

**Course Title: Crop Regulation in Ornamental Crops**

**Course Code: FLS 601**

**Credit Hours: 3 (2+1)**

**THEORY**

**Block 1: Basis of crop regulation**

**UNIT I**

Basis of flowering: Ecophysiological influences on growth and development of flower crops for flowering, Crop load and assimilate partitioning and distribution. Root and canopy regulation,

**UNIT II**

Growth regulators: Study of plant growth regulators including biostimulants and polyamines in floriculture- structure, biosynthesis, metabolic and morphogenetic effects of different plant growth promoters and growth retardants. Absorption, translocation and degradation of phytohormones – internal and external factors influencing hormonal synthesis, biochemical action, growth promotion and inhibition, Plant architecture management for flower crops and ornamental plants, molecular approaches in crop growth regulation.

**Block 2: Programming**

**UNIT I**

Growth regulation: Growth regulation aspects of propagation, embryogenesis, seed and bud dormancy, flower bud initiation, regulation of flowering, photo and thermo periodism, off season production, bulb forcing techniques,

**UNIT II**

Programmed production: Programmed production of important flower crops like chrysanthemum, tulips, liliun, daffodils, poinsettia, kalanchoe, gypsophila.

**PRACTICALS**

1. Plant architecture studies in important flower crops (2)
2. Bioassay and isolation through chromatographic analysis for auxins, gibberellins, cytokinins, ABA (4)
3. Growth regulation during propagation, dormancy, flowering (2)
4. Photoperiod regulation in short day and long day crops (2)
5. Off season production in important crops (2)
6. Bulb forcing in bulbous ornamental crops (2)
7. Exposure visits (2)

**RESOURCES**

- Buchanan, B. Gruissem, W. & Jones, R. 2002. *Biochemistry and Molecular Biology of Plants*. 2015. Wiley Blackwell Publ. 2<sup>nd</sup> Edition, pp. 1280.
- De Hertagh, A. & Le Nard, M. 1993. *The Physiology of Flower Bulbs*. Elsevier, London, UK. Epstein, E. 1972. *Mineral Nutrition of Plants: Principles and Perspectives*. John Wiley & Sons.
- Fosket, D. E. 1994. *Plant Growth and Development: A Molecular Approach*. Academic Press. pp. 580.
- Leopold, A. C. & Kriedemann, P. E. 1985. *Plant Growth and Development*. McGraw-Hill, New York. 3<sup>rd</sup> Edition.
- Peter, K. V. 2008. *Basics of Horticulture*. New India Publ. Agency, New Delhi, India.
- Roberts, J., Downs, S. & Parker, P. 2002. *Plant Growth Development: In Plant*. Oxford University Press. pp. 221-274.
- Salisbury, F. B. & Ross, C.W. 1992. *Plant Physiology, Hormones and Plant Regulators: Auxins and Gibberellins*. Wadsworth Publ., Belmont. 4<sup>th</sup> Edition, pp. 357-381.

\*\*\*\*\*

**Course Title: Postharvest Biology Of Floricultural Crops**  
**Course Code: FLS 602**  
**Credit Hours: 3 (2+1)**

**THEORY**

**Block 1:** Preharvest and post harvest physiology and biochemistry

**UNIT I:**

Pre harvest physiology: Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and other biochemical changes, respiration, transpiration in important flower crops.

**UNIT II:**

Senescence: Physiology and biochemistry of flowering, enzymatic changes, Ethylene sensitivity, ethylene evolution and management, factors leading to post-harvest loss, pre-cooling. Petal senescence at molecular level, functional gene analysis for postharvest flower quality in important flower crops etc.

**UNIT III:**

Pigments and secondary metabolites: Biosynthetic pathways of chlorophyll, xanthophyll, carotenoids, flavonoids and anthocyanins and betalains. Chemistry and importance of secondary metabolites. Biochemistry and utilization for commercial products in important flower crops.

**Block 2:** Storage and packaging

**UNIT I:**

Storage of flowers: Treatments prior to shipment, viz., precooling, pulsing, impregnation, chemicals, Irradiation, biocontrol agents and natural plant products. Methods of storage: ventilated, refrigerated, Modified atmosphere, Controlled atmosphere storage, cool chain management, physical injuries and disorders in important flower crops.

**UNIT II:**

Packaging: Packing methods and transport, Smart technologies in packaging and storage, advanced tools like nanotechnology application for quality parameters and post harvest treatments for export in important flower crops, packaging standards, flower labels value chain in floriculture,

**UNIT III:**

Recent trends: Recent trends- extraction of bio-colours from flowers-conventional as well as *in*

*vitro* methods and their value addition uses in food and textile industries. Molecular techniques for enhancing postharvest flower quality, transgenics in ornamental plants for enhanced postharvest life.

#### **UNIT IV:**

Dried ornamental crops: Post harvest handling of dried ornamental crops including packing, storage and shipment. Storage pest and mould problems in dried ornamental produce, colour retention, physiological and biochemical changes, etc.

#### **PRACTICALS**

1. Improved packaging and storage of important flowers (2).
2. Physiological loss in weight of flowers, estimation of transpiration, respiration rate, ethylene release and study of vase life (2)
3. Extension in cut flower vase life using chemicals (1) Estimation of quality characteristics in stored flowers (1).
4. Estimation of biochemical changes like enzymatic changes, lipids and electrolyte leakage (2)
5. Extraction of flower pigments – Chlorophyll, xanthophylls, carotenoids and anthocyanins (4)
6. Cold chain management - visit to cold storage, MA and CA storage units (2)
7. Project preparation (2)

#### **RESOURCES**

- Buchanan, B. Gruissem, W. & Jones, R. 2002. *Biochemistry and Molecular Biology of Plants*. 2015. Wiley Blackwell Publ. 2<sup>nd</sup> edition, pp. 1280.
- Dey, P. M. & Harborne, J.B. 1997. *Plant Biochemistry*. Academic Press. 2<sup>nd</sup> Edition.
- Glover, M. D. 1984. *Gene Cloning: The Mechanics of DNA Manipulation*. Chapman & Hall Publ.
- Goodwin, T. W. & Mercer, E. I. 2003. *Introduction to Plant Biochemistry*. CBS Publ.

\*\*\*\*\*

**Course Title: Specialty Flowers, Fillers And Cut Greens**

**Course Code: FLS 603**

**Credit Hours:2(1+1)**

**THEORY**

**Block 1: Scope**

**UNIT I:**

Importance, national and international scenario: Introduction, present status, scope, importance and avenues for specialty flowers and cut greens.

**Block 2: Avenues**

**UNIT I:**

Specialty flowers: Cultivation practices of specialty flower crops like heliconia, red ginger, Bird of Paradise, Ornamental banana, ornamental curcuma, gingers, wax flower, kangaroo paw, limonium, rice flower, *etc.*

**UNIT II:**

Fillers: Cultivation practices of fillers like gypsophila, solidago, Mollucella, lupins,*etc.*

**UNIT III:**

Cut greens: Cultivation practices of cut greens like anthurium, ferns, asparagus, cycas, thuja, bottle brush, ornamental palms, zanado, dracaena, eucalyptus, ruscus, dianella, alpinia, *etc.*

**Block 3: Trade and Marketing**

**UNIT I:**

Post harvest management: Pre and post harvest factors influencing the vase life of the flowers and fillers, Post harvest management including pulsing, holding, packing, storing, forward and backward linkages, value chain management

**UNIT II:**

Standards: Quality standards, Packaging standards, marketing and trade in important flower, filler and foliage crops.

**PRACTICALS (16)**

1. Identification of specialty flowers, fillers and cut greens (2)
2. Media and bed preparation for cultivation (2)
3. Propagation of important crops (2)
4. Integrated disease and pest management in important crops (2)
5. Post harvest handling of specialty flowers, fillers and cut greens (2)
6. Preparation of value added products from important specialty flowers, fillers and foliages (2)
7. Exposure visits (2)
8. Economics and Project preparation (2)

**RESOURCES**

- Armitage, A. M. & Laushman, J. M. 2008. *Speciality Cut Flowers*. Timber Press. 2<sup>nd</sup> Edition, pp. 636.
- Bhattacharjee, S. K. 2006. *Vistas in Floriculture*. Pointer Publ., Jaipur, India.
- Bhattacharjee, S. K. & De, L.C. 2003. *Advanced Commercial Floriculture* Vol.1. Aavishkar Publ. & Distributors, Jaipur India.

- Bose, T. K., Yadav, L. P., Pal, P., Parthasarathy, V.A. & Das, P. 2003. *Commercial Flowers*. Vol. I & II. Naya Udyog, Kolkata, India.
- Misra, R. L. & Misra, S. 2017. *Commercial Ornamental Crops: Traditional and Loose Flowers*. Kruger Brentt Publisher UK Ltd.
- Mukherjee, D. 2008. *Speciality Cut Flowers-Production Technologies*. Naya Udyog Kolkata, India. pp. 614.
- Salunkhe, K., Bhatt, N. R. & Desai, B. B. 2004. *Post harvest Biotechnology of Flowers and Ornamental Plants*. Naya Prokash, Kolkata, India.

\*\*\*\*\*

**Course Title: Biotechnological Approaches In Floricultural Crops**

**Course Code: FLS 604**

**Credit Hours: 3 (2+1)**

**THEORY**

**Block 1: Scope of biotechnology**

**UNIT I:**

Scope of biotechnology: Present status of biotechnology, tools techniques and role in floriculture industry, physical factors and chemical factors influencing the growth and development of plant cell, tissue and organs, cyto-differentiation, organogenesis, somatic embryogenesis in important flower crops.

**Block 2: Cell, tissue and organ culture**

**UNIT I:**

Micropropagation: 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 in important flower crops.

**UNIT II:**

Somaclonal variation and *in vitro* conservation: Somaclonal variation and its applications – variability induction through in vitro mutation, development of cell suspension cultures, types and techniques, Synthetic Seed technology, in vitro production of secondary metabolites, role of bioreactors in production of secondary metabolites, quantification and quality analysis of secondary metabolites using HPLC/ MS/GCMS/ in vitro conservation and cryo-preservation techniques in important flower crops.

**Block 3: Genetic engineering and molecular biology**

**UNIT I:**

Genetic engineering: Gene cloning, genetic engineering: vectors and methods of transformation – electroporation, particle bombardment, Functional gene analysis techniques like PTGS including VIGS in ornamental plants, Agrobacterium mediated, transgenic plants in flower crops, Biosafety of transgenics isolation of DNA, RNA, quantification, Polymerase Chain Reaction for amplification; AGE & PAGE techniques; identification of molecular markers in important flower crops.

**UNIT II:**

Molecular approaches: Molecular markers as a tool for analysis of genetic relatedness and selection in ornamental crops. Molecular control of flower development, light sensing with respect to plant development, flower pigmentation, fragrance, senescence, ethylene synthesis pathway in important flower crops. Molecular biology- Gene isolation, characterization, manipulation and transfer in important flower crops.

Construction of c- DNA library, DNA fingerprinting technique in economic flower crop varieties, RNAi, Genome editing basics, molecular approaches to control ethylene response, Fragrance, Plant Architecture, desirable flower traits, colour, shape, improving postharvest 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 bio-technology in flower crops.

### **PRACTICALS**

1. Micropropagation, Pollen- Ovule and Embryo culture- Synthetic seed production (2)
2. *In vitro* mutation induction, in vitro rooting – hardening at primary and secondary nurseries (3).
3. DNA isolation from economic flower crop varieties – Quantification and amplification (2)  
DNA and Protein profiling – molecular markers, PCR Handling (2)
4. Vectors for cloning and particle bombardment (3)
5. DNA fingerprinting of flower crop varieties (3)
6. Project preparation for establishment of low, medium and high cost tissue culture laboratories (1)

### **RESOURCES**

- Chopra, V. L. & Nasim, A. 1990. *Genetic Engineering and Biotechnology- Concepts, Methods and Applications*. Oxford & IBH Publ. Company, USA. pp. 200.
- Debnath, M. 2011. *Tools and Techniques of Biotechnology*. Pointer Publ.
- Glover, M. D. 1984. *Gene Cloning: The Mechanics of DNA Manipulation*. Chapman & Hall Publ.
- Gorden, H. & Rubsell, S. 1960. *Hormones and Cell Culture*. AB Book Publ.
- Keshavachandran, R., Nazeem, P. A., Girija, D., John, P. S. & Peter, K. V. 2007. *Recent Trends in Horticultural Biotechnology*. Vols. I & II, 1018 p.. New India Publ. Agency, New Delhi, India.
- Keshavachandran, R. & Peter, K. V. 2008. *Plant Biotechnology: Methods in Tissue Culture and Gene Transfer*. Orient Blackswan. 312 p.

\*\*\*\*\*

**Course Title: Advances In Landscape Gardening**  
**Course Code: FLS 605**  
**Credit Hours:3 (1+2)**

**THEORY**

**UNIT I:**

Landscape design: Commercial landscape gardening- History, Plant identification and ecology, Materials of garden design, Design making by different garden styles and types. Design principles in ancient and modern landscape. Principles of designing a commercial landscape project. Role of landscaping in environment improvement, ecology conservation (birds, butterflies, animals). Plant wealth for edges, hedges, herbaceous borders, trees, floral beds, water plants, cacti, ferns, palms,*etc.*

**UNIT II:**

Site analysis: Assessing site and plants adaptability for different locations, Landscape engineering (Topographical survey and designing concept including GIS,GPS, Remote sensing), special techniques in garden landscaping (Burlapping, waterscaping, xeriscaping, hardscaping, lawn establishment, topiary styles specializing, bioaesthetic planning).

**UNIT III:**

Software in landscaping: 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 IV:**

Landscaping for different situations: Contemporary landscaping, Urban landscaping, Environmental landscaping, Industrial and institutional landscaping, Public and private garden making, play ground landscaping, Inventory management, Landscape restoration, Assessing a successful design in site.

**UNIT V:**

Maintenance: Maintenance of different types of gardens, waste water utilisation, historical and archaeological garden sites, Permissions required for bigger projects, carbon sequestration, carbon credits *etc.*,

**PRACTICALS (32)**

1. Plant identification (1)
2. Materials of garden design, Design making by different garden styles and types (2)
3. Assessing site and plants adaptability for different locations (2)
4. Way of designing a commercial landscape project (4)
5. Landscape engineering (Topographical survey and designing concept) (2)
6. Preparation and drawing of site plan (4)
7. Learning the basics in computer aided design (CAD) for developing a gardenlandscape plan (4)
8. Handling soft landscape materials (AUTOCAD & ARCHICAD), GIS as a tool for spatial designing (4)
9. Case study with the successful landscapist (4)
10. Budget/Project cost estimating (2)
11. Exposure visits (3)

**RESOURCES**

- Bose, T.K., Maiti, R.G., Dhua, R.S. & Das P. 1999. *Floriculture and Landscaping*. NayaProkash, Kolkata, India.
- Nambisan, K.M.P.1992. *Design Elements of Landscape Gardening*. Oxford & IBH Publ. Co.,New Delhi, India.
- Ozayuvuz, M. 2013. *Advances in Landscape Architecture*. In Tech Open Publ.
- Woodrow, M. G. 1999. *Gardening in India*. Biotech Books, New Delhi, India.

\*\*\*\*\*

**Course Title: Vertical Gardening**

**Course Code: FLS 605**

**Credit Hours: 3(1+2)**

**THEORY**

**Block 1: Importance**

**UNIT I:**

Scope: Present status of vertical gardening, benefits of vertical gardening, History of vertical gardens, role of indoor plants in mitigating pollution.

**UNIT II:**

Growth: Factors influencing the growth and development of the plants including light, humidity, temperature, nutrition, irrigation, growth regulation.

**Unit III:**

Making of vertical gardens: Containers, media, frames, cost effective components, cables, wires, nets for the vertical formations, modular living walls,

**Block 2: Green roofing**

**UNIT I:**

Green Facades: Influence of green facades in providing thermal comfort, atmospheric cleansing and related environmental benefits, Energy saving potential of green façades, Aesthetic appeal of green structures and other relevant studies on urban greening .

**UNIT II:**

Mitigation of pollution: Plants suitable, Dust mitigation, Radiation absorption, Pollution mitigation, Acoustic attributes of urban greening

**UNIT III:**

Maintenance: Lifecycle, maintenance, Plants with low light, medium, high intensity requirement, cost effectiveness and overall sustainability of living walls

**PRACTICALS**

1. Identification of plants (2)
2. Components of vertical gardens (2)
3. Designing of vertical gardens for different locations (4)
4. Maintenance of vertical gardens (2)
5. Economics (1)
6. Project preparation (1)
7. Exposure visit (4)

**RESOURCES**

- Chopra, V. L. & Nasim, A. 1990. *Genetic Engineering and Biotechnology- Concepts, Methods and Applications*. Oxford & IBH Publ. Company, USA. pp. 200.
- Debnath, M. 2011. *Tools and Techniques of Biotechnology*. Pointer Publ.
- Glover, M. D. 1984. *Gene Cloning: The Mechanics of DNA Manipulation*. Chapman & Hall Publ.
- Gorden, H. & Rubsell, S. 1960. *Hormones and Cell Culture*. AB Book Publ.
- Keshavachandran, R., Nazeem, P. A., Girija, D., John, P. S. & Peter, K. V. 2007. *Recent Trends in Horticultural Biotechnology*. Vols. I & II, pp. 1018. New India Publ. Agency, New Delhi, India.
- Keshavachandran, R. & Peter, K. V. 2008. *Plant Biotechnology: Methods in Tissue Culture and Gene Transfer*. Orient Blackswan. pp. 312.

\*\*\*\*\*

**Course Title: Advances In Breeding Of Flower Crops**

**Course Code: FLS 606**

**Credit Hours: 3(2+1)**

**THEORY**

**Block 1:**

*In vitro* techniques and biosynthetic pathways

**UNIT I:**

*In vitro* techniques: Role of biotechnology in improvement of flower crops; *in vitro* mutagenesis, embryo culture, somaclonal variation, transformation, *in vitro* cryopreservation, somatic hybridization, anther and ovule culture including somatic embryogenesis.

**UNIT II:**

Biosynthetic pathways: Biosynthetic pathways of pigment, fragrance and senescence, flower form; chemistry and importance of secondary metabolites, genomics, proteomics, metabolomics.

**Block 2:**

Molecular techniques

**UNIT I:**

Molecular breeding: Molecular breeding and Marker assisted selection; molecular characterization; construction of c-DNA library; High throughput sequencing.

**UNIT II:**

Genome editing: Genome editing, CRISPER CAS, gene pyramiding, allele mining.

**UNIT III:**

Advances in flower crops: Breeding for biotic and abiotic stresses using biotechnological means; designer flower crops. Advancements in important flower crops like rose, chrysanthemum, carnation, orchids, anthuriums, lily, gerbera etc.,

**PRACTICALS (16)**

- *In vitro* mutagenesis, embryo culture, somaclonal variation (2)
- Somatic hybridization, anther and ovule culture and somatic embryogenesis (2)
- Genetic transformation (2)
- Genetic fingerprinting, Genome editing techniques (4)
- PCR, genomics, blotting techniques (2)
- Cloning, marker assisted selection (2)
- Bioinformatics (2)

**RESOURCES**

- Anderson, N. O. 2007. *Flower Breeding and Genetics Issues, Challenges and Opportunities for the 21<sup>st</sup> Century*. Springer Publ., The Netherlands.
- Arthur, M. L. 2013. *Introduction to Bioinformatics*. Oxford University Press, U.K. 400 p.
- Chadha, K. L. & Chaudhury, B. 1992. *Ornamental Horticulture in India*. ICAR, New Delhi, India.
- Nelson, D. L. & Cox, M. M. 2000. *Principles of Biochemistry*. 4<sup>th</sup> Edition, Lehninger Publ.
- Panopoulos, N.J. (Ed.). 1981. *Genetic Engineering in Plant Sciences*. Praeger Publ.
- Parthasarathy, V. A., Bose, T. K., Deka, P. C., Das, P., Mitra, S. K. & Mohanadas, S. 2001. *Biotechnology of Horticultural Crops*. Vol. I-III. Naya Prokash, Kolkata, India.

- Pierik, R.L.M. 1987. *In vitro Culture of Higher Plants*. MartinusNijhoff Publ. Amsterdam.
- Primrose, S. B. & Twyman, R. 2006. *Principles of Gene manipulation and Genomics*.Blackwell Publ., USA.
- Srivastava, P.S., Narula, A. & Srivastava, S. 2005. *Plant Biotechnology and Molecular Markers*. Anamaya Publ., New Delhi, India.
- Vainstein, A. (Ed). 2002. *Breeding for Ornamental crops: Classical and Molecular Approaches*. Springer-Science-Business Media, B.V. 1<sup>st</sup> Edition.
- Wilson, K. & Walker, J. 2010. *Principles and Techniques of Biochemistry and MolecularBiology*. 7<sup>th</sup> Edition, Cambridge University Press, UK.

\*\*\*\*\*

**Course Title: Advances In Production Technology Of Flower Crops**

**Course Code: FLS 607**

**Credit Hours: 3(2+1)**

**THEORY**

**Block 1:** Production technology

**UNIT I:**

Scope and scenario: Commercial flower production; Scope and importance; Global Scenario in cut flower production and trade, varietal wealth and diversity; Soil and Environment; cut flower, loose flowers, dry flowers and essential oil trade, flower seed production. Special characteristics and requirements. Essential oil industry, recent advances in extraction methods.

**UNIT II:**

Cultural operations: Propagation and multiplication; Greenhouse management; Soil/media decontamination techniques; Microirrigation; nutrition and fertigation; slow release fertilizers and biofertilizers; influence of environmental parameters, light, temperature, moisture, humidity and CO<sub>2</sub> on growth and flowering.

**UNIT III:**

Crop Regulation: Flower forcing and year-round flowering through physiological interventions; Chemical regulation; Environmental manipulation, important insect pests, diseases, nematodes and their management through IPM and IDM, quarantine measures for export and other export norms.

**UNIT IV:**

Advances in production technology of crops: Advances in roses, chrysanthemum, carnation, tuberose, gladiolus, lily, gerbera, orchids, anthuriums, etc.,

**Block 2:** Mechanization and Post harvest management

**UNIT I:**

Mechanization: Mechanization, automation, ICT and AI in floriculture.

**UNIT II:**

Post harvest management: Harvest indices, Harvesting techniques; Post harvest handling for local, distant and export market, Cluster production, Contract farming, FPOs, Value chain management.

**PRACTICALS (16)**

1. Greenhouse management; Soil decontamination techniques (2)
2. Microirrigation; Nutrition and fertigation (2)
3. Special practices- bending, netting, pinching, disbudding, defoliation and chemical pruning etc (2)
4. Photoperiodic and chemical induction of flowering (2)
5. Assessing harvest indices; Post-harvest handling (2)
6. Case studies (2)
7. Visit to commercial cut flower and essential oil units (4)

**RESOURCES**

- Bose, T.K., Maiti, R.G., Dhua, R.S. & Das P. 1999. *Floriculture and Landscaping*. Naya Prokash, Kolkata, India.
- Chadha, K. L. & Choudhury, B. 1992. *Ornamental Horticulture in India*. ICAR, New Delhi, India.

- George, S. & Peter, K. V. 2008. *Plants in a Garden*. New India Publ. Agency, New Delhi, India.
- Lauria, A. & Victor, H. R. 2001. *Floriculture-Fundamentals and Practices*. Agrobios Publ., Jodhpur, India.
- Misra, R.L. & Misra, S. 2017. *Commercial Ornamental Crops: Traditional and Loose Flowers*. Kruger Brentt Publisher UK Ltd.
- Randhawa, G.S. & Mukhopadhyay, A. 1986. *Floriculture in India*. Allied Publ.
- Reddy, S., Janakiram, T., Balaji T., Kulkarni, S. & Misra, R. L. 2007. *Hi- Tech Floriculture*.
  - Indian Society of Ornamental Horticulture, New Delhi India.
- Singh, A. K. 2006. *Flower Crops: Cultivation and Management*. New India Publ. Agency, New Delhi, India.
- Singh, A. K. 2014. *Breeding and Biotechnology of Flowers, Vol.1: Commercial Flowers*. New India Publ. Agency, New Delhi, India. pp.740.

\*\*\*\*\*

**Course Title: Advances In Protected Cultivation Of Flower Crops**  
**Course Code: FLS 608**  
**Credit Hours: 3 (2+1)**

**THEORY**

**Block 1:** Production technology

**UNIT I:**

Scope and Scenario: Prospects of protected floriculture in India, growing structures, basic considerations in establishment and operation of green houses, functioning and maintenance. Global trade, forward and backward linkages for import clusters, International and national auction houses.

**Unit II:**

Microclimate management: Environmental control systems in greenhouse, regulation of light through LEDs containers, substrate culture, soil decontamination techniques, aeroponics, hydroponics and vertical farming.

**UNIT III:**

Cultural operations: Water and nutrient management, crop regulation, special horticultural practices under protected cultivation of rose, chrysanthemum, carnation, orchids, anthurium, gerbera, liliun, cut foliage and potted ornamental crops; plant architecture management in ornamental plants.

**UNIT IV:**

Advances in flower crops: Advances in protected cultivation of important flowering (rose, chrysanthemum, carnation, gerbera, orchids, anthurium, liliun, and foliage plants (agloenema, monstera, dracaena, syngonium, pothos, diffenbachia etc)

**Block 2:** Precision floriculture and regulations

**UNIT I:**

Precision floriculture: Precision floriculture, Principles and concepts, enabling technologies of precision floriculture, remote sensing, sensors, automation in greenhouses, solar greenhouses, retractable greenhouses. Computers and robotics, decision support systems, apps, cold chain management, use of AI for production and trade.

**UNIT II:** Regulations: PBR / IPR issues; Forward and backward linkages, 100% EOU, packaging and export standards, Cool chain Management, non-tariff barriers, APEDA regulations for export, marketing channels, auction houses, major markets.

**PRACTICALS**

1. Growing structures, basic considerations in establishment and operation of greenhouses.
2. Environmental control systems in greenhouse.
3. Containers, substrate culture, soil decontamination techniques.
4. Crop regulation.
5. Special horticultural practices under protected cultivation.
6. Precision equipments, computers and robotics in precision farming.
7. Harvest indices – harvesting, Post harvest handling, marketing.
8. Export and cold chain management.

## RESOURCES

- Bhattacharjee, S. K. 2018. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
- Reprint, 2065 p.
- Bose, T.K., Maiti, R.G., Dhua, R.S. & Das P. 1999. *Floriculture and Landscaping*. NayaProkash, Kolkata, India.
- Reddy, S., Janakiram, T., Balaji, Kulkarni, S. & Misra, R. L. 2007. *Hi- Tech Floriculture*.
- Indian Society of Ornamental Horticulture, New Delhi, India.

\*\*\*\*\*