. Evaporation – Principles, types of evaporators for fruits and vegetable juice
5. Refrigeration and cold storage – Storage condition at different levels of processing of fruits and vegetables

PRACTICALS:

111-112 Identification of tools and equipment required for processing, canning, bottling and dehydration of fruits and vegetables
113-114 Study of equipment for preparation of different fruit products on commercial lines – jams and jellies
115-116 Care and maintenance of equipment used in marketing of fresh produce, processing of horticultural crops
117-118 Visit to fruit and vegetable processing industries
119-120 Visit to flower, plantation, medicinal and aromatic crop processing units
ELP-404  Post harvest technology and value addition of Horticultural crops
Supporting Dept: Pathology

THEORY:

1. Identification & management of major post harvest pathogens in flowers
2. Identification & management of post harvest diseases of mango, citrus, banana
3. Identification & management of post harvest diseases of grapes, guava, Sapota, apple etc.
4. Biological control of post harvest diseases by various treatments
5. Post harvest treatments to fruits & vegetables to reduce microbial spoilage
6. General methods of cleaning & sterilization of post harvest processing equipment
7. Identification & management of post harvest diseases of mushrooms
8. Identification of microbial flora of processed products
9. Visit to markets to assess post harvest losses due to pathogens

PRACTICALS:

1. Post harvest diseases of fruits & vegetables
2. Post harvest diseases of flowers, spices, medicinal & aromatic crops
3. Post harvest treatments in various crops affecting post harvest deterioration by pathogens
4. Post harvest treatments in various crops to prevent post harvest losses due to pathogens
5. Microbial spoilage of processed products
THEORY:

1. Exports and imports of fresh and processed horticultural products – Indian scenario – policy initiatives for encouraging exports
3. Detailed procedure and licensing arrangements – certification for export and import
4. Project evaluation – projects, horticulture projects – project cycle, identification, formulation, appraisal, implementation – evaluation

PRACTICALS:

1. Visit to marketing committee (regulated)
2. Visit to fruit / vegetable markets (study of maintenance of records and transactions)
3. Visit to flower market (wholesale market) study of records auctioning and price fixation
4. Visit to reliance fresh / heritance fresh and study of procurement, arrangements, value addition, single day turn over in terms of money and quantity of sale etc.
5. Case study on street vendors
6. Visit to exporting firm
7. Visit to quality control lab
8. Visit to APEDA – exposure visit
9. Visit to Department of Horticulture to know the schemes implemented by government to promote Horticulture exports
10. Practical on project evaluation techniques, discounted and undiscounted measures – selection of projects based on feasibility
Experiential Learning Programme – Module
Commercial Horticulture
College of Horticulture, Anantharajupeta, Kadapa district

College of Horticulture, Mojerla, Mahaboobnagar district

College of Horticulture, Rajendranagar, Rangareddy district

College of Horticulture, Venkataramannagudem, W.G. district