Department of Fruits and Orchard Management
Course Content for Ph. D. Programme

FSC -701 Advances in Breeding of Fruit Crops (2+1)

Objective
To update knowledge on the recent research trends in the field of breedingof fruit crops with special emphasis on tropical, subtropical and temperate crops grown in India.

Theory
Evolutionary mechanisms, adaptation and domestication, Genetic resources, cytogenetics, cytomorphology, chemotaxonomy, genetics of important traits and their inheritance pattern, variations and natural selection, spontaneous mutations, incompatibility systems in fruits , recent advances in crop improvement efforts-introduction and selection, chimeras, apomixis, clonal selections, intergeneric, interspecific and intervarietal hybridization, mutation and polyploid breeding, resistance breeding to biotic and abiotic stresses, breeding for improving quality, molecular and transgenic approaches in improvement of selected fruit crops.

Crops
UNIT I: Mango and banana

UNIT II: Papaya, grapes and citrus

UNIT III: Guava and sapota

UNIT IV: Pineapple and avocado

UNIT V: Apple, pear, plums, peaches, apricot, cherries and strawberry

Practical
Description and cataloguing of germplasm, pollen viability tests, pollen germination-isozyme techniques-survey and clonal selection, observations on pest, disease and stress reactions in inbreds and hybrids, use of mutagenes and colchicine for inducing mutation and ploidy changes, practices in different methods of breeding fruit crops and in-vitro breeding techniques.

FSC -702 Advances in Growth Regulation of Fruit Crops (1+1)

Objective
Appraisal on the advances in growth regulation of fruit crops.

Theory

UNIT I
Ecophysiological influences on growth and development of fruit crops- flowering, fruit set- Crop load and assimilate partitioning and distribution.
UNIT II
Root and canopy regulation, study of plant growth regulators in fruit culture- structure, biosynthesis, metabolic and morphogenetic effects of different plant growth promoters and growth retardants.

UNIT III
Absorption, translocation and degradation of phytohormones – internal and external factors influencing hormonal synthesis, biochemical action, growth promotion and inhibition, canopy management for fertigated orchards.

UNIT IV
Growth regulation aspects of propagation, embryogenesis, seed and bud dormancy, fruit bud initiation, regulation of flowering, off season production.

UNIT V
Flower drop and thinning, fruitset and development, fruit drop, parthenocarpy, fruit maturity and ripening and storage, molecular approaches in crop growth regulation- current topics.

Practical
Root- shoot studies, quantifying the physiological and biochemical effects of physical and chemical growth regulation, bioassay and isolation through chromatographic analysis for auxins, gibberellins, experiments on growth regulation during propagation, dormancy, flowering, fruitset and fruit development stages.

FSC -703 Advances in Production of Fruit Crops -I (1+1)

Objective
To keep abreast with latest developments and trends in production technology of fruit crops.

Theory
National and International scenario in fruit production, Recent advances in propagation - root stock influence, planting systems, High density planting, crop modeling , Precision farming, decision support systems - aspects of crop regulation- physical and chemical regulation effects on physiology and development, influence of stress factors, strategies to overcome stress effects, integrated and modern approaches in water and nutrient
management, , Total quality management(TQM) - Current topics.

Crops
UNIT I: Mango and banana

UNIT II: Papaya, grapes and citrus

UNIT III: Guava, sapota, pomegranate and aonla

Practical
Survey of existing fruit cropping systems and development of a model cropping system, Estimating nutrient deficiency- estimation of water use efficiency, soil test-crop response correlations, practices in plant growth regulation, studying physiological and biochemical responses, quality analysis

FSC -751 Advances in Production of Fruit Crops- II (1+1)

Objective
To keep abreast with latest developments and trends in production technology of fruit crops.

Theory
National and International scenario in fruit production, Recent advances in propagation - root stock influence, planting systems, High density planting, crop modeling , Precision farming, decision support systems - aspects of crop regulation- physical and chemical regulation effects on physiology and development, influence of stress factors, strategies to overcome stress effects, integrated and modern approaches in water and nutrient

management, Total quality management(TQM) - Current topics.

Crops

UNIT I: Pineapple, avocado, jack fruit and fig

UNIT II: Apple, pear, plums, strawberry, peach, apricot, cherries and nut crops

Practical

Survey of existing fruit cropping systems and development of a model cropping system, Estimating nutrient deficiency- estimation of water use efficiency, soil test-crop response correlations, practices in plant growth regulation, studying physiological and biochemical responses, quality analysis

***FSC -752 Genomics and Bioinformatics in Fruit Crops (1+1)**

Objective

Studies on the fundamentals and application of genomics and bioinformatics in horticulture.

Theory

UNIT I

Primer on bioinformatics and computational genomics, database fundamentals – biological databases, horticultural genome and protein databases, functional genomics.

UNIT II

Dynamic Programming Sequence Alignment, BLAST search engine, FASTA search engine, Microarrays-Microarray Clustering and Classification, Terminologies and Ontologies - EcoCYC knowledge base of E. Coli metabolism - Description of UMLS Semantic Network.

UNIT III

Multiple Sequence Alignment, MSA algorithm descriptions, ClustalW, 1D Motifs, Algorithms and Databases, methods for sequence weighting, BLOCKS database, Making BLOCK motifs, PROSITE database, 3D structure alignment, SCOP, DALI, LOCK, MUSTA algorithm for geometric hashing and multiple alignment.

UNIT IV

Hidden Markov models , Molecular energetics and dynamics , Protein structure prediction, Genetic networks - Modeling and Simulation of Genetic Regulatory Systems- KEGG database of genes and gene pathways/networks - EcoCYC database of metabolic pathways in E. Coli - EGF-signal pathway modeling, Gene finding algorithms - Genome

Annotation Assessment Project for Arabidopsis, Comparative genomics algorithms, Genome Alignment.

UNIT V

3D structure computations, NMR, Xtallography, NMR Structure Determination, X-ray Crystallography Structure Determination, Distance Geometry Description, RNA secondary structure, Molecular Modeling and Drug discovery programs.

UNIT VI

Phylogenetic algorithms - Treebase database of phylogenetic information for plants mostly, Tree of Life Page, Samples from the Tree of Life, Ribosomal Database Project, Natural Language Processing , Proteomics, 3D Motifs, Applications and Integration with Horticulture, Final Thoughts.

Practical

Computers, Operating systems and Programming languages, Internet Resources, Horticultural Genome and Protein Databases, BLAST/RNA Structure, Sequence Alignment, Microarray Data Analysis, Ontology, MSA, HMMs, Identification of Functional Sites in Structures, Protein Structure Prediction - Phylogenetics - Gene Finding - Molecular Modeling and Drug Discovery Software – Assignments

***FSC -753 Biotic and Abiotic Stress Management in Fruit Crops (2+1)**

Objective

To update knowledge on the recent research trends in the field of biotic and abiotic stress management in fruit crops.

Theory

UNIT I

Stress – definition, classification, stresses due to water (high and low), temperature (high and low), radiation, wind, soil conditions (salinity, alkalinity, ion toxicity, fertilizer toxicity, etc.).

UNIT II

Pollution - increased level of CO_2, industrial wastes, impact of stress in horticultural crop production, stress indices, physiological and biochemical factors associated with stress, horticultural crops suitable for different stress situations.

UNIT III

Crop modeling for stress situations, cropping system, assessing the stress through remote sensing, understanding adaptive features of crops for survival under stress, interaction among different stress and their impact on fruit crop growth and productivity.

UNIT IV

Greenhouse effect and methane emission and its relevance to abiotic stresses, use of anti transpirants and PGRs in stress management, mode of action and practical use, HSP inducers in stress management techniques of soil moisture conservation, mulching, hydrophilic polymers.

UNIT V

Rain water harvesting, increasing water use efficiency, skimming technology, contingency planning to mitigate different stress situations, cropping systems, stability and sustainability indices.

Practical

Seed treatment /hardening practices, container seedling production, analysis of soil moisture estimates (FC, ASM, PWP), analysis of plant stress factors, RWC, chlorophyll flurosence, chlorophyll stability index, ABA content, plant waxes, stomatal diffusive resistance, transpiration, photosynthetic rate etc. under varied stress situations, influence of stress on growth and development of seedlings and roots, biological efficiencies, WUE, solar energy conversion and efficiency, crop growth sustainability indices, economics of stress management, visit to fruit orchards and water shed locations.

FSC -799 Seminar I (1+0)

Objective

To present seminar on synopsis of Doctoral Research

FSC -849 Seminar II (1+0)

Objective
To present seminar on general tropic

FSC -999 Seminar III (1+0)

Objective
To present seminar on findings of the Doctoral Research.

FSC-1000 Doctoral Research (0+45)