

## **Fruits and Orchard Management**

### **Ph.D Programme**

<b>Course No.</b>	<b>Title of the Courses</b>	<b>Credits</b>
<b>1<sup>st</sup> Semester</b>		
FSC701	Advances in Breeding of Fruit Crops	2 + 1
FSC 702	Advances in Growth Regulation of Fruit Crops	2 + 1
FSC 703	Advances in Production of Fruit Crops-I	1+1
<b>2<sup>nd</sup> Semester</b>		
FSC 751	Advances in Production of Fruit Crops-II	1 + 1
*FSC 752	Genomics and Bioinformatics in Fruit Crops	1 +1
*FSC 753	Biotic and Abiotic Stress Management in Fruit Crops	2 + 1
FSC 799	Seminar I	1 + 0
<b>3<sup>rd</sup> Semester</b>		
FSC 849	Seminar II	1 + 0
<b>4<sup>th</sup> semester</b>		
	Nil	
<b>5<sup>th</sup> Semester</b>		
	Nil	
<b>6<sup>th</sup> Semester</b>		
FSC 999	Seminar III	1+0
FSC 1000	Doctoral Research	0+45

**\* Courses are optional**

### **Programme Details:**

#### **FSC 701 Advances in Breeding of Fruit Crops 2+1**

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**

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**

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**

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**

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**

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<sub>2</sub>, 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 fluorescence, 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.

.....