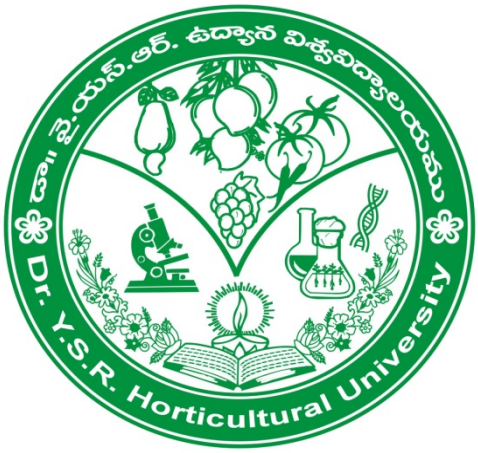
LECTURE OUTLINES

B.Sc.(Hons.) Horticulture

2018



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DEAN OF HORTICULTURE &
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DR.YSR HORTICULTURAL UNIVERSITY

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Dt.
Venkataramannagudem

(M.LAKSHMINARAYANA REDDY)
DEAN OF HORTICULTURE &
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Contents

Semester wise distribution of
B.Sc.(Hons.)Horticulture degree course curriculum

Semester – I

Sl. No	Course No.	Title of the Course	Credit Hours
1	FRSC-1.1.1	Fundamentals of Horticulture	3(2+1)
2	FCLS-1.3.1	Principles of Landscape Architecture	1(0+1)
3	ENTO-1.6.1	Fundamentals of Entomology	2(1+1)
4	GPBR-1.8.1	Principles of Genetics and Cytogenetics	3(2+1)
5	ASSC-1.9.1	Fundamental of Soil Science	2(1+1)
6	PPBM-1.10.1	Introductory Crop Physiology	2(1+1)
7	PPBM-1.10.2	Introductory Microbiology	2(1+1)
8.	ESSC-1.11.1	Economics and Marketing	3(2+1)
9	ESSC-1.11.2	Information and communication technology	2(1+1)
10	ESSC-1.11.3	Communication Skills and Personality Development	2(1+1)
		Credit load	**22(12+10)**

Semester – II

S.No	Course No.	Title of the Course	Credit Hours
1	FRSC1.1.2	Tropical and Subtropical Fruits	3(2+1)
2	FRSC-1.1.3	Plant Propagation and Nursery Management	2(1+1)
3	VGSC-1.2.1	Tropical and Subtropical Vegetables	3(2+1)
4	PATH-1.7.1	Fundamentals of Plant Pathology	3(2+1)
5	GPBR-1.8.2	Principles of Plant Breeding	3(2+1)
6	ASSC-1.9.2	Soil Fertility, Soil Chemistry and Soil Taxonomy	3(2+1)
7	PPBM-1.10.3	Elementary Plant Biochemistry	2(1+1)
8	PPBM-1.10.4	Growth and Development of Horticultural Crops	2(1+1)
9	ESSC-1.11.4	Fundamentals of Statistics	3(2+1)
		Credit load	**24(15+9)**
10	NSS-101	National Service Scheme/National Cadet Corp	1 (0+1)(NC)*
		Total	**25(15+10)**

NC* - Non credit courses

Semester – III

S.No	Course No.	Title of the Course	Credit Hours
1	FRSC-2.1.1	Temperate Fruit Crops	2(1+1)
2	VGSC-2.2.1	Temperate Vegetable, potato and Tuber Crops	3(2+1)
3	FCLS-2.3.1	Commercial Floriculture	3(2+1)
4	SPMA-2.4.1	Spices and Condiments	3(2+1)
5	SPMA-2.4.2	Plantation Crops	2(1+1)
6	PHTH-2.5.1	Fundamentals of Food Technology	2(1+1)
7	GPBR-2.8.1	Elementary Plant Biotechnology	2(1+1)
8	ASSC-2.9.1	Weed Management in Horticultural Crops	2(1+1)
9	HEES-2.12.1	Environmental studies and Disaster Management	3(2+1)
10	VLPM-2.0.1	Live Stock Management	1(0+1)
		Total	**23 (13+10)**
	PED-201	Physical and Health Education	1(0+1) (NC)*
		Total	**24 (13+11)**

NC* - Non credit courses

Semester – IV

S.No	Course No.	Title of the Course	Credit Hours
1	FCLS-2.3.2	Ornamental Horticulture	3(2+1)
2	SPMA-2.4.3	Medicinal and Aromatic crops	3 (2+1)
3	ENTO-2.6.1	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	3(2+1)
4	ENTO-2.6.2	Integrated Pest Management and Nematodes Pest Management	2(1+1)
5	PATH-2.7.1	Diseases of fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)
6	GPBR-2.8.2	Breeding of Fruit and Plantation Crops	3(2+1)
7	ASSC-2.9.2	Water Management in Horticultural Crops	2(1+1)
8	ASSC-2.9.3	Manures, fertilizers and nutrient management	2(1+1)
9	HEES-2.12.2	Surveying, soil and water engineering in horticultural crops	2(1+1)
		Total	**23(14+9)**

Semester – V

S.No	Course No.	Title of the Course	Credit Hours
1	FRSC-3.1.1	Dryland horticulture - principles and practices	2(1+1)
2	VGSC-3.2.1	Precision Farming and Protected Cultivation	3(2+1)
3	PHTH-3.5.1	Postharvest Management of Horticultural Crops	3(2+1)
4	ENTO-3.6.1	Insect Pests of Vegetable, Ornamental and Spice Crops	2 (1+1)
5	PATH-3.7.1	Diseases of Vegetables, Ornamentals and Spice Crops	3 (2+1)
6	GPBR-3.8.1	Breeding of Vegetable, Tuber and Spice Crops	3 (2+1)
7	ASSC-3.9.1	Organic Farming in Horticultural Crops	2 (1+1)
8	ASSC-3.9.2	Introduction to Major Field Crops	2 (1+1)
9	ESSC-3.11.1	Fundamentals of Extension Education	2 (1+1)
		Total	**22(13+9)**

Semester – VI

S.No	Course No.	Title of the Course	Credit Hours
1	FRSC-3.1.2	Orchard and Estate Management	2(1+1)
2	PHTH-3.5.2	Processing of Horticultural Crops	3(1+2)
3	ENTO-3.6.2	Apiculture, Sericulture and Lac culture	2(1+1)
4	GPBR-3.8.2	Seed Production and certification of Vegetable, Tuber and Spice Crops	3(2+1)
5	GPBR-3.8.3	Breeding and Seed Production of Flower and Ornamental Plants	2(1+1)
6	ASSC-3.9.3	Agro-meteorology and Climate Change	2 (1+1)
7	ASSC-3.9.4	Introductory Agro Forestry	2(1+1)
8	ESSC-3.11.2	Horti-Business Management	2(1+1)
9	ESSC-3.11.3	Entrepreneurship Development and International trade	2(1+1)
10	HESS-3.12.1	Farm power, machinery and processing equipment	2(1+1)
		Total	**22 (11+11)**

Student READY – Rural Entrepreneurship Awareness Development Yojana

*** Semester – VII – RHWE / Semester – VIII - ELP**

****Semester – VII – ELP (two modules) + Semester VIII - RHWE**

S.N	Title of the Course	Credit Hours
1	Student READY – RHWE Placement in Villages / Industries / Tours	0+20
	Total	**20 (0+20)**

S.No	Course No.	Title of the Course / Modules	Credit Hours
1	(ELP-401)	Commercial Horticulture	10(0+10)
2	(ELP-402)	Protective Cultivation of High Value Horticulture Crops	10(0+10)
3	(ELP-403)	Processing of Fruits and Vegetables for Value Addition	10(0+10)
4	(ELP-404)	Floriculture and Landscape Architecture	10(0+10)
5	(ELP-405)	Bio-inputs: Bio-fertilizers and Bio-pesticides	10(0+10)
6	(ELP-406)	Mass Multiplication of Plant And Molecules through Tissue Culture	10(0+10)
7	(ELP-407)	Mushroom culture	10(0+10)
8	(ELP-408)	Bee keeping	10(0+10)
Any two modules			**20 (0+20)**

* Batch (50%) of students of IV year will register RHWE in VII Semester and ELP (2 modules) in VIII Semester

* Another (remaining 50%) batch of students of IV year will register ELP (2 modules) in VII Semester and RHWE in VIII Semester.

DEPARTMENT OF ANIMAL HUSBANDRY

VLPM 2.0.1 Live Stock Management 1 (0+1)

Practicals:

1. Domestication of farm animals, behavior of animals, Land-Livestock-human relationships, common animal husbandry terms; Body parts of domestic animals.
2. Various breeds of cattle, buffalo, sheep, goat and swine Indian & Exotic.
3. Types of Animal housing including poultry – Effect of climate on animals.
4. Forage and fodder production (various fodder grass, Fodder trees grown).
5. Common feed ingredients, their nutritive value, digestion & absorption, competition of balanced rations, Haymaking, silage making.
6. Visit to dairy farm, observation of routine dairy farm operations.
7. Reproduction in farm animals. Anatomy, Physiology, Reproduction management – Pregnancy & Parturition.
8. Visit to Poultry Farms, features of poultry production – Common breeds of poultry – layers & brodiers feeding poultry.
9. Visit to sheep & goat farms – feeding of sheep and goat, Management and Economics involved.
10. Visit to commercial hatchery, management incubation. Eggs and its handling.
11. Animal diseases, signs of ill health, Prevention of control of Contagious diseases, first aid on farm animals. Deforming and vaccination.
12. Visit to piggery unit/swine farm – feeding – management.
13. Visit to semen bank, Artificial Insemination importance. (i.e.) Genetic improvement.
14. Live Stock Management during natural calamities and disasters.
15. Economics of Live stock production – Cattle, buffaloes, sheep, goat, surine and poultry.
16. Record keeping various records maintained in livestock farms, importance.
    Judging of live stock cattle and buffaloes, sheep, goat & poultry in livestock shows.

References:

Livestock Production Management -Sastry N.S.R. and Thomas C.K. (2005) 4th Ed.Kalyani Publishers

Goat, Sheep and Pig Production Management – Jagadish Prasad (2005) 3rd Ed. Kalyani publishers

Poultry production (Reprinted 2011) – R.A.Singh (1990) 3rd Ed. Kalyani Publishers

DEPARTMENT OF FRUIT SCIENCE

FRSC-1.1.1 Fundamentals of Horticulture 3 (2+1)

Theory:

1 Definition of Horticulture - Importance of Horticulture in terms of economy, production, employment generation, environmental protection and human resource development.
2 Area and Production of Horticultural crops in A.P and India – Export and Import scenario – Scope for Horticulture in India.
3 Divisions of Horticulture with suitable examples and their importance. Nutritive value of various Horticultural crops.
4 Classification of Horticultural crops based on soil and climatic requirements.
5 Fruit and vegetable zones of India and Andhra Pradesh.
6 Definition of 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 Vegetable gardens, nutrition and kitchen garden , truck garden, vegetable forcing, market garden and roof garden.
9 Orchard establishment – Points to be consider while selecting the soil for the establishment of orchard – Different steps followed in planning and layout of orchards
10 Different steps in establishment of orchards and management of orchards.
11 Different systems of planting orchards – square, rectangle, quincunx, hexagonal and contour systems of planting – their merits and demerits.
12 Calculation of planting densities in different systems of planting.
13&14 Definition of pruning - Principles and objectives of pruning – Different types and methods of pruning in Horticultural crops.
15&16 Definition of training - Principles and objectives of training – Methods of training in Horticultural crops – open centered, close centered and modified leader systems their merits and demerits.
17 Different types of growth regulators and their practical importance in Horticulture.
18 Water management– Definition of irrigation – Different Irrigation methods followed in Horticultural crops and their merits and demerits.
19 Weed management – definition of weed- Different types of weeds and their management in Horticultural crops.
20&21 Fertility management - Definition of manures and fertilizers - Different methods of application of manures and fertilizers to Horticultural crops.
22&23 Cropping systems- intercropping, multi-tier cropping and their merits and demerits with suitable examples.
24&25 Definition of mulch – objectives of mulching- Advantages of mulching - Different types of mulches – organic and inorganic mulches with suitable examples.
26 Classification of bearing habits of fruit trees.
27&28 Definition of fruitfulness and unfruitfulness - Factors influencing the fruitfulness and unfruitfulness with suitable examples.
29 Rejuvenation of old orchards – importance of rejuvenation – different methods for rejuvenation top working, frame working.
30 Concept, Definition of organic farming - Principles – Advantages and components of organic farming.
31 Maturity – Definition of maturity – Different methods followed for judging the maturity in Horticultural crops.

32 Post harvest operations in Horticultural crops – Harvesting, Grading, Packing and Storage of Horticultural produce , Different methods of storage.

Practicals:

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

References:

Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
Neeraj Pratap Singh, 2005. Basic concepts of Fruit Science 1st Edn. IBDC Publishers.
Gardner/Bardford/Hooker. J.R., 1957. Fundamentals of Fruit Production. Mac Graw Hill Book Co., New York.
Edmond,J.B, Sen,T.L, Andrews,F.S and Halfacre R.G., 1963. Fundamentals of Horticulture. Tata Mc Graw Hill Publishing Co., New Delhi.
Kumar, N., 1990. Introduction to Horticulture. Rajyalakshmi publications, Nagarcoil, Tamilnadu
Jitendra Singh, 2002. Basic Horticulture. Kalyani Publishers, Hyderabad.
Denisen E.L.,1957. Principles of Horticulture. Macmillan Publishing Co., New York.
Chadha,K.L.(ICAR),2002,2001. HandbookofHorticulture . ICAR, NewDelhi
K.V.Peter, 2009. Basics Horticulture. New India Publishing Agency
Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture. Biotech Books.
D.K. Salunkhe and S.S. Kadam, 2013. A handbook of Fruit Science and Technology. CRC Press.
S. Prasad and U. Kumar, 2010. A handbook of Fruit Production. Agrobios (India).
Jitendra Singh, 2011. Basic Horticulture. Kalyani Publications, New Delhi.

FRSC 1.1.2 Tropical and Subtropical Fruits 3(2+1)

Theory:

1. Horticultural zones of India.
2. Classification of fruits.
3. Mango: Introduction & History, Nutritive Value, Uses, Origin & Distribution Area and Production, Export Potential, Importing Countries, Important Species of Mango Production Technology: Climate requirements- Temperature, rainfall and other requirements for optimum vegetative growth, flowering, and fruit development under North Indian and South Indian conditions Soil requirements.
4. 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. (Rayalsesema,Telangana and Coastal) and Varieties of North, South, East and West; Hybrids of Mango released for cultivation all over India.
5. 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; Inter cropping, Weed management.
6. Special Horticultural Practices: Manipulation of flowering through canopy management & application of plant growth regulators, Flowering: Environmental factors influencing flowering, types of flowers, agents of pollination, fruit set, fruit drop and its control.
7. Alternate Bearing/Biennial Bearing: Causes and control Pysiological Disorders & their control: Malformation (Vegetative & Floral), Black Tip, Spongy Tissue, and leaf Scorch. Harvesting & Yield: Harvest Indices, Methods of Harvesting, Grading, Packing, Transport. Storage and Ripening.
8. 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, Production Technology: Climate, Soil requirements. Propagation by Suckers, Treatment of suckers before planting; Micro Propagation: Planting density Irrigation
9. Nutritional requirements: Fertilizer doses recommended, Management of Banana crop: Desuckering, Ratoon sucker selection, Weed control, Mulching, Earthing up. Leaf removal, Provision of Wind breaks; Bunch management: Propping of bunches, Wrapping, Trimming, Removal of Male bud, Bunch covering.
10. Citrus: Introduction and History, Economic importance, Nutritive value of Sweet and Acid groups, Uses, Origin & Distribution, Area & Production and Export Potential, classification of Citrus: I. Swingle Classification (1948) Eucitrus (10) and Papeda (6) : II. Tanaka Classification (1954). III. Hodgsons Classification: Acid members, Oranges, Mandarins, Pummelos and Hybrid of Citrus, Production Technology: Climate & Soil requirements of importance 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 disease, stock & Scion relationship, methods of propagation- Bud Wood Certification-Virus free bud wood, Nucellar clones, Virus indicator species.
11. 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), Flowering: Factors effecting fruits 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.

12. 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, Production Technology: Climate requirements, Soil requirements, Propagation, Method of propagation of root stocks, Planting Density, Planting,
13. Training: Purpose, systems of training (Bower, telephone system, Trellis system-T and Y-vertical cordon system –Single & double, kniffin system, Gable system), Nutritional roles of Major & Minor nutrients, Fertilizer Scheduling, Irrigation; Symptoms of water deficit; 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, bud forecasting.
14. Improvement of yield through practices like girdling, pinching thinning of flowering and berry drop. Fruit set, Stenospermocarpy, Stages of berry growth; Uses 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-venial chorosis, Poor Bud Burst, flower and Berry drop, Barrenness of vines, Pink berry, Cracking of Rachies,
15. 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; Climate & Soil requirements; Propagation, Root Stocks, Planting Density, methods of irrigation, nutrient management, Intercultural operations, weed management and inter-cropping, Maturity Indices, Harvest & Yield; Handling, Grading, Packing, Transport, Marketing, Ripening and Storage.
16. Guava: Economic Importance, Nutritive value, Origin & Distribution , Area & Production,; Species & Varieties (Indian & Exotic), Hybrids; Production Technology; Soil & Climate 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.
17. Jackfruit, Breadfruit and Durian: Economic Importance, Nutritive value, Origin & Distribution, Area & Production; Species & Types; Types based on fruit characters, Varieties and hybrids; Production Technology; Climate & Soil requirements; Propagation, Planting, method of irrigation, nutrient management, Intercultural operations, weed management and inter-cropping, Maturity Indices, Harvest & Yield; Handling, Grading, Packing, Transport, Marketing, Ripening and Storage.
18. 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.
19. 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.

20. Pine Apple: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Varieties; Groups: Spanish, Abacaxi, Queen, Cayene, Maipore Production Technology; Soil & Climate requirements; Propagation; by shoot suckers, Ground suckers, slips, crowns, stumps, micro propagations, High Density Planting, Water and Nutrient management, Intercultural, flowering and fruiting. Use of chemical 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.
21. Pomegranate: Economic importance, nutritive value, origin and distribution, Area and production, Varieties: Hard seeded and soft seeded. Production technology: Soil & Climate requirements; Propagation, Planting, Training and Pruning, Irrigation, Nutrient Management, Bahar treatment, Flowering, flower and Fruit thinning, Harvest indices, Yield and storage, Physiological disorders- Fruit cracking.
22. Custard Apple: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Annona squamosa, A muricata, A.reticulate, A.Cheromola, Atemoya Hybrid: Varieties & Groups- Green fruit & Red fruit: Production Technology: Soil Nutrient management, flowering time, Fruit Development, Stone Fruit formation and their control, Harvest, yield, Storage.
23. 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.
24. Fig: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Types & Varieties (Capri fig, Adriatic fig, Smyrna fig and San Pedro 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.
25. Aonla: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Species and Varieties: Production technology: Soil and Climatic requirements; propagation density, planting, pruning; Irrigation, Nutrition, Flowering and Fruiting: Maturity indices, Harvesting, Yield.
26. 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.
27. Rambutan: Economic Importance, Nutritive value, Origin & Distribution, Area & Production, Exotic varieties, Propagation, Planting density, Nutrient Management, Flowering, Harvesting and Yield
28. Avocado: Economic Importance, Nutritive 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.
29. Passion fruit: Economic Importance, Nutritive value, Origin & Distribution, Area & Production; Species & Types; (Purple, Golden yellow, Hybrid (Kaveri), Noel's special), Varieties and hybrids; Production Technology; Climate & Soil requirements; Propagation, Planting methods and training, method of irrigation, nutrient management, Intercultural operations, weed management and Flowering Fruiting, fruit set, Harvesting indices and Harvesting, Yield, Handling, Grading, Packing, Transport.

30,31,32: Bael, carambola, mangosteen, bilimbi, rose apple and loquat: Economic Importance, Nutritive value, Origin & Distribution, Area Production; Important Species & Cultivars, Production technology, Harvesting.

Practicals:

1. Description and identification of varieties of Mango and Banana based on leaf, 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, Jackfruit, 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, rose apple, Bael, Carissa, Fig, Phalsa
7. Training and Pruning of Grapes
8. Training and Pruning of Mango, Guava and Citrus.
9. Visit to commercial orchards diagnosis of maladies (Nutrient deficiencies, Pest & Diseases, Physiological disorders, etc.)
10. Pre-treatment of Banana suckers and de-suckering in Banana. Study of sex forms in Papaya.
11. Use of plastics in fruit production viz., in propagation, mulching, irrigation, packaging, storage etc.
12. Manure & Fertilizer application including Bio-fertilizers in different fruit crops (Methods of application, calculation of the required Manure & Fertilizers based on the nutrient content)
13. Seed production in Papaya, latex extraction and preparation of crude papain
14. Visit to fruit market to observe marketing, packaging and handling of fruits and losses occurring
15. Ripening of fruits, grading & Packaging and production economics for tropical and sub-tropical fruits
16. Visit to cold storage unit.

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FRSC 1.1.3 Plant Propagation and Nursery Management 2(1+1)

Theory:

1. Propagation-Definition- Need for propagation-Potentialities for plant multiplication-Methods of Propagation of Horticultural crops.
2. Sexual method of propagation-advantages and disadvantages –Seed germination-types of seed germination-stages of seed germination with examples-Factors affecting seed germination-internal and external.
3. Seed dormancy –Types of seed dormancy-Phases of dormancy - means to break seed dormancy (Stratification and Scarification, Seed priming etc.,- –use of growth regulators and chemicals to overcome the seed dormancy
4. Nursery Establishment-Components of a nursery- i) progeny block ii) mother plant block iii) Rootstock iv) Seed beds v) Nursery beds vi) Pot yard vii) Packing yard viii) Office building and store- Selection of mother plant –Establishment of progeny orchard/mother plant block-. Nursery techniques-clipping, cutting, defoliation, deshooting, wintering etc.,-Nursery management- nursery tools and implements- Lay out of Model nursery
5. Asexual method of propagation-advantages and disadvantages- A)apomixes-types of apomixes-a)Recurrent b) Non recurrent, c) Vegetative B) poly embryony -- Chimeras – Types of chimeras- bud sports- uses
6. Propagation structures- Mist chamber, humidifier, greenhouses, glasshouses, poly houses, plastic tunnels cold frames, hot beds, Bottom heat box, plastic tunnels, Net house and phytotrons.
7. Vegetative propagation-advantages and disadvantages- methods and Techniques-Propagation through specialized organs- by division -Corm, Rhizome, bulbs, tubers- by separation–Runners, Stolons, Sucker, pseudo bulbs, bulbils, offsets, cloves, slips, crowns, tuberacles.
8. Propagation by cutting – A) Stem cutting-i) Hardwood cutting-simple cutting, Mallet cutting, limb cutting, Heel cutting ii) Semi hardwood cutting iii) Soft wood cutting, iv) Herbaceous cutting B) Leaf cutting i) Leaf bud cutting ii) leaf section cuttings iii) leaf slashing C) Root cutting- Factors influencing rooting of cuttings; means to enhance the rooting of cuttings – use of growth regulators in rooting of cuttings.
9. Propagation by layering – types of layering- A) Ground layering-i) simple layering ii) Tip layering, iii) Compound layering iv)Trench layering v)Mound layering B) Air layering- C) Herbaceous layering- establishment of layers in the field; physiological and biochemical basis for rooting in cutting and layering
10. Graftage –principles, advantages and disadvantages, general requirements for successful grafting -Methods of grafting – A) Approach method of grafting B) Detached method of grafting-i) Veneer grafting ii) Whip grafting iii) Splice grafting iv) Tongue grafting v) Wedge grafting vi) Saddle grafting vii) Bridge grafting -Special techniques of grafting-Soft wood grafting, Epicotyl grafting, Herbaceous grafting, green wood grafting, root grafting, crown grafting, cutting-graft-top working, double working.
11. Selection and maintenance of mother trees-pre curing of scion- collection of scion wood sticks- Stock and scion relationship- their influences- Characteristics of a good root stock-Important Rootstocks for Tropical , Subtropical and Temperate Fruit crops
12. Formation of graft union- factors affecting healing of graftage- Anatomical studies of graft unions -Graft incompatibility (Localised and translocated) — means for graft success-opacity and grafting

13. Methods of budding – 'T-budding, Inverted T-Budding, I- budding, Patch budding, Chip budding, Ring bidding, Flute budding, Forket budding, skin budding, Top budding-Anatomical studies of bud union
14. Micro propagation – Choice of explant (Totepotency)- Micrografting-meristem culture, callus culture, anther culture-Organogenesis – Somaclonal Variation-Hardening of plants in nurseries.
15. Bud wood certification and nursery registration Act- Licencing requirements of a nursery, Inspection of a nursery & nursery stock certification
16. Insect/Pest Disease control in nursery- common insect pests and diseases in nursery plants and their management- soil treatment, seed treatment etc.,

Practicals:

1. Media for propagation-Study of various propagation media for nursery beds and pots-criteria for selecting media.
2. Preparation of nursery beds and sowing- Preparation of raised and flat nursery beds - Use of different types of nursery tools and implements for general nursery- Seed treatments for breaking dormancy and inducing vigorous seedling growth.
3. Raising of root stocks of different fruit plants – Seedling rootstocks and Clonal rootstocks- Use of virus tested plant material in the nursery.
4. Hardening of plants in the nursery- different methods like reducing irrigation, shade, exposure for short periods to sun etc.-Use of mist chamber in propagation and hardening of plants
5. Propagation by cutting— practicing of different propagation methods by cutting.
6. Propagation by layering-practicing of different propagation methods by layering.
7. Propagation by grafting - practicing of different propagation methods by grafting
8. Propagation by budding - practicing of different propagation methods by budding
9. Preparation of plant growth regulators for seed germination and vegetative propagation – hormonal powders, Hormonal solutions, Hormonal pastes, - precautions-methods of applications
10. Preparation of plant material for potting and repotting.
11. Visit to tissue culture / biotechnology laboratories- Media preparation, autoclaving, sterilization procedures
12. Propagation structures-Cost of establishment of a mist chamber, green house, glass house, Poly house and their maintenance
13. Visit to a commercial nursery in the locality – Layout of commercial nursery, Maintenance of nursery records.
14. Application of nutrients and plant protection chemicals in the nursery- preparation of starter solution, application of manures, fertilizers, liquid fertilizers- foliar sprays, drenching, dusting, granule application of chemicals
15. Digging, labelling, packing of nursery fruit plants
16. Final Practical Exam

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FRSC-2.1.1 Temperate Fruit Crops 2(1+1)

Theory:

1 Definition of temperate region, climatic conditions of temperate zone, Classification of temperate fruits.

2 Apple: Introduction, origin, and distribution, composition and uses, area, production, varieties, climate and soil requirements, root stocks (Dwarf, Semi-dwarf, Vigorous root stocks, M-Series and MM- Series root stocks), Propagation, planting methods, Training & Pruning methods of Apple.

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

9 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.

10 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.

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

12 Strawberry: Introduction, origin, and distribution, varieties, composition and uses, Ploidy series, climate and soil requirements, Vegetative propagation, rising of runners

13 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

14 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.

15 Introduction, origin, and distribution, composition and brief production technology 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 of minor temperate fruit and nut crops viz., cherry, walnut, persimmon and kiwi

16 Introduction, origin, and distribution, composition and brief production technology 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 and 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 of minor temperate nut crops viz., queens land nut(Macadamia nut), pecan nut, hazel nut and chest nut.

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
16. Physiological disorders of Apple.

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FRSC-3.1.1 Dry land Horticulture 2 (1+1)

Theory:

1. Dry land horticulture definition, importance and limitation of dry land horticulture, present status and future scope.
2. Watershed development, soil and water conservation techniques and management of dry land horticulture crops.
3. Methods of control and impounding of run-off water, water farm ponds, trenches, macro catch pits in dry land horticulture
4. In-situ water harvesting methods, micro catchment, different types of tree basins, use of shelter belts, anti-transpirants, growth regulators in dry land horticulture.
5. Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – varieties suitable for dry land system – spacing and planting patterns in for rainfed areas- in situ grafting and budding techniques followed in ber
6. Alternative land use systems – mulching - soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – regulation of cropping – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production in ber.
7. Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – varieties suitable for dry land system – spacing and planting patterns in for rainfed areas- in situ grafting and budding techniques followed in pomegranate
8. Mulching - soil and moisture conservation methods – Alternative land use systems – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – regulation of cropping – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production in pomegranate.
9. Aonla Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – varieties suitable for dry land system – spacing and planting patterns in for rainfed areas- in situ grafting and budding techniques
10. Soil and moisture conservation methods – Alternative land use systems –chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – regulation of cropping – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production in Aonla
11. Fig Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – varieties suitable for dry land system – spacing and planting patterns in for rainfed areas- in situ grafting and budding techniques- top working and rejuvenation
12. Manuring and fertilizers, flowering, regulation of cropping, pollination and fruit set, maturity indices, harvesting, post harvest handling and storage of Fig.
13. Datepalm Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – varieties suitable for dry land system – spacing and planting patterns in for rainfed areas- in situ grafting and budding techniques

14. Management of nutrients, water, weeds and problem soils Flowering, induction of early flowering, use of growth regulators in flowering, pre harvest drop, blossom and fruit thinning post harvest handling – economics of production
15. Annona, Jamun, Wood apple, Bael Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties -cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns in for rainfed areas- in situ grafting and budding techniques.
16. Carissa, Phalsa, West Indian cherry and tamarind : Management of nutrients, water, weeds and problem soils Flowering, induction of early flowering, use of growth regulators in flowering, pre harvest drop, blossom and fruit thinning post harvest handling – economics of production.

Practicals:

1. Study of rainfall pattern and distribution of rain in dry land area
2. Study of contour bunding/ Trenching and micro catchment areas in dry land horticulture
3. Study on soil erosion and its control
4. Study on moisture conservation methods followed in dry land horticulture
5. Special techniques of planting and after care in dry landhorticulture
6. Water use efficiency- need based irrigation and micro system of irrigation
7. Description and identification of varieties of Ber
8. Study on morphological and anatomical features of drought tolerant varieties and canopy management in ber
9. Description and identification of varieties of Aonla
10. Canopy management and study on morphological and anatomical features of drought tolerant varieties in aonla
11. Visit to micro catchment and water shed area
12. Canopy management and study on morphological and anatomical features of drought tolerant varieties in Pomegranate
13. Canopy management and study on morphological and anatomical features of drought tolerant varieties in Custard apple
14. Canopy management and study on morphological and anatomical features of drought tolerant varieties in Fig, Jamun, Wood apple
15. Canopy management and study on morphological and anatomical features of drought tolerant varieties in Datepalm, Bael, Carissa.
16. Canopy management and study on morphological and anatomical features of drought tolerant varieties in West Indian cherry and tamarind.

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FRSC 3.1.2 Orchard and Estate Management 2 (1+1)

Theory :

1. Definition of Orchard and Estate Management. Objectives and Importance, Merits and Demerits.
2. Clean cultivation by ploughing- Application of weedicides- mud plastering- merits and Demerits- Sod culture- characteristics of ideal sod- Methods of growing- Types of sod culture- Sod culture method- sod pasture method- Sod mulch method- temporary sod- merits and demerits
3. Weed management in orchards- Cultural methods- Biological methods- Chemical methods- Guidelines for using herbicides in orchards- Herbicides used for weed control in the orchards
4. Mulching in orchards- Definition of mulch and mulching- Objectives of mulching – Types of mulches-Organic mulches- garden compost- Peat- leaves and leaf mould- Straw and Hay – Saw dust and wood chopping- husk – flax- Hop waste- pine needles-news paper and card board- Inorganic mulches- Plastic mulches- clear and black plastic – Coloured plastic mulches- Dust mulches- Grave- stones- sand- merits and demerits of mulching
5. Cropping systems- Tropical and subtropical horticultural systems- Mono cropping- multicropping- inter cropping- Factors determining choice of intercrop- Mixedcropping- ratoon cropping- Multistorey or multitier cropping- Temperate horticultural systems- Medium High density planting- optimum high density planting viz., Tatura trellis- pyramid system- Cordon system- Curtain system- Hedge row system- Hedge row system- Ultra high density planting viz., - meadow orchard- mechanized system – Intersive system
6. Plant interaction- types of interactions in cropping systems- competitive interactions- above ground and below- Complimentary interactions- Annidation in space and time- allelopathy – types. Biological efficiency of cropping systems- Crop Equivalent yield- land equivalent ratio- Cropping intensity index
7. Systems of irrigation- Surface systems- flooding- check or bed method- furrow method- border method- basin method- ring method- Drip (surface) method- pitcher method- pipe method- Soil sloping method- Merits and Demerits
8. Sub surface sytems – straight trench methods- cross trench method- Circular trench method- Perforated pipeline method- Trench drip method- Buried drip method-merits and demerits- over head system- Sprinkler system of irrigation- Merits and demerits
9. Soil management in relation to Soil organisms- ploughing and tillage – continuous cultivation- crop rotation- Irrigation- liming- gypsum- fertilizers and manures- oil cakes- Soil aggregation- Soil Management in relation to water uptake – Soil water – factors influencing infiltration- Soil properties- Continuous cultivation- Tillage- inter cultivation- Soil management of Soil environment- Soil environment- Soil temperature and plant growth- Soil temperature.
10. Integrated Nutrient Management (INM)- Concept – Need for INM- Components of INM- Soil Source- Mineral fertilizer- Organic sources- Biological sources- Merits of INM- Nutrient management in orchards- Factors effecting fertilizer use- Soil – Crop- Climate- Economic factor- Time of application- Root distribution and nutrition- Frequency of application- Method of application of fertilizers in orchard- surface application- Trench application- punch bar method- Feeding needles- foliar application- Fertigation- tree injection
11. Integrated Pest management

12. & 13 Polllination- and fruit set problems- Pollination- self and cross pollination- Definitions of fruit setting- Fruitfull ness- fertility- Soil fertility-0 Self sterile- cross unfruitful- pollinator- polliniser- causes of unfruitfulness- internal factors- evolutionary tendencies- Structural peculiarities- Dichogamy- impotency from abortive flowers- impotency of pollen- genetic influences- Sterility or unfruitfulness due to hybridity- Incompatibility- physiological influences- slow pollen tube growth- premature or delayed pollination- nutritive condition of plant- External factors- nutrient supply- Pruning and grafting- Locality season- Temperature – pests and diseases- Age and vigour of plant- Distributed water relations- rain- wind- spraying
14. Utilisation of resource constraints in existing system- soil- water and land resources
15. Crop regulations in relation to cropping systems
16. Crop models

Practicals:

1. Lay out of different systems of Orchard soil management
2. Study of clean cultivation
3. Study of intercropping systems in orchards
4. Study of cover cropping with suitable examples
5. Study of mixed cropping with suitable examples
6. Study of filler crops in orchards, characteristics of a filler plant
7. Study of use of organic and inorganic mulches
8. Study of moisture conservation methods

9 &10 Use of different weedicides in orchards

11&12. Layout of basin and ring system of irrigation

13&14. Lay out of drip irrigation

15. Lay out of Sprinkler irrigation
16. Visit to local orchards

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DEPARTMENT OF VEGETABLE SCIENCE

VGSC 1.2.1 Tropical and Subtropical Vegetables 3(2+1)

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.
6. Production Technology: Soil and Climate – Method of raising the crop Nursery Vs Direct Sowing, Seed Rate Nursery techniques – Main field preparation – Basal Application of Nutrients – Transplanting, Spacing – Irrigation – Nutrition – Fertilizers Schedule, Major Nutrients, Minor Nutrients, Deficiency of Nutrients.
7. Inter cultivation – Weed Control Mulching. Effect of Chemicals & Growth Substances on various growth and Yield Parameters, stages of maturity, Harvesting and Yield – Grading (4Grades-Super A, Super, Fancy & Commercial) – Post Harvest Handling and Storage.
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.
12. Effect of Growth Substances on Fruit set, Harvest Indices –Colour, Glossy Appearance, Calyx and Stem Ends; Yield, Grading and storage and Economics.
13. 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.
14. 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.
15. 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.
16. Okra (Botanical Name): Introduction, Origin, Area and Production, nutritional composition and uses-Distribution and Export Potential of Okra-cultivars and hybrids.

17. 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.
18. Cucurbits: Introduction, Area and Production, Origin and distribution, composition and uses, characteristics of cucurbitaceous family-list of cultivated cucurbits (Botanical Names & common names) Bitter Principle-Flowering, Sex mechanisms sex expression-use of Plant Growth Regulators for Sex modification.
19. Cucurbits: Cultivation details of Cucumber, Pumpkin and squashes –production technology –soil and climate-cultivars-propagation and planting methods –seed rate, spacing, irrigation, nutrient management – inter culture–Weed control, Mulching, plant growth regulators – maturity indices –harvesting and yield.
20. Cucurbits: Cultivation details of gourds- Production technology – soil and climate – cultivars – propagation and planting methods – seed rate, spacing, irrigation, nutrient management – Inter culture – Weed Control, Mulching, plant growth regulators – maturity indices – harvesting and yield.
21. Cucurbits: Cultivation details of melons- Production technology – soil and climate – cultivars – propagation and planting methods – seed rate, spacing, irrigation, nutrient management – Inter culture – Weed Control, Mulching, plant growth regulators – maturity indices – harvesting and yield – Production of seedless watermelons.
22. Cucurbits: Cultivation details of Coccinia & Chowchow- Production technology – soil and climate – cultivars – propagation and planting methods –spacing, irrigation, nutrient management – Inter culture – Weed Control, Mulching, plant growth regulators – maturity indices – harvesting and yield.
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 Amaranthus: Introduction, Origin, Area, Nutritive value –cultivars-soil & climate land preparation, sowing seed rate, spacing, irrigation and nutrition – methods of harvesting and yield.
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. 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.
31. Drumstick / Moringa (Botanical Name) : Introduction, Origin, Composition of Pods, Leaves and uses of Moringa-cultivars.
32. Production technology: 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.
9. Identification and description of Okra and Legume vegetables.
10. Plant growth regulators in vegetable production.
11. Identification and description of varieties of cucurbits.
12. Harvesting indices and maturity standards in tropical vegetables.
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. Final practical examination

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VGSC-2.2.1 Temperate Vegetables, Potato and Tuber Crops 3(2+1)

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.
3. **Production Technology**: - Nursery techniques – Seed Rate and nursery sowing. Main field preparation – Transplanting, Spacing, - Irrigation – Nutrition – Inter cultivation – Stage of maturity – method of harvesting and Yield – Post Harvest Handling and Storage- Physical disorders.
4. **Cauliflower** (Botanical Name): Introduction, Origin, Area and Production, nutritional value – Distribution and Export potential – Cultivars- types and classification – Soil and climate- Seed Rate and nursery sowing – Transplanting, Spacing and Irrigation- Nutrition – Deficiency symptoms of Nutrients.
5. Inter cultivation and blanching- Stage of maturity, Harvesting and Yield – post Harvest Handling and Storage- Physiological disorders and their control.
6. **Brussels Sprouts**(Botanical Name): Introduction, Origin, Area and Production, nutritional composition and Uses – Cultivars – Production Technology – Soil and climate – Seed Rate and sowing – Transplanting, Spacing, - Irrigation – Nutrient management – Inter cultivation – Harvesting and Yield – Post Harvest Handling and Storage.
7. **Sprouting Broccoli** (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.
8. **Knol – Khol** (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.
9. **Chinese Cabbage** (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.
10. **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.
11. **Production Technology**: Propagation and planting methods – seed Rate and sowing. Main field preparation – Transplanting, Spacing, - Irrigation - Nutrition – Deficiency symptoms of nutrients – Inter cultivation – stage of maturity, Harvesting, curing and Yield – Post Harvest Handling and Storage – Physiological disorders.
12. **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.
13. **Salad crops**:

Lettuce & Celery (Botanical Name) : Introduction, Origin, importance and nutritional value – Cultivars – types of lettuce – Production Technology – Soil and climate – seed rate, sowing/ planting – spacing, Irrigation – Nutrition – Inter cultivation – Harvesting and Yield – Post Harvest Handling and Storage.

14. **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)
15. **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.
16. **Beet root** (Botanical Name): Introduction, Origin, Area, Production and productivity – nutritional value – pigmentation – Cultivars – Classification based on root shape- Production Technology – soil and climate – seed rate, sowing and spacing, - Irrigation, - Irrigation – Nutrition – Inter culture – Harvesting and Yield – Post Harvest Handling and Storage.
17. **Turnip**(Botanical Name): Introduction, Origin, Area, Production and productivity – nutritional value – pungency and pigmentation – Cultivars – Asiatic and European types – production Technology – Soil and climate – seed rate, sowing and spacing, - Irrigation – Nutrition – technology- Soil and climate – seed rate, sowing and spacing, - Irrigation – Nutrition – Inter culture – Harvesting and yield – Post Harvest Handling and Storage.
18. **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.
19. **Production Technology** – Soil and climate – seed rate, methods of sowing and spacing, - Irrigation – Nutrition – Inter culture – use of plant growth regulators – maturity indices (tenderness) – Harvesting and Yield – Post harvest handling and Storage.
20. **Broad bean** (Botanical Name): Introduction, Origin, Area, Production and productivity – nutritional value – Cultivars – Production Technology – Soil and climate – seed rate, sowing and spacing, Irrigation – Nutrition – Inter culture- Harvesting and Yield – Post Harvest Handling and Storage.
21. **Temperate Leafy vegetables**: Palak/Spinach beet (Botanical Name) : Introduction, Origin, nutritional value- botany and cultivars – differentiation with spinach – Production Technology – Soil and climate – seed rate, sowing and spacing – Irrigation – Nutrition – Inter culture- Harvesting, yield and storage.
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.
25. **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.
26. Harvesting, curing and Yield – Post Harvest Handling and Storage- Physiological disorders- Production of certified seed – Suggestions to produce healthy seed in Indian plains.
27. **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
28. **Tapioca/Cassava**(Botanical Name): Introduction, origin, area and production – nutritional value and toxic principle – Cultivars – production Technology – Soil and climate – Propagation and planting material – seed rate and spacing, -Irrigation – Nutrition – Inter culture – Harvesting, Yield and storage.
29. **Yams**(Botanical Name): Introduction, Origin, area and production – nutritional value and uses – alkaloids – types of Yams – Cultivars – Production Technology – Soil and climate – propagation and planting material – seed rate and spacing, Irrigation – Nutrient management – Inter culture (training of vines – Harvesting, Yield and storage.
30. **Elephant foot Yam** (Amorphopallus) (Botanical Name): Introduction, Origin, area and production – nutritional value – acridity principle – Cultivars – production Technology – Soil and climate – propagation and planting material – seed rate and spacing, - Irrigation – Nutrition – Inter culture – Harvesting, curing, yield and storage.
31. **Colocasia/ Taro** (Botanical Name): Introduction, Origin, area and production nutritional value – acridity principle – Cultivars – Production Technology – Soil and climate- propagation and planting material – seed rate and spacing, - Irrigation- Nutrition – Inter culture – Harvesting, curing, yield and storage.
32. **Arrow root** (Botanical Name): Introduction, Origin and importance – nutritional value – Cultivars – Production Technology – Soil and climate – propagation and planting material – seed rate and spacing, - Irrigation – Nutrition – Inter culture – Harvesting, yield and storage.

Practicals:

1. Preparation of nursery beds and raising of nurseries for temperate vegetables.
2. Identification and Description of cabbage and cauliflower varieties
3. Identification and description of Knol- Khol, Sprouting broccoli and Brussels Sprouts varieties.
4. Hardening and transplanting of nursery raised temperate vegetables.
5. Identification and Description of Root crops Varieties
6. Visit to farmer's field.
7. Identification and Description of Potato varieties
8. Identification and Description of pea varieties and Bulb crops.
9. Visit to vegetable research station.
10. Identification and Description of Tuber crops varieties.
11. Harvesting and curing techniques for potato and other tuber crops.
12. Identification of nutrient deficiencies and physiological disorders in temperate vegetable crops.
13. Study of harvest indices and maturity standards for temperate vegetables and tuber crops.

14. Post harvest handling and storage practices for important temperate vegetables and tuber crops.
15. Visit to vegetable markets for study of marketing problems of vegetables.

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VGSC 3.2.1. Precision Farming & Protected Cultivation 3 (2+1)

Theory

Unit I
Precision farming – laser leveling, mechanized direct seed sowing; seedling and sapling transplanting, mapping of soils and plant attributes, site specific input application, weed management, insect pests and disease management, yield mapping in horticultural crops.

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

Unit III
Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying.

Unit IV
Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies.

Unit V
Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics.

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Jitendra Singh, S.K. Jain, L.K. Dashora, B.S. Cundawat.2013. Precision forming in Horticulture. New India Publishing Agency, New Delhi.
T. Pradeep Kumar, B. Suma, Jyothi Bhaskar and K.N.Satheson. 2008. Management of Horticultural crops. New India Publishing Agency, New Delhi.
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Pant V Nelson. 1991. Green House Operation and Management. Bali Publication

VGSC: 3.2.1 Precision Farming& Protected Cultivation 3 (2+1)

Theory :

1&2 Precision farming -Definition, scope, concept and components of precision farming. Terminology: Global Positioning System (GPS), Geographic Information System (GIS), Computer software model, Remote sensing for aerial/satellite imagery, Site Specific Management (SSM), Robotics, Comparative yield, quality and farm profits under SSM practices Vs Uniform Rate Technology (URT) practices.

3. Precision farming techniques – Laser guided land leveling, Importance, Applications
4. Precision farming techniques- Precision seed drills, Mechanized: direct seed sowing; Nursery raising in portrays. Seedling and sapling transplanting, Permanent bed planting.

5&6 Site specific input application: Preparation of soil fertility maps. Grid based soil sampling.

7&8. Site specific input application- VRTs for fertilizer application, weed management, insect pests and disease management. GIS in pest and disease management.

9&10 Yield mapping- Importance-Yield mapping in important vegetable crops.

11&12 Protected cultivation: importance and scope. Current status of protected cultivation in India. Problems / constraints of greenhouse cultivation and future strategies

13&14 Classification of protected structures- green house, poly house, net house, poly tunnels, and screen house, rain shelters, protected nursery house, Vegetable grafting sheds

15&16 Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying.

17&18 Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes.

19&20 Green house equipment, materials of construction for traditional and low cost green houses.

21&22 Soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization.

23 Soil less culture-Advantages, Disadvantages. Types of growing media, in peat moss and mixtures, rock wool and other inert media,

24. NFT, Hydroponics and aeroponics.
25. Irrigation and fertigation systems used in green houses.
26. Choice of selection of crops for green house cultivation (Tomato, Capsicum, Cucumber).
27. Training and pruning methods in green houses
28. Hi-tech protected cultivation, plant protection and postharvest handling techniques for Tomato.
29. Hi-tech protected cultivation, plant protection and postharvest handling techniques for Capsicum,
30. Hi-tech protected cultivation, plant protection and postharvest handling techniques for Cucumber

31&32 Economics of precision farming and protected cultivation

Practical :

1. Study of different types of greenhouses based on shape, construction and cladding materials
2. Calculation of air rate exchange in an active summer winter cooling system
3. Calculation of rate of air exchange in an active winter cooling system
4. Estimation of drying rate of agricultural products inside green house
5. Soil sampling and testing to study its suitability for growing crops in greenhouses

6. Practicing soil fumigation in greenhouses for cultivation of crops
7. Water sampling and testing the quality of water to study its suitability for growing crops in greenhouses
8. The study of fertigation requirements for greenhouse crops
9. The study on estimation of E.C. in the fertigation solution
10. The study of various growing media used in raising of greenhouse crops
11. The preparation of growing media for raising greenhouse crops
12. Pasteurization / sterilization of growing media
13. The study on pro-trays based nursery raising
14. Visit to commercial green houses
15. Visit to Hi tech nursery
16. Study the Economics of protected cultivation

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DEPARTMENT OF FLORICULTURE AND LANDSCAPE ARCHITECTURE

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

Practicals :

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
14. Identification and description of indoor plants, Interior plant-scaping
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.

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FCLS-2.3.1 Commercial Floriculture 3(2+1)

Theory:

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
31. Post harvest technology of cut flowers – causes for deterioration of cut flower quality – Food depletion – Bacterial and fungal infections – Maturation and ageing – Wilting – Bruising – Temperature – Ethylene – Water – Factors affecting cut flower longevity – Handling – Harvest stage – Grading and Bunching – Packaging – Pre – cooling – Storage – Floral preservatives viz., (Pulsing solution – Bud opening solution – Vase solution – Conditioning) – Sanitation.
32. Dehydration technique for drying of flowers – Importance – Pot – pourri – Dehydration methods – Air drying – Embedding and drying – viz., room drying – Sun drying – hot air oven – vacuum drying – microwave drying – Embedding individual flower – embedding individual flower with stem – Embedding branch with flowers – Press drying (simple method, herbarium method).

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
6. Layering methods for Jasmine propagation
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.

16. Drying / Dehydration techniques for flower drying.

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FCLS – 2.3.2 Ornamental Horticulture 3(2+1)

Theory:

1. Definition of Ornamental Horticulture – Importance of Ornamental Horticulture (gardening) – History of gardening – During Aryan Civilization (Epic Era) – Budha Period – Emperor Ashoka period – Gupta period – Mughal Period – British Period – Post Independence Period.
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.
3. Definition of land scape and land scaping – Historical back ground of land scaping – Principles of land scape gardening – Initial approach – Axis – Focal Point – Mass effect – Unity – Space – Divisional Lines – Proportion and Scale – Texture – Time and Light – Tone and Colour – Mobility – Rhythm – Balance – Contract – Harmony – Vista – Style.
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.
6. Garden adornments via., – Garden Seats – Ornamental tubs, urns and Vases – Bird baths – Sun dials – Floral Clocks – Japanese Lanterns – Ornamental Stones – Fountains – statues – Towers – Wells – Plants Containers – Plant Strands.
7. Types of garden – Formal – Informal – Wild Garden – Styles of garden in the world – Mughal Garden – Site and design – Walls and gates – Terrace – Running water – Baradari – Trees and Flowers.

8&9 Features of English – Italian – French – Persian Gardens – Japanese Garden – Types of Japanese Garden – Hill – Flat – Tea – Passage – Sand Gardens – Features of Japanese Garden – Ponds – Streams – Water falls – Fountains – Islands – Bridges – Water Basins – Stone Lanterns – Stones – Pagodas – Fences and Gates – Vegetation (Ever green, Deciduous and Flowering plants)

10&11 Famous Gardens of India –Lal bagh (Bangalore) – Brindavan Garden (Mysore) – Government Botanic Gardens (Ootacamud) Mughal garden (Pinjore) – Chandigarh Rose garden.

12 Specialized gardens – Herb garden – Bog Garden – Sunken garden – Topiary Garden – Kitchen garden – Paved garden – Moon Garden – Gardening in hanging baskets – Window garden – Miniature garden – Mini Zoo – Importance of Green house – Conservatory – Lath house – Fernery in ornamental horticulture.

13 Rock Garden – Types of rock Garden – Selection of site – Construction of the Rockery – Planting – Management of the Rockery – Plants for rock garden – Examples of Cacti and succulents, ferns, shrubs, herbaceous plants, bulbs, flowering annuals.

14 Water garden – Informal pool – Formal Pool – Construction – Planting methods – Filling the pool (water course and falls) – Care of the water garden – Plants for water garden – Surface flowering acquatics – Oxygenators – Floaters – Marginals.

15&16 Roof garden – Need for roof garden – Limitations – Types of roof garden (Private or cooperative) – Planning – Suitability of the roof – Drainage and water proofing – Making of flower beds, pots and containers – Gardening – Concept – Soil Media – Planting – Planting materials Examples – Flowering annuals – Herbaceous perennials – Shrubs – Trees – Creepers – Bulbs – water plants – Maintenance of plants.

17 Lawn – Selection of Grass – Bermuda grass – Korean grass – Poa grass – Fescue grass – Kentucky blue grass - Grasses for shady areas – Site Selection – Soil – Preparation of soil – drainage – digging – manuring and grading – Methods of planting – Sowing of Seeds – Dibbling – Turfing – turf plastering – Bricking – Planting on Polythene – Maintenance of lawn – Mowling – Rolling – Sweeping – Scraping – Raking – Weeding – Irrigation – Top dressing with compost and fertilizers – Diseases and other problems – Fairy ring – Pale Yellow Laws.

18 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 factor s- 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.

19 Shrubs – Definition – Utility (aesthetic values) – Classificaiton with suitable examples – based on Purpose of growing – Flowering – Foliage – Flowering and foliage – Fragrant shrubs – based on sunlight requirement – shrubs requiring full sunlight – semi shade – intermediate group (semi shade and sun – shrubs – Planting of Shrubs in garden – Specimen shrub – Standard shrub – Shrubbery border – Arrangement of shrubs – According to height and colour – Growing of shrubs – Soil – Climate – Preparation of soil – Planting – Propagation – seeds – Cuttings – layering – After care – Irrigation – weeding – Pruning.

20 Herbaceous perennials – Definition – Introduction – Classification with suitable examples – Herbaceous perennials for plains and for hills – Planting – Manuring – Propagation.

21 Climbers – Definition – Climbers – twiners – ramblers – creepers – Utility (aesthetic values) – Classification with suitable examples – Sunny situation – Partial shade – shade loving

climbers – Showy flowering climbers – Climbers with scented flowers – Climbers with attractive foliage – Climbers for pots – Annual climbers – Climbers for hedge making – Classification based on vegetative growth – Heavy climbers – Light climbers – Soil – Digging of pits – Planting of climbers – After care – Manuring – Maintenance.

22 Palms – Definition – Introduction – Utility (aesthetic values) – Classification with examples – Feather leaved Palm – Fan leaved Palm – Propagation – Pot culture – Potting – Re-potting - Potting media – Manuring – Aftercare.

23 Ferns – Introduction – Utility (aesthetic values) – Propagation – Spore – Division of Clumps – Suckers – bulbils – Site of growing – Soil media – Pot culture – re-potting – Irrigation – Indoor culture – Important Examples.

Selaginellas – Introduction – Propagation – Cultural hints – Important Examples.

Ornamental grasses, Bamboos and reeds – Introduction – Propagation – Soil and climatic requirements – Site of growing – Planting – Important Examples.

24 Cacti – Introduction – Characteristics of Cactaceae – Classification – Pereskieae – Opuntieae – Cereae (8tribes) with Examples – Site of growing – Natural habitat – Domestication (Housing of cacti) – Propagation – Seeds – Offsets – Grafting – Soil – Climate – Containers – Time and method of planting – Potting – Re-potting – Irrigation – Staking.

25 Succulents – Characteristics – Difference between cacti and succulents – Utility (aesthetic values) – Climate – Soil – Housing – Propagation – Seeds – Cuttings – Watering – Re-potting – Summer protection

26 Bio-aesthetic Planning – Definition – Aim and Concept – Need for Bio-aesthetic planning – Air pollution – Human welfare.

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.

27 Land scaping – cities and towns – Road side plantation – Planting trees in colonies – Land scaping City parks – Large – medium – small parks – pleasure grounds – Examples of ornamental shade and flowering trees for town roads.

28 Floral Ornaments – Garlands – Floral crowns – Hair decoration – Rangoli – Floral Bouquets – Button holes – Floral arrangement – Western style – Principles of Design viz., – Emphasis – Balance – Proportion – Rhythm – Harmony – Unity – Elements of Design viz., – Line – Form – Texture – Colour

29 Selection of flowers and foliage – Line flowers – Form flowers – Mass flowers – Filler flower – Materials required – Design rules – Types of floral arrangement – Circular – Triangular – Radiating – Crescent – Horizontal Hogarthian curve – Conditioning – Reconditioning of flowers.

30 Japanese floral arrangement – Ikebana – Moribana – Nageire – Jiyu-bana-Zen'ei-ka – Zen'ei-bana-Morimono – Materials required – General rules – for Moribana and Nageire styles of arrangement – Basic styles of Moribana and Nageire – Basic upright and Basic slanting arrangements.

31&32 Bonsai – Definition – Criteria for selecting plants – Examples – Classification of Bonsai – Upright (formal and informal) – Winding – Winding – Oblique – Gnarled – Semi-cascade-cascade – Clasped to stone – Containers (pots) and Media – Potting and Re-potting – Training – Pruning and Pinching (Shoot, leaf and root) – Watering – manuring – Defoliation – Mame Bonsai.

Practicals:

1. Identification and description of annuals, biennials and herbaceous perennials, indoor plants.
2. Identification of climbers, creepers, foliage and flowering shrubs.
3. Identification of avenue trees, palms and ferns
4. Identification of ornamental grasses, cacti and succulents.
5. Planning, designing and establishment of lawn.
6. Visit to nearby landscape garden layout.
7. Study of planning, designing of gardens.
8. Study of planning, designing of rockery, water garden
9. Study of planning, designing of shade garden, roof garden
10. Study of planning, designing of hedges, edges, carpet bedding.
11. Study and creation of terrariums and vertical garden.
12. Study and practice of making different Flower arrangement and preparation of floral bouquets.
13. Bonsai practicing and training.
14. Visit to nearby gardens, nurseries.
15. Visit to nearby recreational and children's corner.
16. Practical examination.

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DEPARTMENT OF SPICES AND PLANTATION, MEDICINAL AND AROMATIC CROPS

SPMA-2.4.1 Spices and condiments 3(2+1)

Theory:

1. History, scope and importance, present status, area and production, uses, export potential and role in Indian economy.
2. Classification of spices- Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavor, plant part used, active principle.
3. Role of spice board and export promotion council, institutions and research centers working on spices and condiments
4. Cardamom – history, scope and importance, area and production, uses, export potential, Botany, varieties, types of cardamom like Malabar, Mysore and Vazuka. Soil and climate, selection of site, propagation , time– vegetative and sexual methods. Advantages and disadvantages.
5. Cardamom – systems of cropping, inter cropping and mixed cropping, planting, shade regulation, nutrient management, irrigation, weeding, intercultural operations : thrashing, mulching, earthing up, raking, harvest indices and yield, post harvest technology.
6. Black Pepper - history, scope and importance, area and production, uses, export potential, Botany, varieties, Soil and climate, selection of site, propagation ,– vegetative and seed.- cuttings, rapid multiplication technique.
7. Black Pepper – establishment of pepper garden planting of standard plants, planting of vines, shade and shade regulation, Training and pruning of pepper vines, nutritional management, irrigation weeding, inter cultural operations, harvesting,
8. Black pepper - post harvest technology, types of pepper white pepper – processing- water steam technique , steam boiling technique. black pepper- drying and curing various forms of black pepper. package and storage, value added products like dehydrated green pepper, freeze dried green pepper, oil, pepper oleo resin, pepper hulls.
9. Betel vine – history, importance, area and production, botany, varieties and species, soil and climate, propagation, planting, standards, training, shade regulation, intercultural operations, plant protection, harvesting , yield, processing.
10. Ginger- Introduction, importance, area and production, uses, export potential, botany, varieties, soil and climate, propagation, preservation of seed rhizome, selection of land and preparation, planting season, seed rate and spacing, methods- bed system, ridge and furrow system, mulching, systems of cultivation- rotations and mixed cropping,
11. Ginger - irrigation, nutrition, weeding, harvesting, yield and post harvest technology- Dry ginger- bleached and un bleached ginger. preserved ginger. storage, value added products like soft drinks, ginger candy, murabba, pickles, ginger wine.
12. Turmeric- Introduction, importance and uses, area and production, botany, varieties, soil and climate, propagation, preservation of seed rhizome, selection of land and preparation. methods of cultivation like bed system, ridge and furrow system of planting, planting season, seed rate, spacing, mulching,
13. Turmeric - irrigation, nutrient management, weeding and intercultural operations, cropping systems like inter cropping, rotations, harvesting- yield.post harvest technology- different methods of cooking.1. Traditional 2. Improved method. packing and storage, value added products like tuemeric powder, oil and oleoresin.
14. Clove- History, scope and 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

15. Nutmeg- History, importance, area and production, uses, Botany, varieties, export value. Propagation – nursery techniques soil and Climate planting, cropping system like mixed cropping manuring, weeding.
16. Nutmeg - constraints like sex determination and improvement in nutmeg cultivation, Harvesting, post harvest technology, Grading and packing, valur added products like oil of the flowers
17. Cinnamon- importance, area and production, uses, Botany, varieties, export potential. Propagation – Seed, cuttings, tree stumps soil and Climate planting, weeding. cinnamon-manuring, Harvesting,
18. Cinnamon- post harvest technology- cutting and peeling, propagation of Quills, drying, Grading – Quills, Quillings, Featherings, Chips, Packaging and storage, Value added products
19. All spice -Introduction, area and production, uses, export value, Soil and climate, propagation like seed and vegetative method- Budding, approach grafting in All spice and seed in curry leaf planting. weeding, manuring, Harvesting, post harvest technology like drying and curing. Value added products – berry oil, leaf oil, oleoresin in All spice, volatile oil.
20. Curry leaf - Introduction, area and production, uses, export value, Soil and climate, propagation like seed and vegetative method- Budding, approach grafting in All spice and seed in curry leaf planting. Weeding, manuring, Harvesting, post harvest technology like drying and curing. Value added products – berry oil, leaf oil, oleoresin in All spice, volatile oil and dehydrated leaves in curry leaf
21. Coriander – History, Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
22. Fenugreek - History, Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
23. Fennel - Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
24. Cumin - Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
25. Dill -Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
26. Celery - Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
27. Bishop’s weed - Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
28. Saffron - History, Importance, Area and production, uses, botany, varieties, soil and climate, propagation, seasons, spacing, irrigation, weeding, intercultural operations, harvesting, yield.

29. Thyme - Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
30. Rosemary- Importance, Area and production, uses, botany, varieties, soil and climate, sowing, seasons, seed rate, spacing, irrigation, weeding, intercultural operations, harvesting, yield, post harvest technology- processing.
31. Vanilla - History, importance, area and production, uses, export value, Botany, varieties, constraints of production, Propagation by cuttings, Soils and Climate, land preparation, staking planting, manuring,
32. Vanilla - 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 essence, vanilla sugar, vanilla oleoresins, Grading, Packing and storage.

Practical :

1. Introduction. identification of spices .visit to instructional farm.
2. Preparation and submission of specimens minimum 30 spices and condiments.
3. Nursery techniques in spice crops
4. Seed treatment, sowing layout and planting methods of spices and condiments.
5. Seed treatment, sowing layout and planting methods of spices and condiments.
6. Inter cultural operations – hoeing, weeding, pruning in spice crops
7. Inter cultural operations – hoeing, weeding, pruning in spice crops
8. Manuring and irrigation, mulching in spice crops.
9. Manuring and irrigation, mulching in spice crops.
10. Harvesting and processing, grading of spice crops
11. Harvesting and processing, grading of spice crops
12. Extraction of essential oils and oleoresins.
13. Extraction of essential oils and oleoresin.
14. Visit to commercial spice gardens
15. Visit to processing units.
16. Semester final Practical examination

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SPMA: 2.4.2 Plantation Crops 2(1+1)

Theory:

1. History and Development, scope and importance, area and production, export and import potential of plantation crops, role in national and state economy.
2. COCONUT-Introduction, origin and distribution- area and production, Botany-Taxonomy- uses, composition and industrial importance -products/ by products, - Soil, Climate- Varieties- 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- micro propagation-Planting systems and methods-Preparation of pits and planting, gap filling-systems of cultivation
3. COCONUT- Soil management-mulching, weed management, water management, Nutrient management-flowering-pollination- nut growth and development -Coconut based cropping system, Inter and multiple cropping, multi storied cropping-Shedding of buttons, immature nuts, production of barren nuts and their control- Deficiency disorders – Crown choke- Harvesting, Post harvest handling and processing- preparation of cup and ball copra, Yield, Marketing and Storage and economics.
4. ARECANUT- Introduction, origin and distribution - area and production, Botany-Taxonomy- uses, composition and industrial importance -products and by products-varieties- Soil and Climate-Propagation- seed and micropropagation- Nursery raising techniques- Selection of mother palms, Seed nut selection, Primary and secondary nurseries – selection of nursery plant material-Establishment of plantation –plating systems and methods Spacing, Season of planting, Plantation management – soil management-mulching, weed management, water management, Nutrient management – cropping systems-Multiple cropping- Intercropping, Mixed cropping, Multi storied cropping-- Flowering, pollination, fruit set, nut growth and development-Harvesting- post harvest handling and processing- Dried ripe nuts, Chali and Kalipak, Scented supari-packaging and marketing- Yield, storage and economics
5. OIL PALM Introduction, origin and distribution -Area and production, Botany and Taxonomy-uses, composition and industrial importance, products/ by products, varieties, propagation-seed propagation and micropropagation, raising of Commercial Nursery – Oil palm growing areas-Soil and Climate –Planting systems and methods, soil management-mulching, weed management, water management, Nutrient management – physiological disorders-Flowering, pollination, fruit set, Fruit growth and development-Harvesting, yield and economics, post harvest handling and Processing – Extraction of oil from Mesocarp and kernel-storage and marketing
6. PALMYRAH Introduction, origin and distribution -Area and production- Botany and Taxonomy-uses, composition and industrial importance- Products/ by-products from palmyrah palm – Neera, Types and Varieties – Male & female palms differentiation, Soil and Climate, Propagation – Raising Nursery- Pre-treatment of seeds in nutrient solution, ethrel and thiourea. Nursery practices – Raising seedlings in situ, in mound nursery bed and in masonary bed- Cultural Practices – leaf pruning- Transplanting-Planting methods, soil management-mulching, weed management, water management, Nutrient management –physiological disorders- Flowering, Pollination, fruit set and Fruit growth and development. Taping, Yield and economics- storage and marketing
7. COCOA Introduction, origin and distribution- Area and production, origin & distribution, Botany and Taxonomy- uses, composition and industrial importance – Cocoa products/ By products – cocoa liquor or cocoa mass, Cocoa powder, Cocoa butter,

chocolate, Types and varieties, Climate, Soil-Propagation – Mother tree selection, Seed and Vegetative propagation, Cuttings, grafting, micropropagation-planting systems and methods-Cocoa under Natural Shade, Cocoa under Artificial Shade, Intercropping-weed management, water management, Nutrient management, types of branching, importance of training and pruning, Flowering, fruit set, Bean growth and development- Harvesting, Yield of pods and post harvest handling- 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- yield of dry beans and economics- Preparation of cocoa to the market- storage.

8. CASHEW NUT Introduction, origin and distribution Area and production, Botany and Taxonomy-by products – uses, composition and industrial importance- Soils and Climate-varieties/ hybrids, Propagation – Vegetative propagation, Epicotyl grafting and Cuttings-micropropagation- Planting methods, Branching Pattern- soil management-mulching, weed management, water management, Nutrient management.
9. CASHEW NUT Training and pruning, Rejuvenation, flowering – Season, type of flowers, pollination, Fruit and Nut development, Fruit drop – control, –physiological disorders -Harvesting, Yield and economics-Post harvest handling and Processing Methods – Karnataka (Manglore) method, Tamilnadu (Panruti) method, Kerala (Quilon) method etc., CNSL extraction, Grading, packing and storage
10. COFFEE Introduction, origin and distribution –Area and Production , Origin and distribution, Botany and Taxonomy, uses, composition and industrial importance- Export, Soil, Climate, types, differences – Arabica/Robusta, branching – climatological differences, Varieties, propagation, Raising nurseries.-Preparation of main field and planting, Cropping Pattern, Type of shades, Provision of shade, Advantages of shade, Disadvantages of shade, shade Trees – their characteristics, Temporary shade and Permanent shade.
11. COFFEE soil management-mulching, weed management, water management, Nutrient management –physiological disorders, Training and pruning – Rejuvenation pruning, Inter cultural practices, Digging, Scuffling or soil stirring, Trenching- Flowering- season of flowering, Fruit set and control of premature fruit drop- Harvest – types of harvest, Processing – Preparation of parchment coffee, Cherry coffee, Types of beans – Elephant bean, Pea berry, Yield, storage- Bean disorders-yield, grading, packing, marketing and economics.
12. TEA Introduction, Origin and Distribution, Area and Production, Botany and Taxonomy-Role of tea industry in Indian economy, Export, uses, composition Soil, Location and Climate, Varieties, Propagation-Vegetative propagation, varieties- Method of planting and bush population, planting season, Mulching, weeding, Shade and its management, Types of Branching,
13. TEA Pruning - Types of pruning – 1. Collar pruning. 2. Medium pruning, 3. Fringe or lung pruning, 4. Skiffing, Rejuvenation pruning, soil management-mulching, weed management, water management, Nutrient management –physiological disorders- Leaf plucking, Yield of leaves, Manufacturing of tea –withering, rolling, fermentation, drying, CTC- Types of Tea- Blended tea, Green Tea, white tea, black tea, Oolong tea- Grading, Packing.-yield, marketing and storage
14. DATEPALM scope and importance, origin and distribution-area and production- export and import-role in national and state economy, botany and taxonomy- uses, industrial importance, by products utilization-soil and climate, varieties, propagation, planting systems and methods, systems of cultivation-soil management- weed management, water management -nutrient management, physiological disorders-flowering and fruit set-fruit

growth and development-harvesting and post Harvest handling-processing-packaging and marketing-yield and economics

15. RUBBER Introduction, Origin and distribution, Area and production, Demand potential, Botany and Taxonomy-uses, composition and industrial importance- 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-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- Types of rubber trees-Practices in Immature rubber trees and mature rubber trees
16. RUBBER Tapping – tapping systems, puncture tapping, slaughter tapping, use of growth regulators for latex flow, rain guarding, latex collection, yield of latex- Processing of rubber latex – Marketable forms – Processing steps – Smoked rubber, sheet rubber, storage – yield, storage and marketing.

Practicals :

1. Description and identification of Coconut varieties
2. Raising of nursery for palm crops-Selection of coconut and Areca nut mother palms and seed nut and planting of seed nut in nursery
3. Raising of nursery and Nursery management in cocoa.
4. Layout and planting of Coconut, Arecanut & Oil palm Cashewnut Cocoa gardens
5. Manuring, irrigation, mulching and other intercultural operations in plantaion crops
6. Description and identification of species and varieties in coffee
7. Harvesting, grading, pulping, fermenting, washing, drying and packing of coffee.
8. Seed berry collection, seed extraction, treatment and sowing of coffee.
9. Mother plant selection preparation of cuttings and rooting of tea under specialized structure.
10. Training, centering, pruning, tipping and harvesting of Tea.
11. Epicotyls, softwood grafting and top working in Cashew nut.
12. Working out the economics and project preparation for Coconut, Arecanut and Oil palm, Cashew nut, Cocoa
13. Different methods of tapping of Rubber
14. Visit to nearby Plantation crop research station.
15. Visit to Commercial Plantations.
16. Final Practical Exam

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SPMA-2.4.3 Medicinal and Aromatic plants 3(2+1)

Theory:

1. Introduction
   History, importance, present status (export &import), future prospects and constraints in the cultivation of medicinal plants.
2. Research institutes working on medicinal and aromatic plants- National, AICRP, Directorates.
3. Aloe
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing.
4. Ashwagandha
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing and grading.
5. Belladonna
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing and grading.
6. Cinchona
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing and grading.
7. Dioscorea
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, intercropping, staking plant protection, harvesting and yield, processing and grading.

8. Isabgol
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing and grading.
9. Kalmegh
   Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield
10. Opium poppy
    Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, lancing and latex collection, harvesting and yield of seed and crude opium, processing.
11. Periwinkle

Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield,

12. Rauvolfia
    Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing and grading.
13. Senna
    Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing and grading.
14. Pyrethrum
    Importance and uses ,chemical composition, origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield, processing, pyrethrin content, extraction and storage.
15. Ammi majus
    Importance and uses ,chemical composition, origin and distribution, description of plant, area and production, soil and climate, land preparation, propagation and planting and after care, irrigation, nutrition, cultural operations, harvesting and yield.
16. Datura, Centella asiatica, Tinospora cardifolia, Brahmi, Guggal, Glori lilly, Phyllanthus amarus.
    Common name, scientific name, family, economic part, uses.
17. Introduction
    History, importance, present status (export & import),future prospects, opportunities and constraints in the cultivation of aromatic plants.
18. Extraction methods
    Extraction methods for essential oil crops- distillation methodology, advantages and disadvantages of water distillation, water and steam distillation, steam distillation.
19. Extraction methods – 2
    Comminution, distillation process, cold fat extraction, hot fat extraction, solvent extraction, expression, Super critical fluid extraction, storage of essential oils, technical terms used in the trade.
20. Ambrette {musk}
    Importance and uses , origin and distribution, description of plant, species and varieties, area and production, soil and climate, land preparation, propagation and nursery techniques, planting and after care, irrigation, nutrition, cultural operations, plant protection, harvesting and yield.
21. Bursera
    Importance and uses, origin and distribution, description of plant, area and production, soil and climate, land preparation, propagation, pruning and training, planting and after care, irrigation, nutrition,intercrop, cultural operations, harvesting and yield.

22. Citronella

Importance and uses, origin and distribution,varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield of herb and oil.

23. Lemongrass
    Importance and uses, origin and distribution,varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield of herb and oil.
24. Geranium
    Importance and uses, origin and distribution, varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield.
25. Khus grass
    Importance and uses, origin and distribution,varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield of herb and oil.
26. Palmarosa
    Importance and uses, origin and distribution,varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield of herb and oil.
27. Lavender
    Importance and uses, origin and distribution,varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield.
28. Mint
    Importance and uses, origin and distribution, description of species of mint,varieties,chemical composition, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield of herb and oil.
29. Patchouli
    Importance and uses, origin and distribution, varieties, description of plant, area and production, soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield.
30. Ocimum
    Importance and uses, origin and distribution, description of species and varieties, area and production
31. Ocimum
    Soil and climate, land preparation, propagation, planting and after care, irrigation, nutrition, cultural operations, harvesting and yield.
32. DAVANA, MARUVAM, EUCALYPTUS, ROSEMARY, LIQUORICE, SANDALWOOD, FLAG:
    Scientific name, common names, family, economic part, uses.

Practical:

1. Collection of locally available medicinal plants, plant description and preparation of herbarium
2. Morphological description of locally available medicinal plants
3. Propagation and nursery techniques for important medicinal plants
4. Harvesting techniques for important medicinal plants
5. Processing techniques for important medicinal plants
6. Visit to AICRP ON medicinal and aromatic plants

7. Collection of locally available aromatic plants, plant description and preparation of herbarium
8. Morphological description of locally available aromatic plants
9. Propagation and nursery techniques for important aromatic plants
10. Harvesting techniques for important aromatic plants
11. Processing techniques for important aromatic plants
12. Visit to commercial perfumery and ayurvedic pharmacy
13. Extraction of aloe gel and aloin from Aloe plant
14. Extraction of essential oil from locally available aromatic plants.
15. Visit to CIMAP or any other research institute working on medicinal and aromatic plants.
16. Semester final practical examination

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DEPARTMENT OF POST HARVEST TECHNOLOGY

PHTH -2.5.1 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.
6. Food processing Techniques – dry heat, moist heat, microwave heating.
7. Processing of cereals – dextrinization, gelatinization, malting, parboiling – effect on nutritive value.
8. Processing of legumes & pulses – germination, fermentation etc.– effect on nutritive value.
9. Processing of fruits & vegetables – effect on nutritive value.
10. Processing of milk and milk products – 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
14. Processing of Oils and fats in food preparation – smoking point, Rancidity changes.
15. Food additives
16. Sanitation and hygiene in food preparation.

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.
6. Germination of legumes.
7. Determination of edible portion of fruits and vegetables.
8. Browning reactions in fruits and vegetables.
9. Cooking of vegetables using various methods – effect on volume and weight.
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.
14. Determination of smoking point of various oils – effect on oil absorption in food preparation.
15. Microwave cooking – effect on cooking time and quality.
16. Practical exam

References:

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PHTH-3.5.1 Post harvest technology of Horticultural crops 3(2+1)

Theory:

1. 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.

2. Structure of fruits and vegetables.
   Protective tissue, Ground system, Vascular system and textural characteristics.
3. 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 pruning and harvesting types

4&5 Factors responsible for deterioration of Horticulture produce 1. Respiration 2. Transpiration 3. Ethylene 4. Mechanical damage 5. Pest and diseases – pests: Fruit flies (Dacus species), control measures – Orchard sanitation and adult trapping. Diseases (Pathogen) – Collectotrichum sp. Botrytis, Xanthomonas, Phytophthora, Aspergullus, Rhizophus and its control measures. Post harvest control measure – cold sterilization, lonising radiation – Di-electric heating, hot-water treatment, vapour heat treatment, Physiological disorder – internal browning, black heart chilling and freezing injury

6. Fruit ripening :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.

7,8&9 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.

10. Harvesting: Definition, methods of harvesting, manual harvesting, mechanical harvesting – Advantage and disadvantages:

11,12&13 Handling: (1) Removal of heat of the produce – Pre-cooling, methods of pre-cooling – hydro cooling, vacuum cooling, air cooling and contact icing. (2) Pre-packaging – Definition, curing, degreening, disinfestations and waxing. (3) Packing house operations – Cleaning, grading and packing – Handling sequence of pack house operations. (4) Damage in the transport bruising – compact and impact injuries.

14&!5 Grading: Definition, benefits of grading type of grading – colour grading and grading for size. Methods of grading – hand grading, machine sizing – Equipment for machine sizing – sizing by weight, sizing by diameter. Grading of fruits: Mango, sweet orange, papaya, pineapple, grapes, banana, guava, grading of vegetables – tomato, okra, cabbage, cauliflower, cucumber, onion, Brinjal, potato, grading of cut flowers – rose, carnation, gerbera and gladiolus.

16. Harvesting handling and grading of cut flowers Anthurium, gerbera, lily, orchids, rose and tuberose. Medicinal plants – Rouvolfia, Coleus, Aswaganda – Aromatic plants – lemon grass, vanilla, davanam, eucalyptus.
17. Ripening Regulation: Hastening ripening – Ethylene and ethylene releasing compounds, smoke, alcohols, Fatty acid. Delaying ripening – 2, 4D, 2,4,5T and 2,4,5 TP.
18. Post harvesting treatments – Washing, use of growth regulators, hot water dip, fungicidal treatment, in-package treatment, waxing and irradiation.

19,20&21 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 membrance technology, Controlled atmospheric (CA) storage.

22&23Type 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

24&25 New innovation in packing materials

A. Active packaging: major active packaging systems –

1. Oxygen scavenging systems, 2. Moisture absorbing and controlling system, 3. CO_2 generating system, 4. Ethanol generators, 5. Ethylene absorbents, 6. Edible coatings, 7. Bio packaging

26&27 Types of containers and Cushioning materials

Typing containers –

A) Paper board and fibre board: Advantages and Disadvatages (B) Plastics: Advantages and Disadvantages (i) Poly styrene (ii) Polyvinyl Chloride (PVC) (iii) Polyvinyledene chloride (PVDC) (iv) Polyethylene (v) Polypropylene (C) Rigid plastic containers: Cushioning material: Paper waste, paddy straw, banana leaf etc.

28 Vacuum packaging and shrink films: Definition and uses.

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

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

31&32 Quality and grades specification of horticultural produce

Practicals:

1. Practice in judging the maturity of various horticultural produce
2. Determination of physiological loss in weight and quality
3. Grading of horticultural produce
4. &5 Post harvest treatment of horticultural crops, physical and chemical methods

6. Packaging studies in fruits, vegetables by using different packing material
7. Packaging studies in plantation crops and cut flowers by using different packing material
8. Methods of storage

9&10 Post harvest disorders in horticultural crops

11 Identification of storage pest and diseases

12-16 Visit to market, packing houses and cold storages

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Fruit and vegetable processing - Bhatti Suman 1995. Vame, CBS Publishers & Distributors, New Delhi
Post Harvest Management of Horticultural Crops - Saraswathy, S. Preethi, T.L. Balasubramanyan, S. Suresh, J. Revathy, N. and Natarajan, S. 2007. Agrotech Publishing Agency, Udaipur.

PHTH-3.5.2 Processing of Horticultural Crops 3(1+2)

Theory:

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
    Preservation by vinegar:
    Problems of pickle making
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
15. Preservation by Freezing.
    Methods of Freezing
    Changes during Freezing and Storage of Frozen food
16. 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
30-31 Visit to Processing units
32 Final Practical Examination

References:

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DEPARTMENT OF ENTOMOLOGY

ENTO 1.6.1 Fundamentals of Entomology 2 (1+1)

Theory:

1. History and scope of entomology and Economic importance , Dominance of insects in Animal Kingdom of Class Insecta. Important characters of Phylum Arthropoda, relationship of Class Insecta with other Arthropods
2. Cuticle: Its structure and function, process of moulting.
3. Body segmentation, head, thorax, abdomen and abdominal structure in insects. Types of insect head, sutures and scelerites of head, tentorium
4. Types of insect mouth parts: Biting and chewing type, Piercing and sucking (bug type and mosquito type), Rasping and sucking type, Sponging type and Siphoning type.
5. Types of insect antenna , legs. Wings: Venation, cross veins, margin and angles, areas of wing and Types of insect wings, types of wing coupling mechanism.
6. Metamorphosis, types of metamorphosis in insects (Ametabola, Hemimetabola, Paurometabola, Holometabloa, Hypermetabola), types of larvae and pupae
7. Digestive system in insects: structure – foregut, midgut and hind gut, peritrophic membrance, filter chamber. Digestive enzyme and process of digestion. Excretory system in insects: Organs involved and process of excretion and osmoregulation, functions of Malphigian tubules, cryptonephry.
8. Circulatory system: Blood, Circulatory organs involved in circulation of blood-Dorsal vessel dorsal and ventral diaphragms, accessory pulsatory organs And Process of circulation in insects. Respiratory system: Organs of respiration-spiracles, tracheae and tracheoles, air sacs, mechanism of respiration. Classification of respiratory system on the basis of functional spiracles. Respiration in aquatic insects. Endocrine System and sensory system
9. Insect Reproductive System : Female reproductive system-structure, physiology of sperm production, different types of reproduction in insects. Male reproductive system – structure, physiology of sperm production, different types of reproduction in insects. Postembryonic development, eclosion in insects.
10. Nervous system: Different types of neurons, nerve impulse conduction. Structure of insect nervous system: Central nervous system, Visceral nervous system and Peripheral nervous system.
11. Classification of insects up to orders and families of economic importance. Binomial nomenclature: importance, history, International Code of Zoological Nomenclature, Law of Priority
12. Study of order and family characters of Apterygota [Thysanura, prothura, Anaplura, Diplura,Collembola], Odonata, Dermaptera, Mallaphaga, Siphunculata, Plecoptera,
13. Study of order and family characters of Orthoptera (Acrididae), Dictyoptera (Blattidae, Mantidae), Isoptera (Termitidae), Thysanoptera (Thripidae),
14. Hemiptera (Pentatomide, Tingidae, Miridae) Homoptera (Cicadellidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae).
15. Lepidoptera (Noctuidae, Sphingdae, Pyralidae, Hesperidae, Papilionidae, Arctidae, Gelechiidae, Lymantriidae, Cochlididae), Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Scarabaeidae, Apoinidae)
16. Hymenoptera (Tenthridinidae, Trichogrammatidae, Formicidae, Apidae, Ichneumonidae, Braconidae, Chalcididae) , Diptera (Cecidomyiidae, Trypetidae Tachinidae, Agromyzidae)

Practicals:

1. Methods of collection and preservation of insects including immature stages.
2. External features of grasshopper / Cockroach/ 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.

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ENTO.- 2.6.1 Insect pests of fruits, plantation, medicinal and aromatic crops 3(2+1)

Theory:

1. Introduction, Economic classification of Insects
2. Study of insect pests (Distribution, host range, biology, Nature of damage and management) in horticultural crops
   Tropical Fruits
   Mango: Hoppers, red banded caterpillar, nut weevil, stem borer, leaf webber, mealy bug, oriental fruit fly, leaf gall midges, thrips
3. Guava: Tea mosquito bug, fruit fly, fruit borer, mealybug , bark eating caterpillar.
4. Sapota: Leaf webber, bud borer, fruit fly., seed borer Ber: Ber fruit fly, fruit borer.
5. Banana: Rhizome weevil, pseudostem borer, aphid. Papaya: Mealy bug, spiralling white fly
6. Pomegranate: Pomegranate butterfly, fruit borer, fruit sucking moths
7. Wood apple: Castor shoot and fruit borer
   Custard apple: Mealy bug
   Tamarind: Fruit borer

8&9 Subtropical Fruits

Grapevine: Flea beetle, thrips, stem girdler, mealy bug, stem borer, 2 spotted spider mite.

10&11 Citrus: Citrus butterfly, Fruit sucking moths, citrus leaf miner, psylla, white fly, black fly, mangu mite.

12. Litchi: Fruit borer, leaf miner, rust mite

13&14 Temperate Fruits

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

Peach: Leaf curl aphid, borer

Plum weevil, Apricot chalcid

16&17 Plantation Crops

Cashew: Cashew shoot and root borer, shoot and blossom webber, tea mosquito bug, thrips, leaf miner, fruit borer.

18&19 Coconut & Oil palm: Black headed caterpillar, rhinocerous beetle, red palm weevil, Eriophid mite, coconut scale.

20&21 Tea: Tea mosquito bug, thrips, mite complex (red spider mite, yellow mite, pink mite, purple mite, scarlet mite)

22&23 Coffee: Green scales, white borer, red borer, shot hole borer, berry borer.

24. Arecanut: Scales, mites, thrips, nymphalid butterfly.

25. Cocoa: Tea mosquito bug, chaffer

Rubber: Bark caterpillar, scales beetles

26, 27 & 28medicinal 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.

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

29, 30&31 Pests of Stored Products

Tamarind beetle, Cigarette beetle, Lesser grain borer, Kapra beetle, Drug store beetle, Dried fruit moth, sweet potato weevil, potato tuber moth, red flour beetle, rice moth, Indian meal moth, Dried current moth, Tobacco moth, dried fruit beetle, saw toothed beetle

32. Insecticide residues problem in fruit, plantation, medicinal and aromatic plants and their tolerance limits.

Practicals:

1. Sampling techniques for estimation of insect damage
2. Survey, surveillance and fore casting of pest incidence
3. Calculation of insecticidal doses/ concentrations of different formulations
4. Typical symptoms of damage caused by various phytophagous insects
5. Identification of insects and damage symptoms of pests of mango
6. Identification of insects and damage symptoms of pests of guava, sapota
7. Identification of insects and damage symptoms of pests of ber, banana, papaya
8. Identification of insects and damage symptoms of pests of pomegranate
9. Identification of insects and damage symptoms of pests of grapevine and citrus
10. Identification of insects and damage symptoms of apple, peach and plum
11. Identification of insects and damage symptoms of pests of cashew
12. Identification of insects and damage symptoms of pests of coconut, oil palm, cocoa
13. Identification of insects and damage symptoms of pests of tea, coffee, rubber
14. Identification of insects and damage symptoms of pests of medicinal and aromatic plants

15 & 16 Identification of insects and damage symptoms of pests of stored products

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ENTO 2.6.2 Integrated Pest Management and Management of Nematodes 2 (1+1)
Theory:

1. History & Definitions of Integrated Pest Management : Introduction, Toxic consequences of indiscriminate use of pesticides, pesticide poisoning and pesticide residues in India., History of IPM, Definitions of IPM, Phases of Pest management,
2. Concepts and Components of IPM : Damage boundary, Economic Threshold levels, Economic Injury levels, Cultural control, Mechanical control, Physical control.
3. Biological control : Techniques in biological control, Qualities of a Successful Parasitoid in Biological Control Programme, successful examples of Biological Control, Kinds of Parasitism.
4. Biological control: Description of important Parasitoids & Predators , Mass multiplication of Parasitoids & Predators.
5. Microbial control : History of Bacillus thuringiensis , Characteristics of Bacillus thuringiensis, Mode of action of Bacillus thuringiensis, Fungal pathogens, Protozoa
6. Microbial control : Characteristics of Baculoviruses, , Mode of action of NPV, Entomopathogenic nematodes (EPNs)
7. Host Plant Resistance : Definition **,** Advantages to the Use of Insect-Resistant Crop Varieties**,** Host Plant Selection Process by an Insect , Theories of Host Plant Resistance, Mechanisms of Host Plant Resistance, Plant defence against herbivory .
8. Chemical control: Pesticide Definition, Different Classifications of Insecticides, Classification of Insecticides based on Chemical nature, Inorganic insecticides, Organic insecticides.
9. Chemical control: Properties, mode of action of Synthetic Organic insecticides and novel insecticides.
10. Toxicology of Insecticides: Definition, LD_{50} as criterion for comparing relative toxicities of toxicants, Bioassay of insecticides, Formulations of Insecticides, Synergists , Adjuvants, Mode of Action of Insecticides, Safe use of Insecticides.
11. Rodenticides , Acaricides and Sterile insect Technology .
12. Applications of Biotechnology in Pest Management : Transgenic Plants (Genetically modified or GM crops) , Bacillus thuringiensis and Genetic Engenering.
13. History and development of nematology - definition, economic importance. General characters of plant parasitic nematodes, their morphology, taxonomy, classification, biology
14. Symptomatology and control of important plant parasitic nematodes of fruits – (tropical, sub-tropical and temperate) vegetables.
15. Symptomatology and control of important plant parasitic nematodes of tubers, ornamental, spice and plantation crops.
16. Role of nematodes in plant disease complex and Integrated nematode management.

Practical:

1. Sampling techniques for estimation of insect damage
2. Survey, surveillance and fore casting of pest incidence
3. Preparation and evaluation of Various components of IPM [Light traps, sticky traps, bait traps, Botanicals, Microbials, Parasitoids, Predators]
4. Visit to IPM plot and recording the pest and natural enemy population
5. Correlation of pest and natural enemy population with abiotic factors in Horticultural Crops
6. Calculations of insecticide doses/concentrations of different formulations
7. Preparation and evaluation of botanical pesticides [NSKE 5 % , neem oil, pongamia oil]

8. Study of various pesticide formulations
9. Preparation of Trichocards and Bracon cards
10. Inoculative and inundative release of Parasitoids and Predators in Horticultural Crops
11. Preparation and evaluation of Microbial insecticides
12. Visit to bio- control laboratory
13. To study various plant protection appliances
14. Methods of sampling and extraction of nematodes from soil , Extraction of nematodes from plant parts. Killing and fixing of nematodes
15. Symptoms of damage by nematodes in vegetable and fruit crops
16. Symptoms of damage by nematodes in spices, plantation, flowers , ornamental crops

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ENTO-3.6.1 Insect Pests of Vegetable, Ornamental and Spice Crops

3 (2+1)

Theory:

1. Economic importance of insects in vegetable, ornamental and spice crops – their pest surveillance, ecology and management.
2. Distribution, host range, bio-econoly, nature and symptoms of damage and integrated management of important insect pests affecting

   Vegetables

   Brinjal: Shoot and fruit borer, stem borer, Epliachna beetle, leaf hoppers, aphids, lace wing bug, mealy bugs, leaf webber
3. Bhendi: Spotted boll worms, Cotton jassid, While fly, Red cotton bug, dusky cotton bug
4. Tomato: Fruit borer, Serpentine leaf miner, While fly, Brinjal stem borer
5. Cucurbits: Fruit files, Pumpin 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.

14. Peas: Pea leaf miner, Pea stem fly, Pea pod borer

    Beans: Gram pod borer, Flower webber, Bean aphid, Leaf hopper, White fly, Blister beetle

15. ORNAMENTALS

Rose: Rose aphid, Thrips, Scales, Leaf cutter bee, Tomato fruit borer

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

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

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

19,20. 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.

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

22. SPICES

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

23, 24.

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

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

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

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

28. Onion, Garlic: Onion fly, ear wig, onion thrips, tomato fruit borer, tobacoo caterpillar, cutworms

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

30. Important storage insect pests of vegetable and ornamental crops

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

32. 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
9. Identification of insect pests of jasmine 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
14. Identification of insect pests of fenugreek and coriander 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.

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ENTO-3.6.2 Apiculture, Sericulture and Lac culture 2(1+1)

Theory:

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.
6. Diseases of bees: Protozoa – Nosema, Malpighamoeba. Bacterial American foul brood, European foul brood. Fungal – Chalk brood, Stone brood, Viral – Sac brood. Natural enemies: Greater wax moth, lesser wax moth, ants, wasp, wax beetles, mites, crow, bee eater etc. Their prevention and control.
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 of cocoons.
12. Post Harvest processing of cocoons- stifling, cocoon boiling, brushing, reeling, rereeling, finishing, testing.
13. Diseases of silkworm: Protozoa: Pebrine, Fungal: White muscardine, green muscardine, Viral: Grasserie, Bacteria: Flacherie. Natural enemies: Uzi fly,Beetles.
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. Lac cultivation-
15. Lac cultivation, food plants, propagation of lac insects, harvesting of lac, lac products and their use- lac dye,lac wax, shellac, bleached shellac, dewaxed bleached shellac, aleuritic 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.

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DEPARTMENT OF PLANT PATHOLOGY

PATH 1.7.1 Fundamental of Plant Pathology 3(2+1)

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 epiphytotics (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, Brefeld, Millardet, Marshal ward) Buffer, Mundkur, Tirumalachar, Subramanian.

4, 5, 6 Terms and concepts used in Plant Pathology – disease disorder, pathogen, parasite, pathogenicity, casual organism, pathogenesis, sing, symptom, syndrome, biotroph, hemibiotroph/ necrotroph, 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)

7, 8, 9 Parasitic causes of plant diseases – Fungi – classification upto sub division(according to Ainsworth, 1973). Kingdom – Mycota – Division 1.Myxomycotina – Class 1. Plasmodio-phoromyctes, Division 2.Eumycetes – sub-division 1.Mastigo – Mycotina, 2.Zygomycotina, 3.Ascomycotina 4.Basidiomycotina, 5.Deuteromycotina – Distinguish (general) characters of each sub-division with important examples of plant pathogenic fungi.

10, 11, 12 History of plant bacteriology – contributions of Burril, Smith and Patel. Classification of phytopathogenic bacteria (BMSB, 1984), important characteristic of individual genera Pseudomonas, Xanthomonas, Agrobacterium, Erwinia,Clavibacter, Streptomyces and their diseases – General characteristics of plant pathogenic bacteria – History of plant virology – contributions of Adolf Mayer, Iwanowski, Beijerink, Stanley and Bawden& Pirie. General characters of plant viruses – classification of plant viruses with examples of diseases (mosaic, mottle, streaks or stripes, yellows, chlorosis, chlorotic rings, vein – banding, reddening, local lesion, etch, Bronzing, shoe-string leaves, leaf curling and enations) – transmission of viruses-artificial and natural – contributions of diener – study of viroids – important characters and diseases caused by them.

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, sesamumphyllody, potato wilt's, bromm, little leaf of brinjal, 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 of important characters. Phytomonas sp. and disease caused by them. Algae – classification, important characters. Cephaleurus 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, germ tube, formation of specialized structures like appressorium, haustoria, rhizomorphs), bacteria and viruses-indirect penetration through wounds or natural openings like stomata, hydathodes and lenticels. Direct penetration through plant surface (epidermis or cuticle) by chemical or mechanical. Post penetration – colonization of the host.

23, 24 Plant disease epidemiology – meaning and importance – difference between compound and simple interest diseases. Factors affecting plant disease epidemics fore casting-advantages, methods of forecasting- Measurement of plant disease with examples of systemic disease (loose smut of the wheat and stripe disease of barley.

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 Biocontrol 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. Koch postulates
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 diseases symptoms and signs of important horticultural crops, phanerogamic parasites, non-parasitic diseases.
10. Preparation of fungicides – Bordeaux mixture, Chaubattia paste, Cheshunt compound and calculations.
11. Study of non-systemic and systemic group of fungicides and calculations related to fungicide concentrations (Copper, Sulphur, Heterocyclic – 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

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PATH–2.7.1 Diseases of Fruit, Plantation, Medicinal and Aromatic Crops 3(2+1)

Theory:

1 to3 Mango 1.Powdery mildew, 2.Ananthracnose, 3.Stem end rot, 4.Sooty mould, 5.Malformation, 6. Red rust, 7.Gummosis, stem bleeding and bark cracking

4 &5 Citrus 1.Gummosis, 2.Diplodia gummosis, 3.Twig blight , 4.Felt, 5.Pink, 6.Ganoderma root rot, 7.Dry root rot, 8.Scab, 9.Powdery mildew, 10.Sooty mould, 11.Canker, 12.Tristeza, 13.Greening, 14.Exocortis, 15.Psorosis, 16.Mosaic, 17.Post harvest disease (Penicillium fruit rots, sour rot, brown rot)

6 &7 Grapevine 1.Anthracnose, 2.Downy mildew, 3.Powdery mildew, 4.Alternaria leaf spot,
5.Rust, 6.Dead arm, 7.Bacterial leaf spot, 8.Post harvest diseases, (Grey mould rot, black
rot)

8 &9 Banana 1.Panama wilt, 2. Sigatoka leaf spot, 3.Anthracnose, 4.Cigar end rot, 5. Freckle leaf spot, 6.Moko disease, 7.Bacterial soft rot/head rot/tip rot, 8.Bunchy top, 9. Mosaic, 10.Infectious Chlorosis, 11.Banna Streak, 12.Bract mosaic, 13.Post harvest diseases, (Botryodiplodia fruit rot)

10 Guava 1.Canker, 2.Wit, 3.Anthracnose, 4.Red rust, 5.Post harvest diseases (Phytophthora, Botryodiplodia and, Phoma fruit rots)

11 Sapota 1.Phavopleospora leaf spot, 2.Pestalolia leaf spot, 3.Flat limb, 4.Fruit rot (different fungi), 5.Post harvest diseases(Phytophthora, Botryodiplodia and, Phoma fruit rots)

12 Papaya 1.Damping off/ foot rot, 2.Anthracnose, 3.Powdery mildew, 4.Alternaria leaf spot 5 .Phytophthora root rot, 6. Ring spot, 7.Mosaic, 8.Leaf curl, 9.Post harvest diseases.
(Rhizpopus fruit rot & Fusarium fruit rot)

13 Pomegranate 1.Cercospora leaf spot, 2.Anthracnose, 3.phomopsis fruit rot, 4.Bacterial leaf spot, 5.Post harvest diseases (Aspergillus and Fusarium and Cladosporium fruit rots)

14 Ber 1.Powdery mildew, 2.Sooty mould, 3.Alternaria leaf spot
Fig 1.Rust, 2.Anthracnose, 3.Cylindrocladium Leaf spot, 4.Mosaic

15&16 Phalsa 1.Rust, 2.Powdery mildew, 3.Cerospora leaf spot
Apple 1.Scab, 2.Powdery mildew, 3.Fire blight, 4.Crown gall, 5.Mosaic, 6.Post harvest diseases (soft rot, Bitter rot, Pink mould rot)

17 Custard apple 1.anthracnose, 2.Glomerella fruit rots,

18. Anola 1.Rust, 2.Anthracnose
Peach 1.Leaf Curl, 2.Rust, 3.Scab, 4.List of minor diseases
Almond, Pear and Plum List of important diseases
Jack fruit 1.Die back 2.Rhizopus Fruit rot
Pine apple 1.Heart rot & root rot, 2. Base rot, 3.Wilt, 4.List of minor diseases

19 Walnut 1. List of important diseases
Strawberry1. List of important diseases

20 Coconut 1.Bud rot 2.Ganoderma root rot 3. Stem bleeding 4.Grey blight 5.Tatipaka

21 Oil palm 1.Nursery Leaf Spots 2. Spear rot 3.Bunch rot 4. Bud rot 5. Basal stem rot

22. Areca nut 1.Fruit rot/Mahali/ Koleroga, 2.Foot rot/ Ganoderma root rot

23 Coffee 1.Rust, 2.Black rot,
Tea 1.Blister blight

24 Cashew 1.Anthracnose, 2.Pink disease
Cocoa 1.Phytophthora blight, 2.Charcoal pod rot, 3.Swollen shoot, 4. Black pod rot

Rubber: 1.Root rot, 2. Powdery mildew

25 Betelvine 1.Phytophthora root rot, 2.Sclerotium foot rot, 3.Leaf spot 4.Powdery mildew
Bacterial leaf spot, 6.Mosaic
Black Pepper 1.Phytophthora foot rot, 2.Anthracnose/pollu

26 Mint 1.Stolon rot, 2.Rust, 3.Alternaria leaf blight, 4.Verticilium wilt, 5.Powdery mildew
Opium 1.Downy mildew, 2.Alternatia leaf spot, 3.Powdery mildew, 4.Mosaic

27 Neem 1.Phoma twig blight
Pyrethrum 1.Damping off, 2. Wilt, 3.Rust, 4.Leaf blotch, 5.Grey mould
Senna 1. Damping off 2. Leaf Spot

28 Hemp 1.List of important diseases
Belladona 1.List of important diseases
Camphor 1.List of important diseases

29 Costus 1.List of important diseases
Crotolaria 1.List of important diseases

30 Datura 1.List of important diseases
Dioscorea 1.List of important diseases

31 Solanum khasianum 1.List of important diseases
Tephrosia 1.List of important diseases

32 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

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PATH-3.7.1 Diseases of Vegetables, Ornamentals and Spice Crops 3(2+1)

Theory:

1. Tomato
   1. Early blight 2. Damping off 3. Cercospora leaf spot 4. Stemphylium leaf spot 5.Septoria leaf spot 6. Anthracnose 7. Buck eye rot
2. Tomato
   8. Collar rot 9. Wilt 10. Bacterial leaf spot 11.Bacterial fruit canker 12. Tomatospotted wilt 13. Mosaic 14. Leaf curl
3. Brinjal
   1. Damping off 2. Cercospora leaf spot 3. Alternaria leaf spot 4. Collar rot 5. Bacterialwilt 6. Phomopsis blight and fruit rot 7. Verticillium wilt 8. Little leaf
4. Chillies
   1. Damping off 2. Anthracnose / Die back and fruit rot 3. Powdery mildew 4.Cercospora leaf spot or Frog eye leaf spot 5. Alternaria blight 6. Wilts (Sclerotialwilt, Fusarium wilt, Verticillium wilt)
5. Chillies
   7. Bacterial leaf spot 8. Leaf curl 9. Mosaic complex
6. Bhendi
   1. Powdery mildew 2. Cercospora leaf spot 3. Alternaria leaf spot 4. Fusarium wilt 5. Yellow vein mosaic.
7. Crucifers (Cabbage, Cauliflower, Knol-Kohl, Brussels Sprout, Radish)
   1. Damping off and wire stem 2. Club root 3. White rust 4. Powdery Mildew 5.Anthracnose 6. Downy mildew 7. Alternaria Leaf spot 8. Black Rot
   9. Black leg 10.Cabbageyellows
8. Peas
   1. Pythium seed and root rot 2. Downy mildew 3. Powdery Mildew 4. Rust 5.Fusarium wilt 6. Anthracnose 7. Ascochyta blight
9. Peas
   8. Cercospora leaf spot 9. Bacterial blight 10. Pea Mosaic 11. Enation
10. Beans
    1. Cercospora leaf spot 2. Rust 3. Powdery Mildew
    4. Anthracnose of beans 5. Stem and spot (Anthracnose) 5. Angular leaf spot 6. Halo blight 7. Bacterial wilt8. Bacterial blight 9. Dry root rot 10. Bean common mosaic 11. Yellow Mosaic
11. Beet root
    1. Seedling disease of beet and sugar beet 2. Cercospora leaf spot 3. Sclerotiumroot rot 4. Rhizoctonia root rot and blight 5. Phoma blight and heart rot of beet 6.Beet yellows.
12. Potato
    1. Late blight 2. Early blight 3. Common scab 4. Sclerotium rot 5. Brown rot 6.Soft rot 7. Wart 8. Dry rot 9. Black leg and soft rot 10. Witches' broom 11. Leaf roll12. Spindle tuber
13. Cucurbits
    1. Powdery mildew 2. Downy mildew 3. Cercospora Leaf spot 4. Fruit rot orcottony leak 5. Fusarium wilt (water melon & musk melon & cucurbits) 6.Anthracnose 7. Angular leaf spot 8. Bacterial leaf spot 9. Mosaic

14. Carrot

    1. Cercospora Leaf blight 2. Alternaria leaf blight 3. Powdery mildew 4. Bacterialblight & root scab 5. Soft rot 6. Yellows

15. Colocasia

    1. Phytophthora blight 2. Pythium rot

    Sweet potato

    1. White rust 2. Fusarium wilt, stem rot and surface rot 3. Soft rot or pox.

16. Amaranthus, Spinach, Sorrel, Portulaca

    1. White rust 2. Downy mildew 3. Damping off 4. Anthracnose 5. Cercospora leaf spot 6. Phyllosticta leaf spot 7. Wilt 8. Rust 9. Mosaic

17. Fenugreek

    1. Collar rot 2. Powdery mildew 3. Leaf spot 4. Downy mildew

    Basella

    Only list of important diseases

    1. Cercospora leaf spot

    Hibiscus

    1. Root and stem rot 2. Leaf spot

    Lettuce

    1. Downy mildew 2. Bacterial leaf rot 3. Bacterial leaf spot and head rot 4. Mosaic

    Moringa

    1. Twig canker

18. Onion & Garlic

    1. Leaf blight (purple blotch) 2. Downy mildew 3. Smut 4. Smudge 5. Neck rot and bulb rot 6. Blast 7. Stemphylium blight 8. Rots (soft rot, slippery skin, sour skin,neck rot, brown stain, black mold and blue mold)

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)

20. Clove

    1. Sudden death 2. Acute die back 3. Sumatra disease

    Cinnamon

    1. Bark canker 2. Leaf spot and die back

    Nutmeg

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

    Cardamom

    Small cardamom

    1. Damping off 2. Azhukal disease 3. Mosaic

    Large cardamom

    1. Foorkey disease 2. Chirkey disease

21. Coriander

    1. Powdery mildew 2. Stem Gall

    Curry leaf

    1. Phyllosticta leaf spot 2. Macrophoma leaf spot

3. Dry root rot.

Cumin

1. Fusarium wilt 2. Powdery mildew 3. Blight

22. Rose

1. Die back 2. Verticillium Wilt 3. Stem canker 4. Black spot 5. Powdery Mildew6. Alternaria leaf spot 7. Rust 8. Crown Gall

23. Jasmine

1. Rust 2. Cercospora leaf spot 3. Alternaria leaf spot 4. Anthracnose 5. Colletotrichum leaf spot 6. Phyllosticta leaf spot 7. Myrothecium leaf spot 8.Chlorotic ring spot 9. Mosaic

24. Crossandra

1. Cercospora leaf spot 2. Wilt 3. Anthracnose 4. Corynespora leaf spot 5. Stem rot

25. Chrysanthemum

1. Septoria blotch 2. Powdery mildew 3. Cercospora leaf spot 4. Grey mold 5.Phyllosticta leaf spot 6. Rust 7. Fusarium wilt 8. Bacterial blight 9. Chlorotic Mottle10. Chrysanthemum stunt

26. Tuberose

1. Alternaria leaf spot 2. Macrophoma leaf spot

Marigold

1. Cercospora leaf spot 2. Colletotrichum leaf spot 3. Powdery mildew 4. Alternarialeaf spot 5. Flower blight

27. Asters

1. Anthracnose 2.Phyllody 3. Aster yellows

28. Gladiolus

1. Wilt / Yellow / brown rot / dry rot 2. Corm rot (several fungi)

29. Gerbera

1. Anthracnose 2. Phyllosticta leaf spot 3. Powdery mildew 4. Ascochyta leaf spot5. Blossom blight or stalk rot 6. Foot and root rot 7. Bacterial blight 8. Mosaic 9.Chlorotic mottle

30. Carnation

1. Damping off 2. Wilt 3.. Die back and stem rot 4 Bacterial wilt.

31. Postharvest diseases

Listing of various postharvest diseases along with pathogens in the above crops and general management practices for postharvest diseases with examples.

32. Anthurium

1.Anthracnose 2.Root rot 3. Powdery mildew

Geranium

1.Alternaria leaf spot 2. Bacterial leaf spot 3. Black leg 4. Botrytis blight 5. Pythium root rot 6. Rust 7. Verticillium wilt

Pepper

1.Anthracnose 2. Charcoal rot 3. Foot rot (Phytophthora capsici)

Practicals:

1 Diseases of Tomato

2 Diseases of Brinjal

3 Diseases of Chilli
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 Field visit
10 Diseases of Carrot, Colocasia, Spinach and Sweet potato
10. Diseases of Anthurium, Gerbera and Geranium
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

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DEPARTMENT OF GENETICS & PLANT BREEDING

GPBR 1.8.1 Principles of Genetics and Cytogenetics 3 (2+1)

Theory:

1. Historical background of genetics, theories and hypothesis-inter-ralationship between cytology, genetics, cytogenetics, plant breeding and biotechnology.
2. Physical basis of heredity-morphology of chromosomes-shape, size and number of chromosomes-structure of the chromosome-euchromatin and heterochromatin-karyotype-ideogram.
3. Chromosome theory of inheritance - special types of chromosomes-lampbrush chromosomes-salivary gland chromosomes-accessory chromosomes
4. Cell reproduction- mitosis definition-process of mitosis-mitotic cycle significance and role in plant breeding.
5. Meiosis-definition-process- differences between mitosis and meiosis-significance in plant breeding.
6. Micro and mega sporogenesis- micro and mega gametogenesis- syngamy and embryogenesis in plants- xenia and metaxenia.
7. Mendelian genetics– terminology-Mendel's experiments reasons for selection of pea as experimental material-characters studied- reasons for Mendel's success.
8. Mendel's principles of heredity- law of segregation-law of independent assortment-principle of dominance-principle of unit characters- deviation from Mendelian inheritance.
9. Monohybrid, dihybrid ratios-Modification of F_2 ratios in monohybrid and dihybrid crosses.
10. Pleiotropism-multiple alleles-pseudo alleles- threshold characters- penetrance and expressivity.
11. Gene interactions - Epistasis-Complementary-Supplementary-Duplicate-Additive and inhibitory interactions.
12. Qualitative and quantitative characters- definition- monogenic and polygenic inheritance and their differences-multiple factor hypothesis.
13. Cytoplasmic inheritance and maternal effects-definition- Eg. 4 '0' clock plant – characteristics of extra chromosomal inheritance.
14. Arrangement of genes on chromosomes-linkage – definition-linkage groups- coupling phage and repulsion phase- types of linkage- distinction between linkage and pleiotropism.
15. Theories of linkage- Morgan's work in drosophila-importance of test cross in linkage studies- significance in plant breeding.
16. 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.
17. Chemical basis of heredity- Evidence to prove DNA and RNA – as genetic material.
18. Structure of DNA- functions- Watson and Crick model-types of DNA.
19. Modes of DNA replication- semi-conservative DNA replication experimental proof.
20. Sex determination – various mechanisms of sex determination – genic balance theory of sex determination in Drosophila melanogaster
21. Sex linked (colourblindness and hemophilia in human beings) sex influenced (horns in some breeds of sheep and baldness in men) and sex limited characters (plumage of male fowls, milk production in female cattle and appearance of beard in men)– pseudohermaphrodites– gynandromorphs.
22. Mutations- introduction-definition-classification of mutations- spontaneous and induced mutations-point mutations-chimeras-types and their significance in plant breeding.

23. Physical and chemical mutagens- classification- induction of mutations-detection of sex linked lethals in Drosophila (ClB method given by Muller).
24. Detection of mutations in plants-importance of mutations in plant breeding programmes-- molecular basis of mutations.
25. Structural chromosomal aberrations- bridge-breakage-fusion cycle- deletions-duplications and their significance in plant breeding.
26. Inversions-pericentric and paracentric inversions-inversions as cross over suppressors.
27. Translocations- simple and reciprocal translocations- pairing pattern- their role in plant breeding.
28. Numerical chromosomal aberrations-terminology- classification- euploidy-aneuploidy.

29. Haploids- autopolyploids -triploids- tetraploids-cytological behavior and their significance in plant breeding.
30. Allopolyploidy- cytological behaviour- role in evolution of crop plants- significance in plant breeding.
31. Evolution of wheat- cotton -tobacco- brassicas-man made polyploids.
32. Aneuploidy-types of aneuploids- their cytological behavior and significance in plant breeding.

Practicals:

1. Study of floral biology of fabaceae members, emasculation and artificial pollination
2. Preparation of fixatives and stains.
3. Cytological techniques-Squash and smear techniques.
4. Demonstrations of permanent slides –preparation of microslides and identification of various stages of mitosis.
5. Demonstrations of permanent slides –preparation of microslides and identification of various stages of meiosis.
6. Study of pollen fertility/ viability
7. Study of pollen germination-hanging drop method
8. Monohybrid ratio and its modifications- Chi-square test
9. Dihybrid ratio and its modifications
10. Trihybrid ratio and determination of gametes
11. Interaction of factors- epistatic interaction
12. Complementary and Supplementary interactions
13. Duplicate and additive factors and inhibitory interactions
14. Linkage – two point test cross
15. Linkage – three point test cross and construction of linkage maps
16. Genetic variation in pea/dolichos beans

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GPBR-1.8.2 Principles of Plant Breeding 3(2+1)

Theory:

1. Introduction to plant breeding, a dynamic science, scope and importance, genetic basis of Plant Breeding.
2. Classical, quantitative and molecular plant breeding in India – limitations, major achievements, -goal setting for future.
3. Modes of reproduction- Sexual reproduction- Asexual reproduction-definition-classification-apomixis- classification- genetic consequences and significance in plant breeding.
4. Modes of pollination – genetic consequences-cross, self-pollination and often cross pollinated crops – differences between self-pollinated and cross pollinated crops-implications of reproductive systems on population structure.
5. Pollination control mechanisms-self-incompatibility-classification- heteromorphic, homomorphic, gametophytic and sporophytic system incompatibility.
6. Pollination control mechanisms-male sterility- classification- genetic, cytoplasmic and cytoplasmic genetic male sterility- transgenic male sterility- its inheritance and maintenance.
7. Utilization of male sterile lines in hybrid seed production- their limitation, advantages and disadvantages.
8. Biometrics – quantitative genetics- definitions- Genetic components of polygenic variation i.e., additive, dominance and epistasis –differences and breeding strategies to exploit different components of genetic variation.
9. Selection as a basis of crop breeding- natural and artificial selection-basic characteristics and requirements of selection-selection intensity-selection differential-heritability and genetic advance.
10. Mass selection-procedure-modification of mass selection-merits-demerits and achievements.
11. Johansenn's pureline theory – origin of variation in purelines and characters of purelines. Progeny test-genetic basis of pureline selection-general procedure for evolving a variety by pureline selection-merits-demerits-achievements-comparison between mass and pureline selection.
12. Clonal selection- genetic basis-procedure-achievements-clonal degeneration. Populaton improvement-recurrenet selection-types of recurrent selection
13. Marker assisted selection- principle, procedure, advantages, disadvantages – achievements.
14. Hybridization- goals of hybridization- steps in hybridization- population developed by hybridization – simple crosses, bulk crosses and complex crosses.
15. Handling of segregating generations (hybridization followed by selection) – pedigree method-procedure-modifications-merits-demerits and achievements.
16. Bulk method- procedure-modifications-merits-demerits- achievements.
17. Back cross method- requirements-application- procedure for transfer of single dominant gene and transfer of single recessive gene.
18. Merits, demerits and achievements of backcross breeding-comparison between pedigree, bulk and back cross methods-multilines concept-definition and uses.
19. Heterosis– manifestation of heterosis- theories of heterosis.
20. Physiological, biochemical and molecular causes of heterosis.
21. Types of heterosis-average heterosis- heterobeltosis-standard heterosis.
22. Inbreeding depression-definition- effects of inbreeding in different crops-procedure for development of inbred lines and their evaluation.

23. Exploitation of heterosis-history of hybrid varieties-important steps in production of single and double cross hybrids- brief idea of hybrids in important horticultural crops.
24. Combining ability- definition- types- general combining ability (GCA)- specific combining ability (SCA)-significance in plant breeding.
25. Synthetics and composites-production procedures-merits-demerits- achievements-comparison between synthetics and composites.
26. Emasculation definition- different emasculation and pollination methods followed in important horticultural crops.
27. Mutation breeding-spontaneous and induced mutations- mutagens-physical and chemical- gamma garden.
28. Procedure for mutation breeding for oligogenic and polygenic characters-limitations and achievements.
29. Polyploidy breeding- auto and allopolyploids – role in plant breeding
30. Wide hybridization- applications-barriers in wide hybridization
31. Techniques to overcome sterility in wide hybridization-application-limitations and achievements.
32. Breeding for resistance to biotic and abiotic stresses-gene for gene hypothesis-vertical and horizontal resistance.

Practicals:

1. Botanical description and floral biology – general.
2. Plant breeder's kit.
3. Different emasculation methods followed in important horticultural crops.
4. Breeding objectives, floral biology-selfing-emasculation-crossing techniques in tomato, bhendi and chillies.
5. Breeding objectives, floral biology-selfing-emasculation-crossing techniques in bottle gourd and ridge gourd.
6. Breeding objectives - floral biology-selfing-emasculation-crossing techniques in mango.
7. Determination of mode of reproduction in crop plants.
8. Handling of breeding material, segregating generations pedigree, bulk and back cross methods.
9. Field layout and experimental designs.
10. Maintenance of experimental records and registers.
11. Development of hybrids (one line, two line and three line breeding) and demonstration of hybrid variation.
12. Hardy Weinberg Law and calculation of gene and genotypic frequencies.
13. Male sterility and incompatibility studies in horticultural crops.
14. Calculation of heterosis, heterobeltioses and standard heterosis and inbreeding depression.
15. Calculation of GCA and SCA effects.
16. Calculation of genetic advance and heritability.

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GPBR 2.8.1: Elementary Plant Biotechnology 2(1+1)

Theory:

1. Definitions of biotechnology, terminology associated with plant biotechnology, tissue culture, genetic engineering and molecular markers
2. Concepts of Plant Biotechnology: History of Plant Tissue Culture, Plant Genetic Engineering and molecular markers
3. Scope and importance of biotechnology in Crop Improvement, Education, Research in India and abroad about biotechnology and international, national organizations involved in biotechnology
4. Micro Propagation,Totipotency and Morphogenesis, procedure, applications, problems and limitations.
5. Nutritional requirements of in-vitro cultures; Different types of media used in tissue culture laboratory

6 & 7.Techniques of In-vitro cultures, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements;

8. Soma clonal variation, Types, Reasons and achievements&Somatic embryogenesis and applications, limitations
9. Synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement.

10 &11. Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer and genomic library, cDNA library

12. Transgenic plants and their applications.
13. Blotting techniques –Southern, Northern and western. DNA finger printing
14. DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes
15. MAS, and its application in crop improvement. Mapping QTL, mapping populations used in MAS – Future prospects.
16. Nanotechnology: Definition and scope, types of nano material and their synthesis, green synthesis. Tools and techniques to characterize the nano particles.Nano-biotechnological applications with examples, Nano toxicology and safety.

Practicals:

1. Requirements and visiting of Plant Tissue Culture and molecular biology laboratory
2. Techniques in Plant Tissue Culture; Media components and preparations
3. Various Sterilization techniques used in tissue culture laboratory
4. Inoculation of various explants; Aseptic manipulation of various explants
5. Callus induction and Plant Regeneration

6,7,8&9. Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening / Acclimatization of regenerated plants

10. Somatic embryogenesis
11. Synthetic seed production
12. Isolation of protoplast; Demonstration of Culturing of protoplast
13. Demonstration of Isolation of DNA
14. Demonstration of Gene transfer techniques, direct methods; Demonstration of Gene transfer techniques, indirect methods
15. Demonstration of Confirmation of Genetic transformation
16. Demonstration of gel-electrophoresis techniques. Green synthesis of nano particles and their size characterization.

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GPBR-2.8.2 Breeding of Fruit and Plantation Crops 3 (2+1)

Theory:

1. Fruit breeding – history, importance in fruit production- distribution.
2. Domestication and adaptation of commercially important fruits and variability for economic traits.
3. History-Breeding objectives, breeding methods for development of fruit crops.
4 . Constraints in fruit breeding.

5&6. History-Breeding objectives, breeding methods for Mango and achievements.

7. History-Breeding objectives, breeding methods for Guava and achievements.
8. History-Breeding objectives, breeding methods for Custard apple and achievements.
9. History-Breeding objectives, breeding methods for banana and achievements.
10. History-Breeding objectives, breeding methods for Papaya and achievements.
11. History-Breeding objectives, breeding methods for Pomegranate and achievements.

12 & 13. History-Breeding objectives, breeding methods for Citrus and achievements.

14 & 15. History-Breeding objectives, breeding methods for Grapes and achievements.

16. History-Breeding objectives, breeding methods for Apple and achievements.
17. History-Breeding objectives, breeding methods for Sapota and achievements.
18. History-Breeding objectives, breeding methods in developing water melon and achievements.
19. History-Breeding objectives, breeding methods in developing musk melon and achievements.
20. History and importance of clonal selection in horticultural crops-hybrid clonal selection for hybrid clone.
21. History of mutation breeding-importance of bud mutations in horticultural crops, fruits and plantation crops.
22. Importance of mutations, mutagens types-chemical and physical mutagens.
23. Application of mutation, mutagens in horticultural crops and achievements.
24. History and development of hybrids, different breeding methods used in fruit crops
25. Breeding - history and importance of plantation crops.
26. Breeding methods and objectives for Tea and achievements.
27. Breeding methods and objectives for coffee and achievements.
28. Breeding methods and objectives for cocoa and achievements.

29 & 30. Breeding methods and objectives for coconut and achievements.

30 Breeding methods and objectives for Oilpalm and achievements.
31 Breeding methods and objectives for Cashewnut and achievements.
32 History -Policy manipulations and in vitro breeding tools followed in important fruit and plantation crops.

Practicals:

1. Selfing, emasculation and crossing techniques.
2. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Mango.
3. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Banana.
4. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Citrus.
5. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Guava.

6. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Sapota.
7. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Papaya.
8. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Custard apple.
9. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Watermelon.
10. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Muskmelon.
11. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Pomegranate.
12. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Cashewnut.
13. Breeding objectives, Floral biology, selfing, emasculation and crossing techniques in Coconut.
14. Study of pollen viability
15. Hybrid seed germination and raising of segregating generations.
16. Induction of mutations and polyploidy in major fruit and plantation crops.

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Kumar, N. 1997. Breeding of Horticultural Crops, Principles and Practices. New India Publishing Agency, New Delhi.
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GPBR-3.8.1 Breeding of vegetable, tuber and spice crops 3(2+1)

Theory:

1. Classification of plants based on pollination system, floral biology, modes of reproduction and genetics of important vegetable, tuber and spice crops.
2. Plant genetics resources-germplasm-types of germplasm- centers of origin and diversity and its conservation.
3. Breeding objectives and importance of breeding in vegetable crops.
4. Application of male sterility in vegetable crop improvement.
5. Role of self incompatibility in vegetable crops.
6. Methods of breeding of self pollinated vegetable, tuber and spice crops.
7. Methods of breeding of cross pollinated vegetable, tuber and spice crops.
8. Methods of breeding of asexually propagated vegetable, tuber and spice crops.
9. Importance of biotechnology in crop improvement of vegetable, tuber and spice crops.
10 & 11. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Tomato.
12. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Brinjal.
13. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Chilli.
14. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Bell pepper.
15. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Okra.
16. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Beans.
17. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in cauliflower.
18. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics breeding objectives and methods in Cabbage.
19. Origin and distribution of species, taxonomy, genetic resources, cytogenetic, genetics, breeding objectives and methods in Raddish.
20. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in carrot.
21. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Cucumber.
22. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics breeding objectives and methods in Ridgegourd.
23. Origin and distribution of species, taxonomy, genetic resources, cytogenetics,genetics, breeding objectives and methods in Bottlegourd.
24. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Bittergourd.
25. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics, breeding objectives and methods in Pumpkin.
26. & 27. Origin and distribution of species, taxonomy, genetic resources, cytogenetics, genetics breeding objectives and methods in Potato.
28. Origin and distribution of species, taxonomy, genetic resources, cytogenetics,genetics breeding objectives and methods in onion.
29. Origin and distribution of species, taxonomy, genetic resources, cytogenetics,genetics, breeding objectives and methods in Palak.

30. Origin and distribution of species, taxonomy, genetic resources, cytogenetics,genetics breeding objectives and methods in Amaranths.
31. Origin and distribution of species, taxonomy, genetic resources, cytogenetics,genetics breeding objectives and methods in Turmeric.
32. Origin and distribution of species, taxonomy, genetic resources, cytogenetics,genetics, breeding objectives and methods in Ginger.

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 Cucumber.
7. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Bottlegourd.
8. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Pumpkin.
9. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Potato.
10. Methods for creation of variability in Turmeric and Ginger.
11. Calculation of heterosis, heterobeltiosis and standard heterosis.
12. Calculation of inbreeding depression.
13. Calculation of General coming ability, specific combing ability, variances and effects.
14. Preparation and use of physical and chemical mutagens and induction of mutations.
15. Stability analysis (G x E interaction).
16. Maintenance of breeding records.

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GPBR-3.8.2 Seed Production and certification of Vegetable, Tuber and Spice Crops 3(2+1)

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 legislation-Seed Act and Seed Act enforcement – main features of the Seed Act 1966 – Central Seeds Committee – Central Seed Certification Board – State Seed Certification Agency – Central Seed Testing Laboratory – State Seed Testing Laboratory – Appellate Authority – recognition of Seed certification Agencies of foreign countries – notification of standards and procedures.
3. Notification of variety – regulation of sale of notified varieties – requirement for sale of seed; Enforcement of the Seed Act – sampling – duties and powers of seed inspectors – offenses of Seed Act and penalties.
4. Definitions of seed- differences between grain and seed- classes of seed.
5. Importance and scope of vegetable seed production in India and principles of vegetable seed production.
6. Seed extraction-methods of seed extraction.
7. Seed drying – methods of seed drying – sun drying – forced air drying – principle of forced air drying – properties of air and their effects on seed drying – moisture equilibrium between seed and air – drying zones in seed bin drying – forced air drying method.
8. Seed drying – heated air drying system – building requirements – types of air distribution system and seed drying – multiple bin storages – selection of crop dryers and systems of heated air drying – recommended temperature and depth for heated air drying of various crop seeds in bin – management of seed drying operations.
9. Seed cleaning – principle and method of cleaning seeds – air screen machine – principle of cleaning – parts of air screen cleaner **-** upgrading the quality of cleaned seeds – different upgrading machines, their principles of operation and uses.
10. Seed treatment – benefits – types of seed treatment – conditions under which seed must be treated – seed treating products – equipment used for seed treatment – colouring of seeds – causes of poor treatments – precautions to be taken during seed treatment.
11. Seed packaging – operations in packaging – equipments used for packaging of seeds – types of bags and packing sizes.
12. Seed storage – categories of seeds – orthodox and recalcitrant seeds – factors affecting seed longevity in storage and conditions required for good storage – general principles of seed storage.
13. Seed marketing – marketing structure and organization.
14. Seed testing – objectives of seed testing – International Seed Testing Association (ISTA) and Association of Official Seed Certifying Agencies (AOSCA) – establishment of Seed Testing Laboratory (STL) – seed testing procedures for quality assessment.
15. Seed purity analysis methods in different horticultural crops.
16. Seed dormancy – seed germination – seed viability – seed vigour – seed health and seed moisture.
17. Varietal identification through Grow Out Test (GOT) and electrophoresis.
18. Seed certification – history of seed certification – procedure for seed certification.
19. World Trade Organization (WTO) – objectives and functions – Intellectual Property Rights (IPR) — Plant Breeders' Rights (PBR) – benefits of PBR – disadvantages of PBR- Protection of Plant Varieties and Farmers' Rights (PPV and FR) Act.

20. Foundation and certified seed production of varieties and hybrids in Tomato.
21. Foundation and certified seed production of varieties and hybrids in Brinjal.
22. Foundation and certified seed production of varieties and hybrids in Okra.
23. Foundation and certified seed production of varieties and hybrids in Chillies and Capsicum.
24. Foundation and certified seed production of varieties and hybrids in Cucumber.
25. Foundation and certified seed production of varieties and hybrids in Bottlegourd and Ridgegourd.
26. Foundation and certified seed production of varieties and hybrids in Cabbage and Cauliflower.
27. Foundation and certified seed production of varieties and hybrids in tuber crops-Potato.
28. Foundation and certified seed production of varieties and hybrids in Carrot and Radish.
29. Foundation and certified seed production of varieties and hybrids in Leafy vegetables.
30. Foundation and certified seed production of varieties and hybrids in Spice crops-Turmeric and Ginger.
31. Foundation and certified seed production of varieties and hybrids in Bulb crops-Onion and garlic.
32. Foundation and certified seed production of varieties and hybrids in leguminous and exotic vegetables.

Practicals:

1. Study of seed structure, colour size, shape and texture.
2. Seed extraction in different crops.
3. Purity analysis in different crops.
4. Germination analysis in different crops.
5. Seed viability tests.
6. Seed vigour tests.
7. Seed certification procedure in different vegetable crops.
8. Study of seed production plots-hybrid seed production plots of cole crops.
9. Study of seed production plots-hybrid seed production plots of root vegetables.
10. Study of seed production plots-hybrid seed production plots of bulb crops.
11. Study of seed production plots-hybrid seed production plots of solanaceous vegetables.
12. Study of seed production plots-hybrid seed production plots of cucurbits.
13. Study of seed production plots-hybrid seed production plots of Okra and leafy vegetables.
14. Study of seed production plots-hybrid seed production plots of spices- Turmeric and Ginger.
15. Study of seed production plots-hybrid seed production plots of leguminous and exotic vegetables.
16. Visit to seed processing plant.

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	Natarajan, T. Saravanan, M. Bhaskaran, A. Bharathi, P. Nateshan, K. Malarkodi Agrobios (India), Jodhpur.
Vegetable Seed Production	*Nemgal Singh, P.K. Singh, Y.K. Singh and Virendra Kumar Technology 2006. International book distributing co., Lucknow.*
Seed Technology	*Khare, D. and Bhole, M.S. 2000. Scientific Publishers (India) Jodhpur.*
An introduction of seed technology	*Thomson, J.R. 1979. Leonard Hill, London*
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GPBR-3.8.3 Breeding and Seed Production of Flower and Ornamental Crops 2 (1+1)

Theory:

1. History of Improvement of Ornamental Plants-breeding objectives and methods in improvement of Ornamental Plants.
2. Plant Introduction, selection, Hybridization-Procedure- techniques and consequences.
3. Mutation Breeding- importance of mutation breeding in ornamental crops-applications of mutation breeding-biotechnological Techniques for the Improvement of ornamental Plants.
4. Heterosis and its exploitation in important ornamental crops-Use of inbred lines for the development of new varieties-Utilization of male sterility for hybrid Seed Production and Production of F_1 hybrids.
5. Techniques of hybrid seed production and OPVs in important flower and ornamental crops
6. Harvesting of Seeds, Seed Processing, Cleaning, Sizing and Packaging and storage.
7. Seed Certification- history of seed certification – procedure for seed certification.
8. Origin, distribution, Breeding Objectives and methods and seed production of Rose
9. Origin, distribution, Breeding Objectives and methods and seed production of Chrysanthemum
10. Origin, distribution, Breeding Objectives and methods and seed production of Marigold.
11. Origin, distribution, Breeding Objectives and methods and seed production of Gerbera
12. Origin, distribution, Breeding Objectives and methods and seed production of Jasmine.
13. Origin, distribution, Breeding Objectives and methods and seed production of Crossandra.
14. Origin, distribution, Breeding Objectives and methods and seed production of Tuberose.
15. Origin, distribution, Breeding Objectives and methods and seed production of Hibiscus.
16. Origin, distribution, Breeding Objectives and methods and seed production of Petunia.

Practicals:

1. Acquaintance with breeding tools for floricultural crops.
2. Pollen collection, its preparation and storage.
3. Determining the pollen viability through staining tests.
4. Methods of emasculation and pollination.
5. Determination of stigma receptivity.
6. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Rose.
7. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Chrysanthemum.
8. Breeding, objectives, Floral biology, selfing emasculation and crossing technique in Marigold.
9. Breeding objectives, Floral biology, selfing emasculation and crossing technique in Gerbera.
10. Breeding objective, Floral biology, selfing emasculation and crossing technique in Hibiscus.
11. Breeding objectives, Floral biology selfing emasculation and crossing technique in Jasmine.
12. Breeding objectives, Floral biology, selfing emasculation and crossing techniques in Petunia.
13. To study the harvesting stages of seed annuals.

14&15. Study of seed production plots of important ornamental crops.

16. Planting ratios, isolation distance, rouging, field inspection, etc., in seed production.

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B.P. Pal. The Rose in India.1966.Directorate of Knowledge management in Agriculture, Indian council of Agriculture Research-New Delhi.

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R.L. Agarwal. 1996. Seed Technology. Oxford&IBHPublishers, New Delhi

P.K. Agarwal. 1994. Principles of Seed Technology. ICAR Publication, NewDelhi

DEPARTMENT OF SOIL SCIENCE

ASSC 1.9.1 Fundamentals of Soil Science 2(1+1)

Theory:

1. Composition of Earth's Crust, Soil as a natural body- major components.
2. Physical Parameters: Texture – definition, methods of texture analysis, Stoke's law, Assumptions, Limitations, Textural classes, Use of textural triangle
3. Absolute specific gravity/ particle density, definition- apparent specific gravity- Bulk density – Factors influencing bulk density- Relation between bulk density, AD- practical problems
4. Soil Colour- definition- its significance, colour variable, Value, Hue and Chroma. Munsell colour chart, factors influencing soil colour- parent material, soil moisture organic matter
5. Soil structure- definition, classification, Clay prism like structure, factors influencing genesis of soil structure; Soil consistency; Soil Plasticity and Atterberg's constants
6. Soil air- air capacity, composition, factors influencing soil air, amount of air space, Soil air renewal
7. Soil temperature- Sources and Distribution of heat, factors influencing soil temperature, measurement and chemical properties
8. Soil colloids- Organic - humus, inorganic- secondary silicate clay minerals, clay, hydrous oxides; Ion exchange, cation – anion importance
9. Soil Water- forms- Hygroscopic, Caplillary and gravitational; Soil moisture constants- hygroscopic coefficient, wilting point, field capacity, moisture equivalent; maximum water holding capacity; Energy concepts, pF scale,
10. Soil water movement – classification, measurement- gravimetric- electric and tensiometer interpretation methods- Pressure plate and pressure membrane apparatus – Neutron probe
11. Aerial photography- Satellite of soil features- their interpretation. Soil orders, land capability classification, soil of different ecosystems and their properties
12. Rocks and Minerals classification-
13. Pedogenic processes
14. Objectives of soil science research institute in India (NBSS & LUP, ISSS, LTFE & NSSTL)
15. Management of soil crusting, Soil compaction and soil compression. Soil biology benefits and harmful effects
16. Methods and objectives of soil survey, Remote sensing application in soil and plant studies . Soil degradation

Practicals:

1. Collection and Preparation of Soil Samples
2. Estimation of Moisture content in the given soil sample
3. Estimation of pH and EC of the given soil sample
4. Estimation of Bulk density and pore space of soil
5. Texture analysis of the soil by robinson's pipette method
6. Description of soil profile in the field
7. Quantification of minerals and their abundance in soil
8. Determination of Soil colour using Munsell colour chart
9. Estimation of water holding capacity and Hydraulic conductivity of soils
10. Estimation of infiltration rate using double ring infiltrometer method
11. Estimation of soil moisture using gypsum block and neutron probe method
12. Soil compaction measurement with penetrometer

13. Determination of Field capacity and permanent wilting point of soil
14. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus
15. Aggregate size distribution analysis of soil
16. Air capacity of soil by field capacity

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ASSC-1.9.2 Soil Fertility, Soil Chemistry and Soil Taxonomy 3(2+1)

Theory:

1. Introduction: Importance of soil chemistry and soil fertility in crop production. Concepts of soil fertility and soil productivity. Definitions and differences. Soil as a source of plant nutrients
2. Nutrient Elements: Arnon's criteria of essentiality – Essential. Functional and Beneficial elements. Scientists responsible for the essentiality of individual nutrient elements. Classification of essential nutrients. Ionic forms of plant nutrients in soil. Beneficial elements.
3. Nitrogen: Occurrence, content and distribution. Factors influencing the content of nitrogen in soil. Forms of soil nitrogen. Nitrogen Cycle – Transformations in soils – Mineralization (Aminisation and Ammonification) – Fate of released ammonia – Factors affecting ammonium fixation. Nitrification – factors affecting nitrification – Fate of nitrate nitrogen – Dentrification – Nitrification inhibitors. Immobilization.
4. Nitrogen fixation: Different types – Biological fixation of nitrogen – Symbiotic and non symbiotic – Nitrogen balance sheet – Gains and loses – Functions – Deficiency symptoms – Corrective measures – Toxicity symptoms
5. Phosphorus: P – cycle – contents in soils – forms of phosphorus in soil – Inorganic and organic phosphorus compounds – Phosphorus fixation – Mechanisms of phosphate fixation.
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
7. Potassium: content in soil – Source – forms of soil potassium – Potassium fixation. Factors affecting potassium fixation- Quantity and intensity parameters – Luxury consumption – Functions and deficiency symptoms – corrective measures.
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
10. Sulphur: S – Cycle – Occurrence – Forms of Sulphur in soil. Sulphur transformation in soils – Mineralization and immobilization. Sulphur Oxidation – Factors affecting oxidation in soils. Sulphide injury – Causes, symptoms and remedial measures – Functions – Deficiency symptoms and corrective measures
11. Micronutrient: Sources – forms in soil solution – Pools of macronutrients – Predisposing factors for occurrence of micronutrient deficiencies in soil and plants.
12. Zinc : Contents – Forms in soils- Critical limits in soils and plants, factors affecting availability of zinc – Functions – Deficiency symptoms corrective measures
13. Copper and Iron – Content – Forms in soils – Critical limits in soils and plants. Factors affecting its availability – Functions – Deficiency symptoms – Corrective measures. Toxicity symptoms
14. Manganese: Content – Forms in soils – Critical limits in soils and plants. Factors affecting its availability. Functions – Deficiency symptoms.
15. Boron: Content – forms in soil – Critical limits in soils and plants. Factors affecting its availability – Functions – Deficiency symptoms – Corrective measures

16. Molybdenum and chlorine – Content – Forms in soils – Critical limits in soils and plants. Factors affecting their availability – Functions – Deficiency symptoms – Corrective measures. Toxicity symptoms.
17. Soil fertility Evaluation: Approaches – Nutrient deficiency symptoms. Soil testing – Objectives of soil testing – Chemical methods for estimating available nutrients
18. Plant analysis - Rapid tissue tests – DRIS – Indicator plants. Biological methods of soil fertility evaluation: Microbiological and pot culture methods. (Mentioning of methods names only)
19. 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.
20. Problems Soils: Definition – Classification – Acid, Saline, Saline Sodic – Sodic and Calcareous soils characteristics – Formation and Nutrient availability in problem soils.
21. 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.
22. 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
23. Soil Survey – Development – Concepts – Definition – Steps – Objectives – Importance
24. Land capability classification – Limitations – Sub classes – Units
25. Soil classification – Early system of soil classification – Soil taxonomy – Advantages – Salient features – Nomenclature at different category
26. Diagnostic horizons – Epipedons and Endpedons
27. Formative elements and keys to soil orders – Salient features of soil orders
28. Aerial photography – Types – Uses. Interpretation – Advantages and disadvantages
29. Remote Sensing – Indian Space Programme – Features of IRS series
30. Application of Remote Sensing Techniques in Horticulture
31. Soils of India – Characteristics – Equivalent taxonomy units
32. 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 NH_4 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

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Analytical Agricultural Chemistry: Chopra, S.C and Kanwar, J.S. 1976., Kalyani Publishers, Ludhiana
Soil Fertility and Fertilizers: Tisdale, S.L. Nelson, W.L. and Beaton, J.D. 1993., Macmillan Publishing Company, New York

ASSC–2.9.1 Weed Management in Horticultural Crops 2(1+1)

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.
3. Propagation of weeds – sexual – asexual – vegetative reproduction – rhizomes – root stocks – runners – stolen – suckers – offsets – tubers – bulbs – bulbils – stems and roots etc. – Dissemination (Dispersal) of weeds – dispersal of weed seeds and fruits – dispersal agents – wind and water – animal, man and manures – farm implements and silage. Dispersal of vegetative propagules.
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
6. & 7 Concepts of weed prevention control and eradication. Methods of weed control physical, mechanical, cultural, chemical and biological methods of weed control – bio-herbicides – integrated weed management.

   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.
11. & 12 Introduction to selectivity of herbicides – Fundamental principles of selectivity differential absorption of herbicides; differences in morphology and growth habits of plants – differential translocation of herbicides – differential rate of deactivation of herbicides by plants; metabolism, reverse metabolism and conjugation of herbicides in plants – differential protoplasmic resistance – multifactor selectivity of herbicides in plants – Compatibility of herbicides with other agro chemicals.

    13. Weed Management in vegetables – Leafy vegetables: Palak, Amaranthus, Soral Menthi, Coriander, Curry leaf; Solanaceous: Tomato, brinjal, chillies. Cucurbitaceae – Guards and melons Crusifers: Cabbage and cauliflower Peas and Beans: French bean, garden bean, cluster bean Tubers: Potato, yam, sweet potato Perennial vegetables: Little guard, pointed guard, drumstick.
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
4. Estimation of weed flora and calculation of weed control efficiency and weed index.
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.

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Modern Weed Management. *Gupta, O.P. 2000. Agribios (India), Jodhpur.*

Principles of Weed Science. *Rao, V.S. 2000. Oxford & IBH Publishing Company, New Delhi.*

Scientific Weed Management. *Gupta, O.P. 1984. Today and Tomorrow Printers and Publishers, New Delhi.*

A Handbook of some. South Indian Weeds. *Tadulingam, C. and Venkatnarayana, D. 1955. Government Press, Madras.*

All about weed Control. Kalyani Publishers, Ludhiana. *Subramanian, S. Mohammed Ali, A. Jayakumar R. 1991.*

ASSC 2.9.2 Water Management in Horticultural Crops 2 (1+1)

Theory:

1. Importance of water – definition – Functions of water in plants and effect of moisture stress on crop growth - Water resources in India and A.P - Irrigation development in India and A.P. before and after independence - Important irrigation projects in India and A.P – Area of different crops under irrigation
2. Soil-water relationships - Importance of soil, plant and water relationship (SPAC) - physical properties of soil influencing water retention - texture, structure and depth, particle density, bulk density and pore space in relation to moisture retention, movement and availability.
3. Soil moisture constants - saturation, field capacity, PWP, hygroscopic coefficient, moisture equivalent, available and unavailable soil moisture - theories of water availability – Kinds of water in soil
4. Methods of soil moisture estimation - Direct and indirect methods - gravimetric, volumetric, infra-red, spirit burning, tensiometers, resistance blocks, neutron moisture probe, pressure plate and pressure membrane apparatus - relative merits and demerits – movement of water and distribution of moisture in soil - Infiltration, percolation, permeability and seepage
5. Rooting characteristics, plant structure and root development, effective root zone depth of crops - moisture extraction pattern and moisture sensitive stages of different crops – soil water potential and plant water potential
6. Evapotranspiration (ET) - evaporation, transpiration and factors influencing evapo- transpiration – Lysimeters – evaporimeters
7. Measurement of PET by empirical methods - Blaney-Cridle, Thornthwaite, modified Penman, radiation method and pan evaporation method - Formulae and their merits and demerits.
8. Crop co-efficient - definition - normalized crop co-efficient curves- Crop co-efficient for different crops at different stages.
9. Water requirement - irrigation requirement - factors influencing water requirement of important crops – water requirement for important horticultural crops
10. 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
11. Methods of irrigation – classification – surface methods – flooding, check basin, basin, border, furrow, surge, cablegation – sub surface irrigation, merits and demerits of irrigation. Economic use of water – irrigation efficiencies – WUE, water conveyance, application and distribution efficiency
12. Drip irrigation – components – advantages and disadvantages – system layout – clogging problems – types of drip irrigation methods
13. Sprinkler irrigation – components – advantages and disadvantages – system layout
14. Fertigation – definition, methods – merits and demerits
15. Water management in problem soils – quality of water – criteria and limits – salinity hazards – management practices
16. Water management in horticultural crops – mango, citrus, grapes, coconut, guava, tomato, chillies, onion, turmeric, brinjal, gourds, water melon and musk melon

Practical

1. Determination of soil moisture content by thermo gravimetric method
2. Installation and working of tensiometer
3. Installation and working of gypsum blocks
4. Installation and working of Neutron moisture meter
5. Estimation of soil moisture constants (Field capacity)
6. Estimation of PWP by field method

7 & 8. Scheduling irrigation using IW/CPE method

9. Calculation of irrigation water needs

10. Layout of surface methods of irrigation
11. Layout and components of sprinkler irrigation, drip irrigation – clogging problems
12. Measurement of irrigation water by using water measuring devices
13 &14. Practice of land leveling and land shaping implements
15. Estimation of irrigation efficiency and water requirement of horticultural crops
16. Study on soil moisture conservation practices

References

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Manual on Irrigation Agronomy : Misra R D and Ahmed M 1987, Oxford and IBH publishing co. Ltd, New Delhi
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*Irrigation -Principles and Practices: Israelsen **O** W and Hansen V E 1962, John Willey & Sons Inc.,USA.*
Efficient Use of Irrigation Water : Sankafa Reddy G H and Yellariianda Reddy T,1996, Kalyani Publishers
Irrigation Agronomy : S R Reddy, Kalyani Publishers
Irrigation Water Management - Principles and Practices : DK Majumdar, 2002, Prentice Hall of India
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Irrigation - Theory and Practice: Michael A M, 1999, Vikas Publishing Home Pvt. Ltd, New Delhi.
Manual on Pressurized Irrigation : Tiwari K N T, 2006, Scientific Publication IIT, Kharagpur

ASSC 2.9.3: Manures, Fertilizers and Nutrient Management 2(1+1)

Theory

1. Introduction- Definition, difference between manures and fertilizers-Classification of manures (Bulky & Concentrated) with suitable examples. Importance of manures in soil fertility management
2. Bulky organic manures –Preparation of FYM –Methods of collection and storage.
   Losses of nutrients from FYM during collection and storage-Ways to minimize these losses
3. Compost and composting –Different methods of composting including the starters and raw materials. Details of methods of preparation of rural and urban compost. Mechanical compost plants –Vermicomposting
4. Biogas plant – Principles of operation and its advantages. Green manures –Classification with examples .Advantages and limitations of green manuring and green leaf manures
5. Definitions of Penning, Sewage, Sullage, Sludge and Poudrette. Concentrated organic manures – Oil cakes, Blood meal, Bone meal, Horn meal, Fish meal, Meat meal and Guano
6. Commercial fertilizers–Nitrogenous fertilizers- Manufacturing of Ammonia-Manufacturing process and properties of nitrogenous fertilizers viz., Ammonia, Ammonium sulphate
7. Manufacturing process and properties of major nitrogenous fertilizers viz., , Urea and Calcium ammonium nitrate. Slow releasing N Fertilizers
8. Phosphatic fertilizers –Rock phosphate –Uses – Occurrence, types and properties. Manufacturing process and properties of SSP, TSP and Basic slag
9. Potassic fertilizers –Mineral sources –Manufacturing process and properties of Muriate of potash and Sulphate of potash- Mode of action of N, P and K fertilizers in soils
10. Secondary and micronutrient fertilizers –Conditions leading to their deficiency-Importance of use of 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 Nitrophosphates and NPK Complexes. manufacturing process and properties.
12. Mixed and bulk blended fertilizers. Dry and wet process of mixing- advantages and Disadvantages of mixed fertilizers over straight fertilizers. Physical and Chemical problems associated in their preparation. Compatibility of fertilizers .
13. Granulaion, Unit value, grade and ratio of fertilizers, computation of fertilizer mixture. Combined application of fertilizers and Agricultural chemicals- Precautions and Compatibility. Biofertilizer – Methods of preparation, Use of biofertilizers in agriculture, horticulture and sericulture.
14. Fertilizer use efficiency- Soil, Plant and Fertilizer and management factors influencing FUE- Measures to improve the use efficiency of N, P and K fertilizers- FUE in relation to balanced fertilization and Soil moisture supply. Direct and Residual effects of fertilizers and Manures. Foliar nutrition of Crops- Importance and Limitations
15. Integrated Nutrient management (INM): For Agricultural and Horticultural crops – Need components, Nutrient gains, constraints and Prospects of adopting INM.
16. Quality Control of Fertilizers- FCO (1957) – Its importance and regulations. specifications and standards for importance chemical fertilizers- urea, SSP, MOP, DAP and Zinc Sulphate

Practicals

1. Sampling of organic manures and fertilizers for chemical analysis
2. Physical properties of manures and fertilizers

3. Quick tests for identification of important fertilizers
4. Detection of adulteration in fertilizers
5. Estimation of ammonical nitrogen in ammonical fertilizers (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 P_2O_5 in SSP
10. Estimation of potassium in MOP/SOP
11. Estimation of Zinc in Zinc sulphate
12. Determination of Calcium in SSP or Lime
13. Determination of Sulphur 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

References:

Manures and Fertilizers — *Yawalkar, K.S. Agarwal, J.P. and Bokde, S. 1977. Agri-Horticultural Publishing House, Nagpur*

Hand Book on Fertilizers Technology — *Seetharamaan, S. Biswas, B.C. Maheswari, S. and Yadav,D.S.1986. The Fertilizers Association of India, New Delhi*

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Hand Book on Fertilizers Usage — *Seetharamaan, S. Biswas, B.C. Maheswari, S. and Yadav, D.S. (1986). The Fertilizers Association of India, New Delhi*

ASSC-3.9.1 Organic Farming in Horticultural Crops 2(1+1)

Theory:

1. Organic farming – Introduction - concept and definition – major aims – relevance in present context – options in organic farming – advantages and components of organic farming – organic production requirements
2. & 3 Biological : intensive nutrient management – definition – Organic manures : Characteristics, advantages and disadvantages, classification – bulky organic manures – FYM, sheep and goat manure, poultry manure, night soil, compost, sewage and sludge, concentrated organic manures – oil cakes, meal group of manures, guano

4. Compost – Definition – Principles of composting – Methods of com posting: Indore method, Bangalore method, Coimbatore method, NADEP compost, composting of coir pith and pressmud
5. Vermi – composting – Definition – advantages – materials for vermicomposting – procedure to prepare vermicompost – Requirements for vermicomposting – application of vermicompost
6. Green manures – Characteristics of green manure crops – crops suitable for green manuring – Types and methods of green manuring – advantages and disadvantages of green manuring
7. Biofertilizers – Definition – Types of biofertilizers – Nitrogen fixers, phosphate solobilising micro organisms – Mycorrhizal fungi – Methods of application of biofertilizers – Advantages and disadvantages with biofertilizers
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
13. & 14 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 plant s – Allelopathy – IWM

15. Quality consideration, certification, labeling and accreditation processors
16. 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-pesticeds 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.
10.
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.

References:

Organic farming for Sustainable Agriculture *Dahama, A.K. 2007. Agros Bios (INDIA), Jodhpur.*

A Hand Book of Organic Farming in India *Arun, K. Sharma. 2006. Agros Bios (INDIA), Jodhpur.*

Trends in Organic Farming in India *Purshit, S.S. 2006. Agros Bios (INDIA), Jodhpur.*

Organic Farming - Theory and Practice *Palaniappan, S.P. and Annadurai, K. 2003. Scientific Publishers (India) Ltd., Jodhpur.*

Organic Agriculture *Thampan, P.K 1995. Peckay tree Crops Development Foundation, Cochin, Kerala.*

Vermiculture and Organic Farming *Sathe, T.V. 2004. Dayas Publishing House, New Delhi.*

ASSC-3.9.2 Introduction to major field crops 2(1+1)

Theory:

1. Classification and distribution of field crops, definitions and concept of multiple cropping, mixed cropping intercropping, relay and alley cropping, sustainable agriculture
2. Rice-introduction-origin-area and production-climate and soils-varieties and hybrids for AP – classification of plant types – rice nurseries-wet, dry, dapog and modified dapog, puddling – rice seasons in AP-seeds and sowing-direct seeding and transplanting.
3. Systems of rice cultivation-upland, low land, SRI, aerobic rice-nutrient management (N, P, K, Zn, iron and bio fertilizers) – steps for increasing fertilizer use efficiency in rice
4. Water management – methods of irrigation – submergence Vs flodding-weed management-crop rotations-harvesting, threshing and processing – yield attributed and yield
5. Wheat-origin-area and production-wheat growing zones of India-climate and soils-varieties-tillage-seeds and seeding-nutrient, water and weed management-crop rotations –harvesting, threshing and processing – yield attributed and yield
6. Maize: Origin-area and production-classification of maize-climate and soils – varieties-tillage-seeds and seeding-nutrient, water and weed management-crop rotations-harvesting, threshing and processing-yield attributed and yield
   Sorghum: Origin-area and production-growing seasons in A.P.-climate and soils – varieties-tillage-seeds and seeding-nutrient, water and weed management-crop rotations-midseason correction-harvesting, threshing and processing-yield attributed and yield-ratooning
7. Importance of pulses – Chickpea and Pigeon pea: Origin-area and production-climate and soils – varieties for AP tillage-seeds and seeding-nutrient, water and weed management-crop rotations-harvesting and storage -yield attributed and yield
8. Black gram, Green gram and cow pea: 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
9. Importance of oil seeds-Soybean: 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 Groundnut: Origin-area and production-characters of Virginia and Spanish species of ground nut-climate and soils – varieties –tillage-seeds and seeding-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
12. Cotton: Origin-area and production-types of cotton-climate and soils – varieties for AP –tillage-seeds and seeding-Topping and boll shedding-nutrient, water and weed management-crop rotations-harvesting –quality evaluation -yield attributed and yield
13. Sugarcane: Origin-area and production-climate and soils – varieties –tillage-seed material-methods of planting-blind hoeing-trash mulching -nutrient, water and weed

management-crop rotations-wrapping and propping-harvesting ratoon crop management

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

References:

Modern Techniques of raising Field crops — *Chidda Singh 1983. Oxford & IBH, Publishing Co., New Delhi*

Text Book of Field crops Production, — *Rajendra Prasad 2002. ICAR, New Delhi.*

Agronomy of Field crops, — *Reddy, S.R. 2004. Kalyani Publishers, Ludhiana.*

Forage Production, — *Subhash Chandra Bose, M. and Balakrishnan, V. 2001. South Asian Publishers, New Delhi.*

ASSC 3.9.3 Agricultural Meteorology and Climate change 2 (1+1)

Theory

1. Meteorology - introduction - definitions of meteorology, climatology and agricultural meteorology - scope and practical utility of agricultural meteorology - Composition and structure of atmosphere - definitions of weather and climate -aspects involved in weather and climate

2. Air temperature - introduction - temperature and heat definitions - isotherms - horizontal and vertical temperature variations in the atmosphere - cardinal temperatures - importance of air temperature in crop production - Low air temperature and plant injury – high air temperature and plant injury – soil temperature – factors affecting soil temperature

3. Solar radiation - definition, introduction of electromagnetic spectrum and functions of light, solar constant, net radiation, black body radiation, emissivity, absorptivity, reflectivity, transmissivity and albedo - Physiological response of different bands of incident radiation - factors affecting distribution of solar radiation within the plant canopy

4. Definitions of atmospheric pressure, cyclones – anticyclones – pressure patterns – wind – effects of wind on crops – mountain and valley winds – land and sea breezes - Atmospheric humidity and its expression - saturation - effects of humidity on crops

5. Evaporation and transpiration - definition - factors affecting rates of evaporation and transpiration - Rainfall - importance of rainfall on crops - types of rainfall - monsoon - definition - origin and distribution of south west monsoon and North East monsoons– their impact on farm operations

6. Condensation and precipitation - definition, different forms of condensations and precipitations - Clouds - cloud formation - cloud classification and characteristics - World Meteorological Organization (WMO) - cloud seeding (artificial rain making)

7. Drought - definition - types of drought - effect of drought on crops - management of drought - Weather disasters and management - rainfall, heat and cold waves, windstorms, hail storms, thunderstorms, dust storms, tornadoes and defective insolation

8. Weather forecasting - applications and utility for agriculture - synoptic charts, reports and symbols - Remote sensing - definition - introduction - applications in Horticulture

9. Climate change: causes – Global warming – Effect of climate change on horticulture – past and future changes in green house gases with in the atmosphere – sources and sinks for green house gases

10. Atmospheric chemistry – plants sense and respond to changes in CO_2 concentration
11. Measurement of short term effects and mechanisms underlying the observed responses in C_3 and C_4 species

12 & 13. Plant growth and development as affected by the elevated CO_2 – physiology of rising CO_2 on nitrogen use and soil fertility – its implication for production – methodology for studying the effect of CO_2

14. Change in secondary metabolites and pest disease reaction of plants – the mechanisms of ozone and UV damage and tolerance in plants.

15. Increased temperature and plants in tropical/sub tropical climates – effect on growing season, timing of flowering, duration of fruit development and impacts on crop yields and potential species ranges, interaction of temperature with other abiotic/biotic stress.

16. Mitigation strategies and prospects for genetic manipulation of crops to maximize production in the future atmosphere. Modifying Rubisco, acclimation, metabolism of oxidizing radicals and sink capacity as potential strategies

Practicals

1. Site selection for agromet observatory
2. Calculation of time
3. Measurement of temperature (air/soil)
4&5. Measurement of rainfall - different types of rain-gauges
6. Measurement of evaporation (atmospheric/soil)
7. Measurement of atmospheric pressure
8. Measurement of sunshine duration
9. Measurement of wind direction and speed
10. Measurement of relative humidity
11. Measurement of radiation and its components
12. Visit to meteorological observatory
13. Visit to IMD - layout plan of standard meteorological observatory
14 & 15. Study of weather forecasting, synoptic charts, weather reports and symbols
16. Estimation of green house gas emissions

References

Radha Krishna Murthy, V., Yakadri, M. and Prasad, P.V.V. 2006. Terminology on Agricultural Meteorology and Agronomy. B.S. Publications, Hyderabad.

Radha Krishna Murthy, V. 2002. Basic Principles of Agricultural Meteorology. B.S.Publications, Hyderabad.

ASSC-3.9.4 Introductory Agroforestry 2(1+1)

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
3. Social Forestry – need, objectives and Scope – Difference between Agroforestry and Social and Farm Forestry.
4. Intercropping, cover cropping, wind breaks and shelter belts – orientation, design and choice of species for wind breaks.
5. Classification of Agroforestry systems and practices – agri-silviculture / agri-horticulture systems – choice of species for timber, fuel wood, fodder and fruits.
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.
10. Home gardens – types – practices in different countries – role in economy – Shifting cultivation – Taungya system.
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
14. Multi-purpose tee species – their management practices for economic cultivation – Acacia catechu, A.nilotica, Dalbrgia sissoo, Quercus Spp.
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.
5. Measurement of tree height and diameter.
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.

References:

An Introduction to Agroforestry	*Ramachandran Nair, P.K. 1993. First reprint in India - 2008 Springer International Edition.*
Agroforestry in India	*Tejawani, K.G. 1994. Oxford & IBH, Publishing Co. Pvt. Ltd., New Delhi.*
Plantation forestry in India	*Luna, R.K. 1989. International Book Distributors, Dehradun.*
Biodiesel and Jatropha Plantations	*Leda Satish. 2006. AGRO BIOS, Jodhpur.*
Trees of A.P and India	*Pullaiah, T. Sandhya Rani, S. 1999. Regency Publication, New Delhi.*
Forest Menstruation	*Chaturvedi, A.N. and Khanna, L.S. 1982. Reprinted in 2006. International Book Distributors, Dehradun.*
Forest Tree Seed	*Negi, S.S. 2006. Prashant Gahlot at Valley printers and publishers, Dehradun.*

Department of Plant Physiology, Biochemistry and Microbiology

PPBM-1.10.1 Introductory Crop Physiology 2(1+1)

Theory

1. Introduction-Definition of Crop Physiology- Importance in Horticulture
2. Water relations in plants- Role of water in plant metabolism-Inhibition of Osmosis- diffusion-water uptake (passive and active) and transport-water potential and its components
3. Methods of measurement of water potential in plants-Mechanism of water absorption-Ascent of Sap- Soil Plant Atmosphere Continuum (SPAC)
4. Transpiration-definition and importance, various modes of transpiration- Factors affecting transpiration-Root pressure-Guttation-Stem bleeding.
5. Structure, distribution and classification of stomata-Mechanism of opening and closing of stomata
6. Drought Types stresses: Effect of water stress on plant growth and development-mechanism of drought tolerance in plants
7. Effect of heat/cold stress on plant growth and development-mechanism of heat/cold tolerance in plants
8. Effect of light on plant growth and development-mechanism of high/low light tolerance in plants
9. Plant Nutrition-Criteria for essentiality of nutrients-Classification of nutrients based on uptake and biochemical function-Mechanism of absorption of plant nutrients
10. Physiological roles of plant nutrients-Biological Nitrogen fixation in plants.
11. Nutrient deficiency and toxicity symptoms-Amelioration
12. Photosynthesis-Importance-Structure and function of chloroplast-Light reactions-Z scheme of electron transport –cyclic, Non-cyclic, Pseudocyclic photophosphorylation
13. Photosynthesis-Dark reactions-C_3, C_4 and CAM pathways-significance and differences
14. Photorespiration and its significance-Factors affecting photosynthesis-light, CO_2, temperature and water-Methods of measurement of photosynthesis.
15. Mode of herbicide action
16. Secondary metabolites-its role in plant defense

Practicals:

1. Preparation of solutions
2. Measurement of water potential in plants
3. Measurement of seedling root pressure in seedlings
4. Identification of structure, distribution, opening and closing of stomata
5. Measurement of Transpiration and its calculation
6. Measurement of photosynthesis by Hill Reaction
7. Measurement of Absorption spectrum of chloroplastic pigments in horticultural crops
8. Identification of chlorophylls, carotenes and xanthophylls in horticultural crops
9. Estimation of catalase activity
10. Estimation of phenols
11. &12 Identification of various plant movements
13. Root Initiation of stem cuttings with different nodes
14. Observation of Root Initiation in Hard wood, semihard wood and soft wood cuttings
15. Root Initiation of stem cuttings by using Hormonal solutions
16. Root Initiation of leaf cuttings

References:

1. Salisbulry. 2007. Plant Physiology. CBS. New Delhi.

2. *Taiz, L. 2010.Plant Physiology. SINAUR. USA.*
3. *Zeiger. 2003.Plant Physiology. PANIMA. New Delhi.*
4. *Edward E. Durna. 2014. Principles Of Horticultural Physiology. CABI, UK.*
5. *Delvin, R.M . 1986. Plant Physiology. CBS. Delhi.*
6. *Richard, N. Arteca. 2004. Plant Growth Substances. CBS. New Delhi.*
7. *Jacobs, W. P. 1979. Plant Hormones And Plant Development. Cambridge Univ. London.*
8. *Basra, A. S. 2004. Plant Growth Regulators in Agriculture & Horticulture. HAWARTH press. New York.*
9. *Lincoln Taiz and Eduards Zeiger (5th Edition). Plant physiology*
10. *Noggle G.R and Fritz T.G. Introductory Plant Physiology*
11. *Pandey and Sinha. Plant Physiology*
12. *Salisbury and Ross. Plant Physiology*
13. *Carl fedtke. Biochemistry and Physiology of Herbicide Action*
14. *Aswani pareek, S.K. Sopory, Hans Bohnert Govindjee. Abiotic stress adaptation in plants: Physiological, Molecular and Genomic foundation*

Horst Marschner, Mineral Nutrition of Higher plants

PPBM 1.10.2 Introductory Microbiology 2(1+1)

Theory :

1. Introduction to microbiology - History of microbiology – spontaneous generation theory and contributions of Antony von Leeuwenhoek, Fransesco Redi, Lazzero Spallanzani, Franz Shultz, Schroder and von Dush, Louis Pasteur and John Tyndal; Role of microbes in fermentation and contributions of Cagnaird Latour, Theodor Schwann, F.Kutzing, Louis Pasteur etc.,
2. Germ theory of disease – contribution of Hippocrates, Louis Pasteur and Robert Koch; Pure culture methods by Joseph Lister, Robert Koch, Beijerinck, Winogradsky, Schroder and Von Dush, John Tyndall etc.,
3. Development of Microbiology in India - Applied areas of microbiology – agricultural microbiology, industrial microbiology, medical microbiology, exo microbiology, geo microbiology, pollution microbiology, aero microbiology, aquatic microbiology, food microbiology and microbial biotechnology
4. Microorganisms – different microbial groups – bacteria, fungi, protozoa and algae – importance of different microbial groups
5. Microscopy- Simple, Compound, Light and electron micro scope, bright field microscope and phase contract microscope
6. Specimen preparation –,fixiation,dyes and simple staining and differential staining
7. Prokaryotic cell structure – morphological types – functions of different parts of bacterial cells – cell wall composition – differences between prokaryotes and eukaryotes
8. Types of culture media, synthetic and non synthetic, Liquid and solid media and pre culture techniques
9. Growth of microorganisms – cell division – growth cycle of bacteria (lag phase, log phase, stationary and death phase) – generation time – growth rate – growth yield – Measurement of bacterial growth
10. General properties of viruses and brief description of bacteriophages- structure and properties of viruses and phages (bacterial viruses) – structure of T2 phage – general properties of bacterial viruses – different morphological types of phages
11. DNA as genetic material - Replication – transcription – translation – genetic code – regulation of gene expression - operon concept - plasmid and episomes
12. Microbial association (intra microbial and extra microbial association) Symbiosis, Antibiosis, mutulism, parasitism and synergism
13. Streilization methods-physical and chemical, Isolation of pure culture and preservation of cultures
14. Plant growth promoting microorganism and mushrooms-Economic importance-. Beneficial microorganisms in Horticulture – biofertilizers and Microbial pesticides (bacterial, cyanobacterial and fungal) – list of bacteria, cyanobacteria, fungi used as bioinoculants / biofertilizers/pesticides– advantages and disadvantages of PGPR – different methods of application
15. Industrial microbiology – Fermentation – components of fermentation – list of different types of fermentations with examples of microorganisms batch, fed- batch continuous and solid state fermentations
16. Mush rooms- edible and poisonous types, nutritive values, culturing and production techniques

Practicals:

1. General instructions and familiarization with instruments, materials, glassware etc.
2. Examination of natural and living bacteria
3. Preparation of nutrient broth, nutrient agar plates and nutrient agar slants

4. Evaluation of aseptic technique with nutrient broth tubes and nutrient agar plates
5. Morphological examination of bacteria by simple and differential staining, Gram's staining
6. Enumeration of bacteria by stained slide method
7 Enumeration of bacteria by most probable number method
8. Methods of Sterilization, liquids, glassware and microbial cultures
9 and 10. Plating methods- Pour plate- streak plate and spread techniques
11. Estimation of microbial growth
12 and 13. Mushroom culture-Spawn production
14. Culture and production techniques, harvesting, packing and storage
15. Visit – biofertiliser or biocontrol agent production unit
16. Semester final practical examination

References:

1. *Microbiology- Pelczar, Chan, M.J.E.C.S. and Krieg, N.R. 1998. McGraw-Hill Publishers, New York.*
2. *General microbiology -Jamaluddin, Malaviya, N. and Sharma, A. 2006. Scientific Publishers, Washington.*
3. *Biology of Micro organisms-Madigan, M., Martinko, J.M. and Parker, J. 2003. Prentice Hall of India Pvt. Ltd., New Delhi.*
4. *.Introduction to Soil and Agricultural Microbiology- Prabhakaram, G. 2004 Himalaya Publication House, Mumbai.*
5. *Microbiology. Prescott, L.M., Harley, J.P. and Klein, D.A. 2002. McGraw-Hill Publishers, Newyork.*
6. *Agricultural Microbiology. - Rangaswami, G. and Bhagyaraj, D.J. 2001.Prentice Hall of India Pvt. Ltd., New Delhi*
7. *General Microbiology.- Sullia, S.B. and Shantaram, S. 1998 Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi*
8. *General Microbiology -Stainer,R-1987,Palgrave Macmillan*
9. *General Microbiology- R. P Singh-2007 Kalyani publication*
10. *Introductory Microbiology-Heritage,J., Evans,E.G.V,Killington,R.A-2008 Cambridge University Press*
11. *Introduction to Microbiology- Edward Alchano-2002 Jones and Bartlett hearing*

PPBM 1.10.3 Elementary Plant Biochemistry 2(1+1)

Theory

1. Carbohydrates: Occurrence, classification and structures;
2. Physical and chemical properties of carbohydrates - isomerism, optical activity, reducing property, reactions with acids and alkalis, ozone formation.
3. Lipids: classification, important fatty acids and triglycerides, essential fatty acids;
4. Physical and chemical control of oils, their rancidity, phospholipids - types and importance.
5. Plant pigments - structure and function of chlorophyll and carotenoids,
6. Sterols - basic structure, role of brassinosteroids in plants.
7. Proteins: Classification, functions and solubility,
8. Amino acids: Classification and structures; essential amino acids, properties of amino acids, colour reactions, amphoteric nature and isomerism;
9. Structure of proteins - primary, secondary, tertiary and quaternary; properties and reactions of proteins.
10. Enzymes: Classification and mechanisms of action;
11. Factors affecting enzyme action, cofactors and coenzymes, vitamins and minerals as co-enzymes/co-factors
12. Carbohydrate metabolism: glycolysis and TCA cycle;
13. Metabolism of lipids: fatty acid oxidation, biosynthesis of fatty acids,
14. Electron transport chain. Bioenergetics of glucose and fatty acids.
15. Structure and function of nucleic acids;
16. Replication, transcription and translation.

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. Estimation of total sugars;
6. Amino acids: Reactions of amino acids;
7. Proteins: Estimation of proteins by Lowry's method;
8. Fatty acids: Estimation of free fatty acids;
9. Determination of iodine number of vegetable oils;
10. Vitamins: Estimation of Ascorbic acid;
11. Techniques: Paper chromatography;
12. Thin layer chromatography;
13. Electrophoresis of pigments extracted from flowers,
14. Extraction of oil from oil seeds;
15. Enzymes: Enzyme assay;
16. Enzyme Immobilization.

References:

1. *Lehninger, Nelson, D. L. and Michael, M. C. 2004. Principles of Biochemistry. Freeman Publishers*
2. *Narayanan L M. Biochemistry. Saras Publications*
3. *Bose. Developments in Physiology Biochemistry & Molecular Biology of Plants Vol.-1. New India Publications.*

4. *Voet, D and Voet J. G. 2004. Biochemistry 4th Edn. Wiley & sons Publishers. USA.*
5. *Sadashiv, S and Manickam, A. 1996. Biochemical methods for Agricultural sciences. New age Interantional publishers, New Delhi.*
6. *Voet, D. and Voet, J.G. 2004. (3rd edit). Biochemistry. John Wiley & sons Incl.USA.*
7. *Rameshwar, A. 2006. (3rd edit). Practical Biochemistry. Kalyani Publishers, NewDelhi.*
8. *Buchanan, B. B., Gruissem, W. and Jones, R. L. 2002. Biochemistry and molecular biology of plants. 2nd edition. Blackwell publications, UK.*

PPBM-1.10.4 Growth and Development of Horticultural Crops
2(1+1)

Theory

1. Definition of Growth and Development- types of growth-monocarpic and polycarpic-Phases of growth-Lag phase, Log phase, decline phase and senescent phase Stages of growth-Embryonic, Juvenile, Transitional, Maturity, senescence; Growth curves-Sigmoid and Double sigmoid with examples-Factors affecting growth
2. Definition of Growth analysis-its advantages and disadvantages-growth parameters Photosynthetic productivity of horticultural crops-LAI, Optimum LAI in horticultural crops
3. Plant Bio- regulators: Auxins-basic functions, biosynthesis-role in crop growth and development—propagation-flowering-fruit setting-fruit thinning-fruit development-fruit drop-and fruit ripening.
4. Plant growth regulators: Gibberellins- basic functions, biosynthesis-role in crop growth and development—propagation-flowering-fruit setting-fruit thinning-fruit development-fruit drop-and fruit ripening.
5. Plant growth regulators: Cytokinins- basic functions, biosynthesis-role in crop growth and development—propagation-flowering-fruit setting-fruit thinning-fruit development-fruit drop-and fruit ripening.
6. Growth Inhibitors: ABA & Ethylene- basic functions, biosynthesis-role in crop growth and development—propagation-flowering-fruit setting-fruit thinning-fruit development-fruit drop-and fruit ripening.
7. Growth Retardants basic functions, biosynthesis-role in crop growth and development—propagation-flowering-fruit setting-fruit thinning-fruit development-fruit drop- and fruit ripening.
8. Flowering- factors affecting flowering-Physiology of flowering-Ripeness to flowering, Definition of photoperiodism-Classification of plants based on photoperiodic response- Long day-short day and day neutral plants-formation of floral stimulus and its translocation-Role of phytochrome in flowering- Importance of photoperiodism in horticulture
9. Vernalization: Definition, examples for vernalization in horticulture, site of vernalization, vernalization stimulus- mechanism of vernalization-Devernalization-conditions required for vernalization-Importance of vernalization in horticulture
10. Physiological Aspects of pruninig and Training in horticultural crops Definition of Pruining-Training-Factors affecting training- Apical dominance-Photosynthsis-Canopy structure-Effective leaf area-Source-sink relationship- Effect of pruning on growth-fruiting spur-fruit bud formation-Effect on yield-size-color and quality of fruits
11. Source-sink relationship-Types of assimilate transport-Various theories explaning short and long distance transport -symplast-apoplastic transport in plants
12. Seed Physiology-Definition of seed-Seed Structures-Development of embryo, endosperm, perisperm and seed coat-Morphological, physiological and biochemical changes during seed development
13. Physiological Maturity-Morphological and Physiological changes associated with physiological maturity in crops with examples-Harvestable Maturity- Definition of Seed viability and vigour-Factors affecting seed viability and vigour
14. Seed and bud dormancy-Definition-Types of seed dormancy-causes and remedial measures of seed dormancy with examples
15. Physiology of fruit growth and development-fruit setting-factors affecting fruit set and -Physiology of Fruit Ripening-Climacteric and non-climacteric fruits development
16. Physiology of fruits under post harvest storage

Practicals

1. Types of growth-Monocarpic and Polycarpic growth (Preparation of Herbarium sheets under each category)
2. Measurement of Leaf area by different methods
3. Growth Analysis
4. Preparation of plant growth regulator solutions
5. Auxin bioassay test
6. Gibberellin bioassay test
7. Cytokinin bioassay test
8. Effect of ABA on Stomatal opening
9. Effect of Ethylene on fruit ripening
10. Important Physiological disorders and their remedial measures in Vegetables
11. Important Physiological disorders and their remedial measures in fruits
12. Rapid tissue tests
13. Breaking dormancy in seeds by chemicals
14. Breaking dormancy in seeds by Growth Regulators
15. Seed Viability by tetrazolium test
16. Seed Germination test

References:

1. *Salisbulry. 2007. Plant Physiology. CBS. New Delhi.*
2. *Taiz, L. 2010.Plant Physiology. SINAUR. USA.*
3. *Zeiger. 2003.Plant Physiology. PANIMA. New Delhi.*
4. *Edward E. Durna. 2014. Principles of Horticultural Physiology. CABI, UK.*
5. *Delvin, R.M . 1986. Plant Physiology. CBS. Delhi.*
6. *Richard, N. Arteca. 2004. Plant Growth Substances. CBS. New Delhi.*
7. *Jacobs, W. P. 1979. Plant Hormones And Plant Development. Cambridge Univ. London.*
8. *Basra, A. S. 2004. Plant Growth Regulators In Agriculture & Horticulture. HAWARTH press. New York.*
9. *Lincoln Taiz and Eduards Zeiger (5th Edition). Plant physiology. Sinauer Associates, Inc.*
10. *Noggle G.R and Fritz T.G.1944. Introductory Plant Physiology.*
11. *Pandey and Sinha. Plant Physiology.*
12. *JKA Bleasdale, Plant Physiology in relation to Horticulture*
13. *Amarjit Basra, Plant Growth Regulators in Agriculture and Horticulture: Their role & Commercial Uses.*
14. *C.Rajendran, K.Ramamoorthy and S. Juliet Hepziba, Nutritional and Physiological Disorders in Crop Plants*

Department of English, Statistics and Social Science

ESSC 1.11.1 Economics and Marketing 3 (2+1)

Theory

1. Nature and scope of economics, definitions of economics, basic terms and concepts
2. Divisions of economics, economic systems, approaches to the study of economics
3. Consumption – theory of consumer behaviour, laws of consumption
4. Classification of goods; Wants – their characteristics and classification
5. Utility, forms of utility, characteristics, utility measurement, cardinal and ordinal
6. Law of Diminishing Marginal Utility – Statement, assumptions of law, explanation, limitations of the law, Importance
7. Law of Equi-marginal Utility – Statement, Assumptions, Explanation of the Law, Practical Importance, Limitations
8. Consumer's surplus - meaning, Assumptions, explanation, difficulties in measuring consumer's surplus, importance
9. Indifference curve and its properties, Consumer equilibrium
10. Demand - meaning, definition, types of demand, Demand schedule, demand curve, law of demand – contraction and extension, increase and decrease in demand
11. Elasticity of demand - meaning, Types and Degrees of elasticity of demand, practical importance of elasticity of demand, Factors determining Elasticity of Demand
12. & 13 Supply - meaning, definition, law of supply- supply schedule, supply curve, Increase and decrease in supply, contraction and extension of supply, Elasticity of supply, Degrees of elasticity of supply, factors affecting elasticity of supply
13.
14. Engel's law of family expenditure, significance and its implications, preparation of family budget
15. Theory of firm , Factors of production – land and its characteristics, labour and division of labour
16. Theories of population-Malthusian theory and modern theory - Daltons formula of maladjustment
17. Capital and its characteristics – classification and capital formation
18. Enterprises – forms of business organization – merits and demerits.
19. & 20 Distribution – theories of rent, wage, interest and profit
20.
21. Marketing- definition – Marketing Process – Need for marketing – Role of marketing, Marketing functions, Constraints in marketing of agricultural produce
22. & 23 Classification of markets, characteristics of perfect competition, imperfect competition-monopoly, oligopoly, monopolistic competition and duopoly

24. & 25 Market equilibrium;Price determination and forecasting under various market structures

26. Producers surplus- Meaning, Marketable surplus, Marketed surplus, importance-factors influencing marketable surplus
27. Marketing channels, Price spread, Marketing Efficiency-meaning-definitions, technical or physical or operational efficiency-pricing or allocative efficiency
28. Market integration-definition-types of market integration-horizontal, vertical and conglomeration

29. Market information –criteria for good market information, Market intelligence-definition and need, sources of market intelligence
30. Procedural formalities of banks in sanctioning of loans
31. & 32 Crop Insurance-meaning and advantages-limitations in application-Agricultural Insurance Company of India-National Agricultural Insurance scheme (NAIS) - salient features-Weather insurance

Practicals

1. & 2 Estimation of demand and supply for various horticultural commodities in India

3. & 4 Identification of marketing channels for various horticultural crops

5. Computation of Marketing costs, marketing margins and Price spread
6. Estimation of marketed surplus and marketable surplus
7. Empirical assessment of marketing efficiency of different horticultural commodities in India
8. Identification of different market structures
9. & 10 Identification of problems in marketing of various Horticultural products in India and suggestions for improvement

11. Visit to a fruit market
12. Visit to a vegetable market
13. Visit to a regulated market
14. Visit to a nationalised bank
15. & 16 Case studies of different forms of business organizations

References :

1. *Acharya S.S and Agarwal NL, 2006, Agricultural Marketing in India. Oxford & IBH Publishing Co.Pvt.Ltd. New Delhi*
2. *Dewett, K.K. and Chand, A.1979 Modern Economic Theory S.Chand and Co.,New Delhi*
3. *Dewett, K.K. and Varma, J.D. 1986 Elementary Economics S.Chand and Co.,New Delhi.*
4. *Jhingan, M.L.1990 Advanced Economic Theory Vikas Publishing House, New Delhi*
5. *Kahlon, A.S and Tyagi.D S, 1983 Agricultural Price Policy in India. Allied Publishers Pvt. Ltd., New Delhi.*
6. *Kulkarni, K R.1964, Agricultural Marketing in India. The Co-operators Books Depot, Mumbai.*
7. *Mamoria, C.B. and Joshi. R L.1995, Principles and Practices of Marketing in India, Kitab Mahal, Allahabad*
8. *Subba Reddy, S., P.Raghu Ram., P. Sastry, T.V.N. and Bhavani Devi I. 2010. Agricultural Economics., Oxford & IBH Publishing Company Private Ltd., New Delhi, 2010*

ESSC 1.11.3 Communication Skills and Personality Development 2(1+1)

Theory:

Structural and Functional Grammar

1. Introduction to parts of speech, articles, auxiliaries and modals.
2. Uses of Tenses – present tense, past tense and future tense.
3. Active voice and passive voice.
4. Conditional sentences
5. Study of conjunctions and Prepositions

Spoken English:

6. Conversations of different situations in everyday life.
7. The concept of stress, stress shift in words and sentences; silent letters in words and pronunciation of words with silent letters and basic intonation patterns.

Communication Skills

8. Effective listening skills, listening and note taking
9. Speaking: oral presentation skills, individual and group presentation, impromptu presentation and public speaking.
10. Reading and comprehension of general and technical articles.
11. Writing: precise writing, summarizing, abstracting
12. Writing Resume and cover letter
13. Group discussion and interview tips; Organizing seminars and conferences.

Personality Development

14. Interpersonal Skills:
    Elements of interpersonal skills i.e., negotiating, being caring an empathetic, upward and downward communication, ability to handle diverse roles
15. Leadership: Definition of leadership, qualities of leadership (vision, passion, self – sacrifice, confidence and role modelling)
16. Creativity: Nature of creativity and Characteristics of a creative person

Practical

1. Exercises on identification of parts of speech in a sentence
2. Exercises on proper use of articles, prepositions and conjunctions
3. Exercise on present tenses with structural and functional approach
4. Exercise on past tenses with structural and functional approach
5. Exercise on future tenses with structural and functional approach
6. Changing sentences of different tenses from active voice to passive voice and vice versa.
7. Proper formation of conditional sentences(if clauses)

Spoken English:

8. Conversations of everyday life, the concept of stress; stress shift.
9. Silent letters in words, basic intonation patterns, preparing and address.

Communication Skills

10. Listening practice from good models of English such as audios of TOEFL and other authentic material
11. Presentation of reports orally – regulating speech – physical appearance- body language in practical classes as well as practical exams
12. Group discussions on a variety of topics in practical classes as well as practical exams
13. Practicing reading and comprehension of general and technical articles.
14. Practice sessions on precise writing, summarizing, abstracting.

15. Preparation o Resumes and cover letters; practicing letter writing.
16. Conducting mock interviews along with role plays as interviewer and interviewee for practice

References:

1. *Balasubramanian T. 1989. A Text book of Phonetics for Indian Students. Orient Longman, New Delhi.*
2. *Balasubrmanyam M. 1985. Business Communication. Vani Educational Books, New Delhi.*
3. *Naterop, Jean, B. and Rod Revell. 1997. Telephoning in English. Cambridge University Press, Cambridge.*
4. *Mohan Krishna and Meera Banerjee. 1990. Developing Communication Skills. Macmillan India Ltd. New Delhi.*
5. *Krishnaswamy,. N and Sriraman, T. 1995. Current English for Colleges. Macmillan India Ltd. Madras.*
6. *Narayanaswamy V R. 1979. Strengthen your writing. Orient Longman, New Delhi.*
7. *Sharma R C and Krishna Mohan. 1978. Business Correspondence. Tata Mc Graw Hill publishing Company, New Delhi.*
8. *Carnegie, Dale. 2012. How to Win Friends and Influence People in the Digital Age. Simon & Schuster.*
9. *Covey Stephen R. 1989. The Seven Habits of Highly Successful People. Free Press.*
10. *Spitzberg B, Barge K & Morreale, Sherwyn P. 2006. Human Communication: Motivation, Knowledge & Skills. Wadsworth.*
11. *Verma, KC. 2013. The Art of Communication. Kalpaz.*
12. *Dr. T. Bharati, Dr. M. Hariprasad and Pro. V. Prakasam, Personality Development and Communicative English. Neelkamal Publications Pvt. Ltd, New Delhi.*
13. *Wren and Martin, S. Key to High School English Grammar and Composition- Chand and Company Ltd., New Delhi*
14. *Wren and Martin, S. High School English Grammar and Composition- Chand and Company Ltd., New Delhi*
15. *Raymond Murphy, English Grammar in Use. Cambridge University Press*
16. *The Official Guide to the TOEFL Test-IV Edition, Educational Testing Services. Mc Graw Hill, New Delhi.*
17. *Balasubramanyam, M. 1985. Business communication. Vani Educational Books Ansari road, New Delhi.*
18. *Krishna Mohan and Meera Banerjee 1990. Developing Communication Skills. Macmillan India Ltd.*

ESSC 3.11.1 Fundamentals of Extension Education 2 (1+1)

Theory

1. Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history.
2. Horticulture extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in Horticulture programmes.
3. Rural leadership, roles of leader, selection of leader.
4. Motivation of Farmers, rural youth and voluntary organizations for Horticulture extension work
5. Rural Development: meaning, definition, objectives and genesis.
6. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR.
7. Communication: meaning, definition, elements and selected models.
8. Audio – visual aids: importance, classification and selection.
9. Adoption and diffusion process.
10. Teaching and learning-concepts and principles, Teaching steps.
11. Programming planning process – meaning, scope, principles and steps.
12. Evaluation: meaning, importance and methods.
13. Scope, importance and tools of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA).
14. Management and administration: meaning, definition, principles and functions.
15. Concepts of human resource development (HRD).
16. ICT in Extension education, ICT use in rural India.

Practical

1. Visit to study structure, functions, linkages and extension programmes of ICFRE institutes.
2. Visit to study structure, functions, linkages voluntary organizations.
3. Visit to study Mahila Mandal.
4. Visit to Village Panchayat.
5. Visit to State Dept. of Horticulture.
6. Visit to All India Radio (AIR).
7. Exercises on distortion of message, script writing for farm broadcasts and telecasts.
8. Planning, preparation & use of NPVA like poster, chart, flash cards, folders etc.
9. Planning, preparation & use AVA like OHP & 35 mm slide projector transparencies.
10. Identification of local leaders to study their role in extension work.
11. Evaluation of some selected case studies of forestry extension programmes.
12. Preparation of Village Agricultural productions plan.

Suggested Reading:

Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.

Dahama, O. P. and Bhatnagar, O.P., 1998, Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.

Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).

Sagar Mondal and Ray, G. L., Text Book On Rural Development, Entrepreneurship And Communication Skills, Kalyani Publications.

Rathore, O. S. et al., 2012, Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech Publishing Academy, Udaipur.
Van Den Ban, A. W. and Hawkins, H. S., Agricultural Extension, S. K .Jain for CBS Publishers & Distributors, New Delhi.
M Hilaris Indian agriculture and information: Soundari, New century Publications, 2011and communication technology (ICT)

ESSC-1.11.2 Information and Communication Technology 2(1+1)

Theory

1. IT and its importance. IT tools, IT-enabled services and their impact on society
2. Computer fundamentals; hardware and software; input and output devices
3. Word and character representation; features of machine language
4. Features Assembly language, high-level language and their advantages and disadvantages
5. Principles of programming- algorithms and flowcharts
6. Operating systems (OS) - definition, basic concepts
7. Introduction to WINDOWS and LINUX Operating Systems
8. Local area network (LAN), Wide area network(WAN)
9. Internet and World Wide Web, HTML and IP
10. Introduction to MS Office - Word
11. Introduction to MS Office - Excel
12. Introduction to MS Office - Power Point
13. Audio visual aids - definition, advantages, classification and choice of A.V aids
14. Cone of experience and criteria for selection and evaluation of A.V aids
15. Video conferencing. Communication process
16. Berlo' s model, feedback and barriers to communication

Practicals

1. Exercises on binary number system
2. Exercises on Algorithm
3. Exercises on flow chart
4. MSWORD- Creation of Document and Features of Word- Processing
5. MSWORD – Creation of Tables and Printing of a Document
6. MS Excel- Calculations using Electronic Spreadsheet
7. Statistical functions Using MS Excel
8. MS Power Point- Preparation and Presentation of Slides, Setting of Slide Show
9. Internet applications: Web Browsing
10. Internet applications: Creation and operation of Email account
11. Analysis of Horticultural data using MS Excel
12. Handling of audio visual equipments
13. Planning, preparation, presentation of posters
14. Planning, preparation, presentation of charts
15. Planning, preparation, presentation of slides
16. Organization of an audio visual programme

References:

1. *Fundamentals of Information Technology- Vinod BabuBandari, Pearson Education, New Delhi, 2012*
2. *Comdex Computer Kit: Windows 7 with Office 2010 – Vikas Gupta, Dream Tech Press, New Delhi*
3. *Fundamentals of Computers, Pearson Education- ITL ESL, New Delhi, New Delhi, 2011*
4. *Gurvinder Singh, Rachhpal Singh & Saluja KK. 2003. Fundamentals of Computer Programming and Information Technology. Kalyani Publishers.*
5. *Kumar A 2015. Computer Basics with Office Automation. IK International Publishing House Pvt Ltd.*
6. *Rajaraman V & Adabala N. 2015. Fundamentals of Computers. PHI.*

ESSC-1.11.4: Fundamentals of Statistics 3(2+1)

Introduction to statistics, Limitations of statistics, Basic concepts: Variable, types and sources of data, classification and tabulation of data, construction of frequency distribution, Graphic representation of data: histogram, frequency polygon and frequency curve, Ogive Curve; Diagrammatic representation: simple, multiple component and percentage bar diagram, pie diagram; Measures of Central tendency: Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, for ungrouped and grouped data; Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Coefficient of Variation for ungrouped and grouped data. Definition of Probability, Basic concepts of Probability: Event, favorable events, Exhaustive events, equally likely events and mutual exclusive events; Theoretical distributions: Binomial, Poisson, Normal distributions and their properties; Tests of Significance: Basic concepts, tests for equality of means, and independent and paired t-tests, chi-square test for application of attributes and test for goodness of fit of Mendalian ratios; Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of simple linear regression, test of significance of correlation and regression coefficient; Experimental Designs: Basic concepts, completely randomized design, randomized block design, Latin square designs

Practical: Measures of Central Tendency, Measures of Dispersion, Coefficient of variation, Binomial distribution, Poisson distribution, Normal distribution, One sample Z-test, Two sample Z-test, One-sample t-test, Two sample t-test , Paired 't' test, F-test , Chi-square test, Correlation, Linear regression, CRD, RBD, LSD.

References:

1. *A Text Book of Agricultural Statistics – R.Rangaswamy , New Age International Publishing Limited, Hyderabad, 2010*
2. *Statistics for Agricultural Sciences – G. Nageswara Rao,BS Publications, Hyderabad (Second Edition) , 2007*

ESSC- 1.11.4 Fundamentals of Statistics 3(2+1)

Theory

1. Introduction to statistics, Limitations of statistics, Definition of variable, types and sources of data, classification and tabulation of data.
2. Construction of Frequency Distribution and Graphical representation of data: histogram, frequency polygon and frequency curve, Ogive Curve.
3. Diagrammatic representation of data: simple, multiple components and percentage bar diagrams, pie diagram.
4. Measures of Central tendency – Arithmetic Mean (A.M) for Grouped and Ungrouped data, Merits and Demerits of A.M.
5. Measures of Central Tendency –Median and mode for Grouped and Ungrouped data, Merits and Demerits of Median and Mode.
6. Measures of Central Tendency –Geometric Mean and Harmonic Mean for Grouped and Ungrouped data, its Merits and Demerits, Characteristics of a Satisfactory Average.
7. Measures of Dispersion – Range, Quartile Deviation (Q.D) for Grouped and Ungrouped data.
8. Measures of Dispersion – Mean Deviation (M.D), Standard Deviation (S.D) for Grouped and Ungrouped data
9. Measures of Dispersion – Variance and Coefficient of Variation (C.V) for Grouped and Ungrouped data
10. Definition of Probability, Basic concepts of Probability(event, favorable events, Exhaustive events, equally likely events and mutual exclusive events)
11. Concept of Binomial distribution and its limitations
12. Properties of Binomial distribution
13. Concept of Poisson distribution and its limitations
14. Properties of Poisson distribution
15. Concept of Normal distribution and its limitations
16. Properties of Normal distribution
17. Introduction and Basic concepts of Testing of Hypothesis
18. Steps involved in Testing of Hypothesis
19. SND (Z) test for One Sample
20. SND (Z) test for Two Samples (Equality of Means) Students' t-test for One Sample
21. Students' t-test for Two Samples (Equality of Means)
22. Paired t-test and F- test
23. Chi square test for 2x2 Contingency Table
24. Chi-square test for goodness of fit of Mendalian ratios
25. Correlation – Definition, Scatter Diagram, Positive and Negative Correlations
26. Correlation – Properties, Calculation of Coefficient of Correlation and its testing
27. Concept of Regression, Fitting of linear regression lines
28. Concept of regression coefficients, properties and testing of regression coefficients
29. Introduction to Experimental Designs – Basic Principles of Experimental Designs and Analysis of Variance (ANOVA) and its assumptions
30. Completely Randomized Design – Layout and Analysis
31. Randomized Block Design – Layout and Analysis
32. Latin Square Design – Layout and Analysis

Practical

1. Arithmetic Mean (A.M) for Grouped and Ungrouped data

2. Median and Mode for Grouped and Ungrouped data
3. Geometric Mean and Harmonic Mean for Grouped and Ungrouped data
4. Quartile Deviation & Mean Deviation for Grouped and Ungrouped data
5. Standard Deviation and Coefficient of variation for Grouped and Ungrouped data
6. Binomial distribution
7. Poisson distribution
8. Normal distribution
9. SND (Z) test for One Sample and Two Samples (Equality of Means)
10. Students' t-test for One Sample, Two Samples and Paired t-test (Equality of Means)
11. F- test, Chi square test for 2x2 Contingency Table and chi-square test for goodness of fit of Mendalian ratios
12. Calculation of Coefficient of Correlation and its testing
13. Fitting of linear regression lines and testing of regression coefficients
14. Analysis of CRD
15. Analysis of RBD
16. Analysis of LSD

References:

1. *Statistics for Agricultural Sciences : Nageswara Rao, G 2007. (Second Edition) BS Publications, Hyderabad*

2. *A Text Book of Agricultural Statistics: Rangaswamy, R. 1995. New Age International Publishing Limited.*

ESSC-3.11.2 Horticultural Business Management 2 (1+1) Credits

1. Farm Management-meaning, definitions, scope, definitions, objectives, its relationship with other sciences, farm management decisions
2. Economic principles applied to farm management – law of diminishing returns, reasons for the operation of the law of diminishing returns in agriculture/ horticulture, Factor-product relationship, 3 stages of production function, Returns to scale.
3. Principle of factor substitution-factor-factor relationship, Isoquant, Isocost, least cost combination, MRTS, Price ratio, profit rules, Ridge lines, Expansion path.
4. Principle of product substitution-product-product relationship-Production possibility curve, Isorevenue line, determination of optimum combination of products, MRS, price ratio, profit rules.
5. Principle of Equi-marginal returns, Opportunity cost principle, Minimum loss principle and Principle of Comparative advantage
6. Time comparison principle-time value of money, compounding and discounting, Theory of costs-Types of costs, cost concepts and income measures, break even analysis.
7. Types of farming-specialized, diversified, mixed, dry farming, types of farm business organizations-peasant, co-operative, capitalistic, state and collective farming.
8. Farm planning-characteristics and limitations, budgeting-partial, complete, steps in farm planning and budgeting
9. Management-introduction, scope and nature of management, various functions of management, unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability
10. Direction – guiding, leading, motivating, supervising, coordination – meaning, types and methods of controlling- evaluation, control systems and devices. Budgeting as a tool for planning and control, Record keeping as a tool of control.
11. Operations Management-overview, functions, interrelationship with 5 P's of management, plant and plant layout, inspection & quality control-Total quality management
12. Marketing management-functions, components of marketing mix (4 P's) - product, price, promotion and place
13. Materials management-overview, objectives, scope, concept, need for inventory and its control ; Personnel Management-concept & role, basic functions of HR managers (selection, retention, incentives, training & development, evaluation etc.,)
14. Financial Management-Financial statements-Financial analysis/ratio analysis
15. Capital budgeting-meaning, Capital budgeting techniques-Undiscounted cash flow methods (payback period, accounting rate of return) and discounted cash flow techniques (NPV, IRR, BC ratio)
16. Project Management-meaning, scope, steps in project preparation and management, various evaluation measures

Practicals

1. Farm cost concepts and their imputation procedure
2. Estimation of cost of cultivation and farm income measures of major horticultural crops
3. How to prepare and conduct Farm holding surveys
4. & 5 Preparation of farm plans and alternate farm plans
5.
6. Preparation of Enterprise budget and Partial budget
7. Study of farm management aspects related to Horticultural College Farm

8. Financial statements- Preparation and interpretation of Balance Sheet
9. Preparation and interpretation of Income Statement
10. Preparation and interpretation of Cash Flow Statement
11. Financial Ratio Analysis
12. Compounding & Discounting techniques
13. Capital budgeting-Project Appraisal Techniques-I (PBP, ROR & NPW)
14. Project Appraisal Techniques-II (BCR & IRR)
15. Visit & Study of Profile of Horti-based industry
16. Formulation of project feasibility report of Horti-based industry-Case studies

References :

Sankhyan, P.L Introduction to Farm Management
Fundamentals of Farm Management Johl; 2007
Bhor. D. 1994. GATT Agreement or Dunkel Draft Treaty . Its impact on Agriculture Industry, TRIPS and TRIMS and Drug Industry, Mittal Publications , New Delhi
Cramer. G.L. and Jenson. C.W.1979. Agricultural Economics and Agribusiness. John Wiley & Sons, New York.
Gitteger Price , J.1989 Economics Analysis of Agricultural Projects, John Hopkins University Press, London
Harsh, S.B. Conner, U.J. and Schwab G.D. 1981 Management of the farm Business. Prentice Hall Inc., New Jersey
Joseph, L. Massie.1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi
Omri Rawlins, N, 1980. Introduction to Agribusiness. Prentice Hall of India Pvt. Ltd., New Delhi
Vaish, M. C. 1993. International Economics. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
Essentials of Farm financial management Johl Vardhaman Books and Periodicals, Delhi
Acharya S.S and Agarwal NL, 2006, Agricultural Marketing in India. Oxford & IBH Publishing Co.Pvt.Ltd. New Delhi
Kulkarni, K R.1964, Agricultural Marketing in India. The Co-operators Books Depot, Mumbai.
Mamoria, C.B. and Joshi. R L.1995, Principles and Practices of Marketing in India, Kitab Mahal, Allahabad
Mamoria, C.B., 1973., Agricultural Problems in India, Kitab Mahal, Allahabad
Subba Reddy, S., P.Raghu Ram., P. Sastry, T.V.N. and Bhavani Devi I. 2010. Agricultural Economics., Oxford & IBH Publishing Company Private Ltd., New Delhi, 2010

ESSC-3.11.3 Entrepreneurship development and International trade 2(1+1)

Theory

1. Assessing overall business environment in the Indian economy, overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs
2. Entrepreneurship; Meaning, concept, entrepreneurial and managerial characteristics, functions of entrepreneur and types of entrepreneurs
3. Managing an enterprise; Motivation and entrepreneurship development; Importance of planning, budgeting, monitoring, evaluation and follow up.
4. Managing competition; Entrepreneurship development programmes
5. Govt. schemes and incentives for promotion of entrepreneurship & Govt. policy on small and medium enterprises. SMEs/ SSIs
6. SWOT analysis of an enterprise, Generation, incubation and commercialization of ideas and innovations
7. Contract farming; Public private partnerships, Venture capital, and joint venture
8. Supply chain management and total quality management
9. Overview of Horti input industries, characteristics of Indian horticultural processing and export industry
10. Social responsibility of Business, Morals ethics in enterprise management
11. International trade-basic terms and concepts, origin of international trade, salient features, advantages and disadvantages of international trade
12. Terms of trade, tariffs, import quotas, foreign exchange rate, exchange control, dumping
13. Balance of payments, balance of trade, International financial institutions-International Monitory Fund (IMF), World bank, International Finance Corporation(IFC)
14. WTO-GATT-origin, history, Agreement on Agriculture (AOA)-market access, export subsidies and domestic support
15. TRIPS, SPS & TBT, anti dumping, Impact of WTO on Indian Agriculture / Horticulture sector
16. Export and import policies relevant to horticulture sector in India

Practicals:

1-3 Conducting market survey and preparation of project proposals on horticultural enterprises
4 Conducting SWOT analysis of horticultural industries
5-6 Assessment of export potentiality of horticultural commodities in India
7-8 Case studies of successful entrepreneurs
9-10 Supply chain analysis of important horticultural commodities
11-13 Visit to horticultural horti-based industries
14-16 Presentation of project proposals on establishment of horti-based industries

References :

1. *Chole, R.R. Entrepreneurship development and communication skills. Scientific Publishers, Jodhpur*
2. *Jasmir Singh Saini. 2005. Entrepreneurship development Programmes and practices. Deep and Deep publications Pvt. Ltd. , New Delhi*
3. *Khanks, S.S. 1999. Entrepreneurship development. S.Chan Company Ltd., New Delhi*
4. *Vilanillam, J.V. 2000. More effective communication. A manual for professions. Response books. New Delhi*

Department of Horticultural Engineering and Environmental Science

HEES – 2.12.1 Environmental Science and Disaster Management
3(2+1)

Theory:

1 Multidisciplinary nature of environmental studies definition, scope and importance, Natural resources and associated problems.
2 Forest resources: use and over exploitation, deforestration, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
3 Water resources: Use and over utilization of surface and ground water, floods, drought conflicts over water, dams – benefits and problems.
4 Mineral resources: use and exploitation, Environmental effects of extracting and using mineral resources, case studies.
5 Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity case studies.
6 Energy resources: growing energy needs, renewable and non renewable energy resources, use of alternate energy sources, case studies.
7 Land resources: land as a resource, land degradation, man induced land slides, soil erosion and desertification. Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles.
8 Ecosystems, concept of an ecosystem, structure and function of an ecosystem: producers, consumers and decomposers. Energy flow in the ecosystem, ecological successions, food chains, food webs and ecological pyramids.
9 Forest ecosystem and grass land ecosystem: Introduction, types, characteristic features structure and functions.
10 Desert ecosystem and aquatic ecosystem (ponds, streams, lakes, rivers, oceans and estuaries): Introduction, types, characteristic features structure and functions.
11 Biodiversity and its conservation: Introduction, definition genetics, species and ecosystem diversity and biogeographical classification of India. Valve of biodiversity – consumptive use, productive use, social, ethical, aesthetic and option values.
12 Biodiversity at global, national and local levels, India as a mega diversity nation. Hotspots of biodiversity. Threats to biodiversity – habitat loss, poaching of wild life, man wild life conflicts.
13 Endangered and endemic species of India, conservation of biodiversity: In-situ and Ex-situ conservation of Biodiversity.
14 Air pollution: definition, cause effects and control measures.
15 Water Pollution: definition, cause, effects and control measures.
16 Soil Pollution: definition, cause, effects and control measures.
17 Marine and noise pollution: definition, cause effects and control measures.
18 Thermal Pollution, Nuclear hazards: definition, cause, effects and control measures.
19 Solid Waste Management: causes effects and control measures urban and industrial wastes, role of an individual in prevention of pollution.
20 Social issues and the environment: From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting , water shed management.
21 Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain ozone layer depletion, nuclear accidents and holocaust dies.
22 Waste land reclamation, consumerism and waste products.

23 Environment protection act, air, water , wild life and forest conservation acts. Issues involved in enforcement of environmental legislation and public awareness.
24 Human population and environment: population growth, variation among nations, population explosion, family welfare programme.
25 Environment and human health: human rights, value education HIV/AIDS, women and child welfare.
26 Role of information technology in environment and human health.
27 Natural disasters – meaning and nature of natural disasters, their types and effects – floods, drought.
28 Cyclones, earth quakes, landslides, avalanches, volacanic eruptions, heat and cold waves.
29 Climate change – Global warming, sea level rise, ozone depletion.
30 Manmade disasters – Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution.
31 Deforestration – effect to migrate natural disaster at natural and global levels. International strategy for disaster reduction.
32 Concept of disaster management, national disaster management framework financial arrangements; role of NGO's, community based organizations and media. Central, state district and local administration; armed forces in disaster response; disaster response; police and other organisation.

Practical

1. Collection, processing and storage of effluent samples.
2. Determination of chemical oxygen demand (COD) in waste water sample.
3. Determination of dissolved oxygen (DO) in waste water sample.
4. Determination of total dissolved salts in waste water sample.
5. Analysis of temporary hardness of waste water sample.
6. Analysis of total hardness of waste water sample.
7. Assessment of Chlorophyll content of plants.
8. Determination of biological oxygen demand (BOD) in waste water sample.
9. Analysis of waste water for heavy metals.
10. Estimation of respirable and non respirable dust in air by using dust sampler.
11. Field work: Visit to local area to document environmental assets river / forest/ grassland/ hill/ mountain.
12. Visit to a local polluted site – urban/ rural/ industrial/ agricultural.
13. Study of common plants, insects, birds and study of simple ecosystems – pond, river, hillslopes etc.
14. Visit to industries to study pollution abatement techniques and
15. Case studies – Solid Waste Management.
16. Visit to In-situ or Ex-situ conservation centre / social service organisation / environmental education centre.

References:

1. *Textbook of Environmental Studies for Under Graduate Courses* — *Erach Bharucha 2005. University Grants Commission, University Press, Hyderabad.*
2. *Principles of Environmental Studies 2004.* — *Manohara Chary and Jaya Ram Reddy*

BS Publishers, Hyderabad

3. *Principles of Environmental Science. Inquiry and Applications* — *William, P. Cunning Ham and Mary Ann Cunningham 2005. Tata MCG raw-hill publishing company Limited, New Delhi*

4. *Methods in Environmental Analysis - Water, Soil and Air* — *Gupta, P.K. 2004. Agro bios (India). Jodhpur*

HEES 2.12.2 Surveying, Soil and Water Engineering in horticultural crops 2(1+1)

Theory

1. Surveying – definition and objectives of survey – primary divisions of surveying – geodetic and plane surveys – classifications – uses of surveys

2. Instruments used in chain survey – constructional details of metric chain, metallic and steel tapes, ranging rods, arrows, cross-staff, optical square, plumb bob and pegs

3. Areas of irregularly bounded fields – different methods, Numerical problems on Simpson's trapezoidal rules

4. Leveling – definition —terminology connected with leveling – datum, elevation, station, back sight, fore sight, intermediate sight, height of instrument, bench mark and its types, change point

5. Leveling procedure – Reduction of levels – height of collimation method and rise and fall method – numerical problems connected with these two methods

6. Contour survey – definition, characteristics and uses of contours

7. Irrigation – definition – classification of irrigation – benefits of irrigation – ill effects of irrigation – flow irrigation and lift irrigation –Water lifting devices – classification of pumps

8. Centrifugal pump – principle of Operation pump efficiencies – capacity calculation based on irrigationscheduling – power calculations of centrifugal pump

9. Deep well pumps – turbine and submersible pumps – installation and working principles of these pumps

10. Measurement of irrigation water – importance – methods of measuring water – volumetric and area – velocity method

11. Direct water discharge methods – water meter – weirs – orifices- water discharge calculation of rectangular and triangular weirs

12. Water conveyance systems – open channel – definitions of wetted perimeter, hydraulic radius, hydraulic slope, area of cross section and free board – Manning's formula for estimating mean velocity, side slopes of channels for different soils and capacity calculations

13. Underground pipeline – advantages of earthen channels – disadvantages – type of pipes recommended for underground pipeline- Components of underground pipeline – installation procedure – discharge calculationof underground pipeline

14. Irrigation methods – sprinkler irrigation – scope – functional components of sprinkler system and their working, Types of sprinkler irrigation – operation and maintenance

of the system – cost economics

15. Drip irrigation system – scope – functional components of drip system and their working principles - Operation and maintenance of the drip system – cost economics

16. Erosion control measures – engineering measures, contour bunds, graded bunds Terracing – broad based terraces and bench terraces

Practical

1. Acquaintance with chain survey equipment
2. Ranging and measurement of offsets
3. Chain triangulation and plotting
4. Cross staff survey and plotting
5. Leveling equipment – dumpy level, leveling staff, temporary adjustments and taking staff reading
6. Simple and differential levelling
7. Plotting of contours
8. Study of centrifugal pumping system
9. Measurement of irrigation water using measuring devices
10. Study of different components of sprinkler irrigation systems
11. Study of different components of drip irrigation systems
12. Study of operation and maintenance of drip Irrigation System
13. Study of fertigation scheduling for different horticultural crops
14. Preparation of buffer solution and fertigation through drip Irrigation system
15. Uniformity of water application in drip and sprinkler systems
16. Study of soil and water conservation measures

References

Kanetkar, T.P. and Kulkarni, S.V. 1981. Surveying and Leveling (Vol.I). Vidyarthi Griha Praksam, Pune.

Mal, B.C. 2005. Introduction to Soil and Water Conservation Engineering. Kalyani Publishers, Ludhiana.

Michael, A.M. 1989. Land and Water Management Engineering. Vikas Publishing House Pvt. Ltd., New Delhi.

Michael, A.M. and Ojha, T.P. 1993. Principles of Agricultural Engineering (Vol. II). Jain Brothers, New Delhi.

Murthy, V.V.N. 1982, Land and Water Management Engineering. Kalyani Publishers, Ludhiana.

HEES 3.12.1 Farm Power, Machinery and Processing Equipments 2 (1+1)

Theory

1. Farm power – sources of different farm power – advantages and disadvantages

2. Internal combustion engine – different components and their functions – working principle of four stroke and two stroke cycle engine – comparison between diesel and petrol engine – difference between four stroke engine and two stroke engine

3. Terminology related to engine power – Indicated Horsepower (IHP), Brake Horsepower (BHP), Fractional Horsepower (FHP), Drawbar Horsepower (DBHP), compression ratio (CR), stroke bore ratio, piston displacement and mechanical efficiency – numerical problems on calculation of IHP, BHP, Compression Ratio (CR), stroke bore ratio,piston displacement volume

4. Fuel supply and cooling system of Internal Combustion (IC) engine – types – components and their functions – working principle of forced circulation cooling system

5. Ignition and power transmission system of IC engine – types – components and their functions – working principle of battery ignition system

6. Lubrication system of IC engine – types – purpose – components and their functions – working principle of forced feed system; Tractors – classification – types – points to be considered in selection of tractors – estimating the cost of operation of tractor power

7. Tillage – primary and secondary tillage – Mould Board (MB) plough – functions – constructional features – operational adjustments and maintenance

8. Disc plough – functions – constructional details – operational adjustments and Maintenance. Numerical problems on MB plough and disc plough

9. Harrows – types – functions – operation of disc harrows – cultivators –rotovators – intercultural implements– hoes and weeders

10. Sowing equipment – seed cum fertilizer drills – types – functions – types of metering mechanisms – functional components – calibration

11. Harvesting equipment –different harvesting equipments used for horticultural crops

12. Plant protection equipment – types of sprayers and dusters – constructional features and care and maintenance of sprayers and dusters

13. Tractor mounted equipment for land development and soil conservation – functions of bund former, ridger and leveling blade

14. Equipments used in harvesting, grading, packaging for horticultural produce

15. Heat and Mass transfer, drying and dehydration equipments-solar, mechanical and Electrical dryers

16. Fruit Juice extractor, fruit juice concentrator, Fruit pulper, Fruits and Vegetables washing machines

Practical

1. Study of different components of IC engine
2. Study of working of four stroke petrol and diesel engine
3. Study of working of two stroke petrol and diesel engine
4. Study of different parts of MB plough, measurement of plough size, horizontal and vertical suction, determination of line of pull, etc.
5. Study of different parts of disc plough and harrows
6. Study of seed-cum-fertilizer drills – furrow openers, seed metering mechanisms and calibration of seed drills
7. Study of different inter cultivation equipment used in Horticultural crops
8. Study of operation and maintenance of tractor and cost calculation
9. Learning of tractor driving – I
10. Learning of tractor driving – II
11. Hitching of tractor drawn implements
12. Study of operation and maintenance of power tiller
13. Study of operation, adjustments and repairs of dusters
14. Study of operation, adjustments and repairs of sprayers
15. Equilibrium Moisture Content and measurement
16. Study of processing Equipments-dryers

References:

Jagadishwar Sahay. 1992. Elements of Agricultural Engineering. Agro Book Agency, Patna.
Jain, S.C. 2003. Farm Machinery – An Approach. Standard Publishers and Distributors, New Delhi.
Kepner, R.A., Roy Bainer and Barger, E.L. 1987. Principles of Farm Machinery. CBS Publishers and Distributors, New Delhi.
Michal, A.M. and Ojha, T.P. 2008. Principles of Agricultural Engineering (Vol. I). Jain Brothers, New Delhi.
Nakra, C.P. 1986. Farm Machinery and Equipment. Dhanpat Rai and Sons, New Delhi.

Student READY – Rural Entrepreneurship Awareness Development Yojana
*** Semester – VII – RHWE / Semester – VIII - ELP**
****Semester – VII – ELP (two modules) + Semester VIII - RHWE**

S.N	Title of the Course	Credit Hours
1	Student READY – RHWE Placement in Villages / Industries / Tours	0+20
	Total	**20 (0+20)**

S.No	Course No.	Title of the Course / Modules	Credit Hours
1	(ELP-401)	Commercial Horticulture	10(0+10)
2	(ELP-402)	Protective Cultivation of High Value Horticulture Crops	10(0+10)
3	(ELP-403)	Processing of Fruits and Vegetables for Value Addition	10(0+10)
4	(ELP-404)	Floriculture and Landscape Architecture	10(0+10)
5	(ELP-405)	Bio-inputs: Bio-fertilizers and Bio-pesticides	10(0+10)
6	(ELP-406)	Mass Multiplication of Plant And Molecules through Tissue Culture	10(0+10)
7	(ELP-407)	Mushroom culture	10(0+10)
8	(ELP-408)	Bee keeping	10(0+10)
Any two modules		**20 (0+20)**	

* Batch (50%) of students of IV year will register RHWE in VII Semester and ELP (2 modules) in VIII Semester

** Another (remaining 50%) batch of students of IV year will register ELP (2 modules) in VII Semester and RHWE in VIII Semester.