

***Department of Floriculture & Landscaping***

**Ph.D Programme**

Course No.	Title of the Courses	Credit
<b>1<sup>st</sup> semester</b>		
FLA 701	Advances in Breeding of Flower Crops	2+1
FLA 702	Advances in Flower Production Technology	2+1
FLA 703	Advances Technology of Greenhouse Management	2+1
<b>2<sup>nd</sup> semester</b>		
FLA 751	Advances in Precision Floriculture	1+1
FLA 752	Advances in Landscape Architecture	1+2
FLA 799	Seminar I	1+0
<b>3<sup>rd</sup> semester</b>		
FLA 801	Foliage Plant Production	1+1
FLA 849	Seminar II	1+0
<b>4<sup>th</sup> semester</b>		
FLA 851	Advances in Biochemistry and Biotechnology of Flowers	2+1
<b>5<sup>th</sup> semester</b>		
Nil		
<b>6<sup>th</sup> semester</b>		
FLA 999	Seminar III	1+0
FLA 1000	Doctoral Research	0+45

***Programme Details:***

**FLA 701 Advances in Breeding of Flower Crops                      2+1**

UNIT I: A brief outline of origin and evolution of varieties, distribution, Genetic resources, genetic divergence, Plant introduction, selection and domestication, Inheritance of important characters, Genetic mechanisms associated with flower colour and flower size, doubleness, fragrance and post-harvest life, Plant Variety Protection Act.

UNIT II: Specific objectives of breeding in flower crops, Methods of breeding suited to seed and vegetatively propagated flower crops, Introduction, selection, polyploidy and mutation breeding in the evolution of new varieties,

Exploitation of heterosis, utilization of male sterility-Incompatibility problems, *In Vitro* breeding.

UNIT III: Breeding for resistance to pests, diseases, nematodes and other biotic and abiotic stresses in flower crops.

UNIT IV: Specific breeding problems and achievements made in rose, jasmine, crossandra, carnation, gerbera, gladioli, orchids and anthurium. heliconia, bird of paradise, bougainvillea, Red ginger hibiscus and ,Amaryllis

**Practical:** Description of crops and cultivars; Cataloguing of species and cultivars, floral biology, selfing and crossing, evaluation of hybrid progenies, induction of mutants, physical and chemical mutagens, induction of polyploidy, screening of plants for biotic and abiotic stresses and environmental pollution, *in-vitro* breeding in flower crops.

## **FLA 702 Advances in Flower Production Technology**

**2+1**

UNIT I: Commercial flower production; Scope and importance; Global Scenario in cut flower& loose flower production and trade, varietal wealth and diversity;; Special characteristics and requirements; cut flower, loose flowers, dry flowers trade.

UNIT II: Propagation and multiplication; IPR issues related to propagation of materials; Growing conditions— in open & Greenhouse; Crop specific requirement of Media and Environment--influence of environmental parameters, light, temperature, moisture, humidity and CO<sub>2</sub> on growth and flowering; regulation for quality flowers.; Nutrient (slow release fertilizers and biofertilizers) & water management

UNIT III: Flower forcing and year-round flowering through physiological interventions; Chemical regulation; Environmental manipulation; Harvest indices; Harvesting techniques; Post-harvest handling; Precooling, pulsing, packing, marketing; Export potential; Agri Export Zones.

UNIT IV: Crop specific practices – rose, anthurium, orchids, carnation, chrysanthemum, gladioli, gerbera, liliams, bird of paradise,

**Practical:** Varietal wealth in flower crops; Greenhouse management; Soil decontamination techniques; Microirrigation; Nutrition and fertigation. Special practices- Pinching, netting, disbudding, defoliation and chemical pruning; Photoperiodic and chemical induction of

flowering; Assessing harvest indices; Post-harvest handling; Tissue analysis; Preparation of floral decorative.

### **FLA 703 Advance Technology of Greenhouse Management 2+1**

UNIT I: Prospects of protected floriculture in India. Basic considerations in establishment of greenhouse structures.

Designing and erection of protected structures; Low cost/Medium cost/High cost structures; Location specific designs; Structural components; Cladding materials.

UNIT II: Environmental control systems in greenhouse, containers, substrate -soil and soilless, physical and chemical properties. Different media component. Media decontamination techniques. Beds and benches

UNIT III: Water systems, Microirrigation; fertigation,

**Practical:** Study of various protected structures, practices in design, layout and erection of different types of structures, practices in preparatory operations, soil decontamination techniques, practices in environmental control systems, practices in drip and fertigation techniques greenhouses. Cost economics of greenhouse construction. Visit to greenhouses. Construction cost of protected structures.

### **FLA 751 Advances in Precision Floriculture 1+1**

UNIT I: Prospects of precision floriculture in India

UNIT II: Precision floriculture, principles and concepts, enabling technologies of precision farming, GPS, GIS, remote sensing, sensors.

UNIT III: Variability management in precision farming, mapping, variable rate technology, precision equipments, computers and robotics in precision farming, post-harvest process management in floriculture using precision farming.

**Practical:** Precision equipments, computers and robotics in precision farming, post-harvest process management in floriculture using precision farming.

### **FLA 752 Advances in Landscape Architecture 1+2**

UNIT I: Commercial landscape gardening- History, Plant identification and ecology, Materials of garden design, Design making by different garden styles and types.

UNIT II: Expenses to model landscaping units of all category, Creativity and communication skills for landscape architect, Way of designing a commercial landscape project.

UNIT III: Assessing site and plants adaptability for different locations, Landscape engineering (Topographical) survey and designing concept), special techniques in garden landscaping (Burlaping, waterscaping, hardscaping, lawn making, topiary styles specializing, bioaesthetic planning).

UNIT IV: Preparation and drawing of site plan, Learning the basics in computer aided design (CAD) for developing a garden landscape plan, Handling soft landscape materials (AUTOCAD & ARCHICAD), GIS as a tool for spatial designing.

UNIT V: Contemporary landscaping, Environmental landscaping, Industrial and institutional landscaping, Public and private garden making, play ground landscaping, Case study with the successful landscapist, Budget / Project cost estimating, Execution strategies, Assessing a successful design in site.

**Practical:** Commercial landscaping, Plant identification, Materials of garden design, Design making by different garden styles and types. Way of designing a commercial landscape project, visit to model ornamental nursery.

Assessing site and plants adaptability for different locations, Landscape engineering (Topographical survey and designing concept), special techniques in garden landscaping (burlaping, waterscaping, hardscaping, lawn making, topiary styles specializing, bioaesthetic planning).

Preparation and drawing of site plan, Learning the basics in computer aided design (CAD) for developing a garden landscape plan, Handling soft landscape materials (AUTOCAD & ARCHICAD), GIS as a tool for spatial designing. Contemporary landscaping, Environmental landscaping, Industrial and institutional landscaping, Public and private garden making, play ground landscaping, Case study with the successful landscapist, Budget/Project cost estimating, Execution.

## **FLA 801**

## **Foliage Plant Production**

**1+1**

UNIT I: Global status and development of foliage plant industry .Recent economics and technical development.

UNIT II: Use of house plants for interiorscaping, plant selection, different groups of plants used for decoration.

UNIT III: Propagation techniques,-sexual, asexual, tissue culture plants. Environmental consideration for propagation.

UNIT IV: Soil and other pot mixtures. Characteristics, physical & chemical characteristics, amendments, potting mixture components & selection.

UNIT V: Nutrition and fertilization, deficiency and toxicity symptoms, fertilizer sources interaction between fertilization and cultural methods. Watering- water requirement on the basis of plant, indoor condition and media, effects of over and under watering, water quality.

Plant growth regulating chemicals-effect on pot plant quality. Plant protection

UNIT VI: Environmental factors- light, temperature, relative humidity, carbon dioxide level, indoor air draft –draft from air conditioners, room heaters and fans.

Concept of Indoor environment cleansing by use of house plants.

UNIT VII: Economic aspects of producing and marketing of indoor plants. Supply and demand characteristics. Marketing indices of potted foliage.

UNIT VIII: Foliage plants- dieffenbachia, aglaonema, bromeliads, Yucca, palms, Begonia, cycad, Dionne, anthurium, spathiphyllum, ferns scafflera etc.

**Practical:** Identification of house plants; propagation, potting, repotting, different potting mixture. Use of PGR to enhance plant quality.

### **FLA 851 Advances in Biochemistry and Biotechnology of Flowers 2+1**

UNIT I: Biochemistry of flowers: Principle involved in the formation of pigments – chlorophyll, xanthophyll, carotenoids, flavonoids and anthocyanins.

Chemistry and importance of secondary metabolites in rose, jasmine, marigold, tuberose, carnation, orchids, lilies and bougainvillea. Biochemistry and utilization commercial products (select items).

UNIT II: Recent trends- extraction of biocolours and their value addition, uses in food and textile industries. Biochemistry of post harvest management of cut flowers.

UNIT III: Biotechnology – tools techniques and role in floriculture industry, physical factors and chemical factors influencing the growth and development of plant cell, tissue and organs, cytodifferentiation, organogenesis, somatic embryogenesis.

UNIT IV: *In vitro* lines for biotic and abiotic stress – Meristem culture for disease elimination, production of haploids through anther and pollen culture – embryo and ovule culture, micrografting, wide hybridization and embryo-rescue techniques, construction of somatic hybrids and cybrids, regeneration and characterization of hybrids and cybrids, *in vitro* pollination

and fertilization, hardening media, techniques and establishment of tissue culture plants in the primary and secondary nursery.

UNIT V: Somoclonal variation and its applications – variability induction through *in vitro* mutation, development of cell suspension cultures, types and techniques, *in vitro* production of secondary metabolites, role of

bioreactors in production of secondary metabolites, quantification and quality analysis of secondary metabolites using HPLC, *in vitro* conservation and cryo-preservation techniques.

UNIT VI: Gene cloning, genetic engineering: vectors and methods of transformation - electroporation, particle bombardment, *Agrobacterium* mediated, transgenic plants in flower crops, medicinal and aromatic crops, isolation of DNA, RNA, quantification, Polymerase Chain Reaction for amplification; AGE & PAGE techniques; identification of molecular markers.

UNIT VII: Construction of c- DNA library, DNA fingerprinting technique in economic flower crop varieties, molecular approaches to control ethylene response, improving shelf life, improving resistance for environmental stress,

approaches to improve flower development, pigment production, secondary metabolite production, post harvest biotechnology of flowers, ornamental plants, achievements of biotechnology in flower crops.

**Practical:** Extraction of flower pigments – xanthophylls, carotenoids and anthocyanins. Plant nutrient stock- growth regulators- media preparation and sterilization- *In vitro* seed germination- callus culture and organ culture- Cell suspension culture – cell plating and regeneration- clonal propagation through Meristem culture, induction of multiple shoots- Anther- Pollen- Ovule and Embryo culture- Synthetic seed production, *in vitro* mutation induction, *in vitro* rooting – hardening at primary and secondary nurseries, Project preparation for establishment of low, medium and high cost tissue culture laboratories, DNA isolation from economic flower crop varieties – Quantification and amplification, DNA and Protein profiling – molecular markers for economic flower crops, restriction enzymes, vectors for cloning and particle bombardment, DNA fingerprinting of flower crop varieties .