

**Faculty of Agriculture Science & Technology**

**Department of Agriculture Science**

**Study and Evaluation Scheme**

**Of**

**M.Sc (Ag) Horticulture  
(FLORICULTURE AND LANDSCAPE ARCHITECTURE)**

(Applicable w.e.f Academic Session 2018-19 till revised)



**AKS UNIVERSITY, SATNA**

**Study and Evaluation Scheme**

**\*\* The University Authorities reserve all the rights to make any additions/ deletions or changes/ modifications to this syllabus as deemed necessary**

**M. Sc. (Ag)**  
**(Two Year Master Degree Programme)**  
**Requirement of credit hours for award of the degree**

<b>S.No</b>	<b>Nature of courses</b>	<b>Credit hours</b>
<b>1</b>	<b>Major courses</b>	<b>23</b>
<b>2</b>	<b>Minor courses</b>	<b>06</b>
<b>3</b>	<b>Supporting courses</b>	<b>06</b>
<b>4</b>	<b>Master Seminar</b>	<b>01</b>
<b>5</b>	<b>Master Research</b>	<b>20</b>
	<b>Total credits</b>	<b>56</b>

**Major Subject:** The subject (Department/Discipline) in which a student takes admission

**Minor Subject:** The subject closely related to a student's major subject.

**Supporting subject:** The subject not related to the major subject. It could be any subject considered relevant for student's research work or necessary for building his overall competence.

**Non-Credit compulsory Courses:** Six courses (PGS 1 –PGS 6) are of general nature and are compulsory

# M.Sc (Ag) Horticulture (FLA)

## Semester wise distribution of courses

### First Semester:

A. Major Courses *			
S.No.	Course code	Title of Course	Credit Hours
1	FLA.502*	PRODUCTION TECHNOLOGY OF CUT FLOWERS	2+1
2	FLA.505	PROTECTED FLORICULTURE	2+1
3	FLA 603	ADVANCES IN PROTECTED AND PRECISION FLORICULTURE	1+1
4	FLA.504*	LANDSCAPING AND ORNAMENTAL GARDENING	2+1
		<b>Total</b>	<b>11(7+4)</b>
B. Minor Courses **			
1	FLA.501*	BREEDING OF FLOWER CROPS AND ORNAMENTAL PLANTS	2+1
		<b>Total</b>	<b>3(2+1)</b>
C. Supporting Courses			
1	STAT 511	Statistical Methods in applied science	2+1=3
		<b>Total</b>	<b>3(2+1)</b>
D. Non Credit Courses			
1	PGS 502	Technical Writing & Communication Skill	N.C.
2	PGS 503	Intellectual Property & its management in Agriculture	N.C.
		<b>Total</b>	<b>17</b>

### Second Semester:

A. Major Courses *			
S.No.	Course code	Title of Course	Credit Hours
1	FLA.503**	PRODUCTION TECHNOLOGY OF LOOSE FLOWERS	2+1
2	FLA.506**	VALUE ADDITION IN FLOWERS	2+1
3	FLA.507*	TURFING AND TURF MANAGEMENT	2+1
4	FLA.508	CAD FOR OUTDOOR AND INDOORSCAPING	2+1
		<b>Total</b>	<b>12(8+4)</b>
B. Minor Courses **			
1	FLA605	ADVANCES IN BIOCHEMISTRY AND BIOTECHNOLOGY OF FLOWERS	2+1=3
		<b>Total</b>	<b>3(2+1)</b>
C. Supporting Courses			
1	STAT 512	Experimental Design	2+1=3
		<b>Total</b>	<b>18</b>
D. Non Credit Courses			
1	PGS 504	Library & Information Services	N.C.
2	PGS 501	Basic Concepts in Laboratory Techniques	N.C.
		<b>Total</b>	<b>18</b>

### Third Semester

<b>A. Major courses*</b>			
<b>S.No</b>	<b>Courses Code</b>	<b>Title of Course</b>	<b>Credit hours</b>
1	FLA 591	Master Seminar	1(0+1)
2	FLA 599	Master's Research	10(0+10)
		Total	11 (1+10)
<b>B. Non Credit Course**</b>			
1	PGS 506	Disaster Management	N.C.
2	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	N.C.
		Grand Total	

### Fourth Semester

<b>A. Major courses*</b>			
<b>S.No</b>	<b>Courses Code</b>	<b>Title of Course</b>	<b>Credit hours</b>
1	FLA 599	Master's Research Seminar	10(0+10)
		Total	10(0+10)

## **M.Sc (Ag) Horticulture (FLA)** **1st Semester**

### **Major Courses**

**FLA 502 PRODUCTION TECHNOLOGY OF CUT FLOWERS**

**2+1**

#### **Objective**

To impart basic knowledge about the importance and production technology of cut flowers grown in India.

#### **Theory**

##### **UNIT I**

Scope of cut flowers in global trade, Global Scenario of cut flower production, Varietal wealth and diversity, area under cut flowers and production problems in India- Patent rights, nursery management, media for nursery, special nursery practices.

##### **UNIT II**

Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO<sub>2</sub> on growth and flowering.

##### **UNIT III**

Flower production – water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

##### **UNIT IV**

Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

##### **UNIT V**

Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Methods of delaying flower opening, Pre-cooling, pulsing, packing, Storage & transportation, marketing, export potential, institutional support, Agri Export Zones.

**Crops:** Cut rose, cut chrysanthemum, carnation, gerbera, gladioli, tuberose, orchids, anthurium, aster, lilies, bird of paradise, heliconia, alstroemeria, alpinia, ornamental ginger, bromeliads, dahlia, gypsophilla, limonium, statice, stock, cut foliage and fillers.

#### **Practical**

1. Botanical description of varieties of cut flower.
2. Propagation techniques of cut flower.
3. Mist chamber operation for cut flower growing.
4. Training and pruning techniques, practices in manuring for cut flower.
5. Drip and fertigation, foliar nutrition, growth regulator application in cut flower.
6. pinching, disbudding, staking, harvesting techniques, post-harvest handling of cut flower.
7. Cold chain, project preparation for regionally important cut flowers.
8. Visit to commercial cut flower units.

#### **Suggested Readings**

Arora JS. 2006. *Introductory Ornamental horticulture*. Kalyani.

Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.

Bose TK & Yadav LP. 1989. *Commercial Flowers*. Naya Prokash.

Bose TK, Maiti RG, Dhua RS & Das P. 1999. *Floriculture and Landscaping*. Naya Prokash.

Chadha KL & Chaudhury B. 1992. *Ornamental Horticulture in India*. ICAR.

**M.Sc (Ag) Horticulture (FLA)**  
**1st Semester**

**FLA 505**

**PROTECTED FLORICULTURE**

**2 + 1**

**Objective**

Understanding the principles, theoretical aspects and developing skills in protected cultivation of flower crops.

**Theory**

**UNIT I**

Prospects of protected floriculture in India; Types of protected structures –Greenhouses, polyhouses, shade houses, rain shelters etc., Designing and erection of protected structures; Low cost/Medium cost/High cost structures – economics of cultivation; Location specific designs; Structural components; Suitable flower crops for protected cultivation.

**UNIT II**

Environment control – management and manipulation of temperature, light, humidity, air and CO<sub>2</sub>; Heating and cooling systems, ventilation, naturally ventilated greenhouses, fan and pad cooled greenhouses, light regulation.

**UNIT III**

Containers and substrates, soil decontamination, layout of drip and fertigation system, water and nutrient management, weed management, physiological disorders, IPM and IDM.

**UNIT IV**

Crop regulation by chemical methods and special horticultural practices (pinching, disbudding, deshooting, deblossoming, etc.); Staking and netting, Photoperiod regulation.

**UNIT V**

Harvest indices, harvesting techniques, post-harvest handling techniques, Precooling, sorting, grading, packing, storage, quality standards.

**Practical**

1. Study of various protected structures.
2. Practices in design, layout and erection of different types of structures,
3. Practices in preparatory operations, soil decontamination techniques,
4. Practices in environmental control systems,
5. Practices in drip and fertigation techniques, special horticultural practices,
6. Determination of harvest indices and harvesting methods,
7. Postharvest handling, packing methods,
8. Project preparation, visit to commercial greenhouses.

**Suggested Readings**

Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.  
Bose TK & Yadav LP. 1989. *Commercial Flowers*. Naya Prokash.  
Bose TK, Maiti RG, Dhua RS & Das P. 1999. *Floriculture and Landscaping*. Naya Prokash.  
Chadha KL. 1995. *Advances in Horticulture*. Vol. XII. Malhotra Publ. House.  
Lauria A & Victor HR. 2001. *Floriculture – Fundamentals and Practices*. Agrobios. Nelson PV. 1978. *Green House Operation and Management*. Reston Publ. Co.  
Prasad S & Kumar U. 2003. *Commercial Floriculture*. Agrobios  
Randhawa GS & Mukhopadhyay A. 1986. *Floriculture in India*. Allied Publ.  
Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. *Hightech Floriculture*. Indian Society of Ornamental Horticulture, New Delhi.

## **M.Sc (Ag) Horticulture (FLA)** **1st Semester**

### **FLA 603    ADVANCES IN PROTECTED AND PRECISION FLORICULTURE**

**1+1**

**Objective** Appraisal on the advances in protected and precision farming of flower crops.

#### **Theory**

##### **UNIT I**

Prospects of protected floriculture in India, growing structures, basic considerations in establishment and operation of green houses, functioning and maintenance.

##### **UNIT II**

Environmental control systems in greenhouse, containers, substrate culture, soil decontamination techniques.

##### **UNIT III**

Water and nutrient management, crop regulation, special horticultural practices under protected cultivation of rose, chrysanthemum, carnation, orchids, anthurium, gerbera, liliiums, cut foliage; Harvest indices – harvesting, PH handling, marketing, export.

##### **UNIT IV**

Precision floriculture, Principles and concepts, Enabling technologies of precision farming, GPS, GIS, Remote sensing, sensors.

##### **UNIT V**

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**

1. Growing structures, basic considerations in establishment and operation of Greenhouses.
2. Environmental control systems in greenhouse, containers, substrate culture.
3. Crop regulation, special horticultural practices under protected cultivation.
4. Precision equipments, computers and robotics in precision farming.
5. post-harvest process management in floriculture using precision farming.

#### **Suggested Readings**

- Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
- Bose TK, Maiti RG, Dhua RS & Das P. 1999. *Floriculture and Landscaping*. Naya Prokash.
- Reddy S, Janakiram B, Balaji T, Kulkarni S, & Misra RL. 2007. *Hightech Floriculture*. Indian Society of Ornamental Horticulture, NewDelhi

**M.Sc (Ag) Horticulture (FLA)**  
**1st Semester**

**FLA 504                      LANDSCAPING AND ORNAMENTAL GARDENING                      2+1**

**Objective**

Familiarization with principles and practices of landscaping and ornamental gardening.

**Theory**

**UNIT I**

Landscape designs, types of gardens, English, Mughal, Japanese, Persian, Spanish, Italian, Vanams, Buddha garden; Styles of garden, formal, informal and free style gardens.

**UNIT II**

Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporates.

**UNIT III**

Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

**UNIT IV**

Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves.

**UNIT V**

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

**Practical**

1. Selection of ornamental plants, practices in preparing designs for homegardens,
2. Industrial gardens, institutional gardens, corporates, avenueplanting,
3. Practices in planning and planting of special types of gardens.
4. Burlapping, lawn making, planting herbaceous and shrubbery borders.
5. Project preparation on landscaping for different situations,
6. Visit to parks. And botanical gardens.
7. Case study on commercial landscape gardens.

**Suggested Readings**

- Bose TK, Maiti RG, Dhua RS & Das P. 1999. *Floriculture and Landscaping*. Naya Prokash.
- Lauria A & Victor HR. 2001. *Floriculture – Fundamentals and Practices* Agrobios.
- Nambisan KMP. 1992. *Design Elements of Landscape Gardening*. Oxford & IBH.
- Randhawa GS & Mukhopadhyay A. 1986. *Floriculture in India*. Allied Publ.
- Sabina GT & Peter KV. 2008. *Ornamental Plants for Gardens*. New India Publ. Agency.
- Valsalakumari et al. 2008. *Flowering Trees*. New India Publ. Agency.
- Woodrow MG. 1999. *Gardening in India*. Biotech Books.



**M.Sc (Ag) Horticulture (FLA)**  
**1st Semester**

**Minor Courses**

**FLA 501 BREEDING OF FLOWER CROPS AND ORNAMENTAL PLANTS**

**2+1**

**Objective**

To impart comprehensive knowledge about the principles and practices of breeding of flower crops and ornamental plants.

**Theory**

**UNIT I**

Principles -- Evolution of varieties, origin, distribution, genetic resources, genetic divergence- Patents and Plant Variety Protection in India.

**UNIT II**

Genetic inheritance -- of flower colour, doubleness, flower size, fragrance, post harvest life.

**UNIT III**

Breeding methods suitable for sexually and asexually propagated flowercrops and ornamental plants-- introduction, selection, domestication, polyploid and mutation breeding for varietal development, Role of heterosis, Production of hybrids, Male sterility, incompatibility problems, seed production of flower crops.

**UNIT IV**

Breeding constraints and achievements made in commercial flowers - rose, jasmine, chrysanthemum, marigold, tuberose, crossandra, carnation, dahlia, gerbera, gladioli, orchids, anthurium, aster, heliconia, liliams, nerium.

**UNIT V**

Breeding constraints and achievements made in ornamental plants –petunia, hibiscus, bougainvillea, Flowering annuals (zinnia, cosmos, dianthus, snap dragon, pansy) and ornamental foliage-- Introduction and selection of plants for waterscaping and xeriscaping.

**Practical**

1. Description of botanical features-- Cataloguing of cultivars, varieties and species in flowers, floral biology, selfing and crossing, evaluation of hybrid progenies,
2. Seed production-Induction of mutants through physical and chemical mutagens,
3. Induction of polyploidy, screening of plants for biotic.
4. Abiotic stresses and environmental pollution, *in vitro*
5. Breeding in flower crops and ornamental plants.

**Suggested Readings**

- Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
- Bose TK & Yadav LP. 1989. *Commercial Flowers*. Naya Prokash.
- Chadha KL & Choudhury B. 1992. *Ornamental Horticulture in India*. ICAR.
- Chadha KL. 1995. *Advances in Horticulture*. Vol. XII. Malhotra Publ. House.
- Chaudhary RC. 1993. *Introduction to Plant Breeding*. Oxford & IBH.
- Singh BD. 1990. *Plant Breeding*. Kalyani.

**M.Sc (Ag) Horticulture (FLA)  
1st Semester**

**Supporting Courses**

**STAT 511                      STATISTICAL METHODS FOR APPLIED SCIENCES                      3(2+1)**

**Objective**

It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, and tests of significance, regression and multivariate analytical techniques.

Theory

**UNIT I**

Classification, tabulation and graphical, representation of data. Box-plot, Descriptive statistics. Exploratory data analysis;

**UNIT II**

Measures of central tendency- Mean, Median, Mode, Geometric mean, Harmonic mean.

**UNIT III**

Measures of Dispersion- Range, Quartile deviation, Mean deviation, Standard deviation.

**UNIT IV**

Theory of probability. Random variable and mathematical expectation. Discrete and continuous probability distributions. Correlation and regression

**UNIT V**

Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, t and Fdistributions. Tests of significance based on Normal, chi-square, t and F distributions.

**Practical**

1. Exploratory data analysis, Box-Cox plots; fitting of distributions.
2. Binomial, Poisson, Negative Binomial, Normal; Large
3. Sample tests, testing of hypothesis based on exact sampling distributions-chi square, t and F;
4. Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution.
5. Correlation and regression analysis, fitting of orthogonal polynomial regression;
6. Applications of dimensionality reduction and discriminant function analysis.
7. Nonparametric tests.

**Book & Reference:**

- ❖ Anderson TW. 1958. An Introduction to Multivariate Statistical Analysis. John Wiley.
- ❖ Goon AM, Gupta MK & Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I
- ❖ Goon AM, Gupta MK & Dasgupta B. 1983. Fundamentals of Statistics. Vol. I.
- ❖ Hoel PG. 1971. Introduction to Mathematical Statistics. John Wiley.



**M.Sc (Ag) Horticulture (FLA)**  
**1st Semester**

**Non Credit Courses**

**PGS 503                    Intellectual Property and Its management in Agriculture                    1(1+0)**

**Objective**

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledgebasedeconomy.

**Theory**

**Unit I:**

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;

**Unit II:**

Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Unit III:

Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.

**Unit IV**

National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture.

**Unit V:**

Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

**Book & Reference:**

Erbisch FH & Maredia K.1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI. Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill. *Intellectual Property Rights: Key to New Wealth Generation*. 2001. NRDC & Aesthetic Technologies. Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol. V. *Technology Generation and IPR Issues*. Academic Foundation. Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI. Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House. *The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.*

**M.Sc (Ag) Horticulture (FLA)  
2nd Semester**

**Major Courses**

**FLA 503      PRODUCTION TECHNOLOGIES FOR LOOSE FLOWERS**

**2+1**

**Objective**

To impart basic knowledge about the importance and management of looseflowers grown in India.

**Theory**

**UNIT I**

Scope of loose flower trade, Significance in the domestic market/export, Varietal wealth and diversity, propagation, sexual and asexual propagation methods, propagation in mist chambers, nursery management, pro-traynursery under shadenets, transplanting techniques

**UNIT II**

Soil and climate requirements, field preparation, systems of planting, precision farming techniques.

**UNIT III**

Water and nutrient management, weed management, rationing, training and pruning, pinching and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM.

**UNIT IV**

Flower forcing and year round flowering, production for special occasions through physiological interventions, chemical regulation.

**UNIT V**

Harvest indices, harvesting techniques, post-harvest handling and grading, pre-cooling, packing and storage, value addition, concrete and essential oil extraction, transportation and marketing, export potential, institutional support, Agri Export Zones.

**Crops:** Jasmine, scented rose, chrysanthemum, marigold, tuberose, Crossandra, nerium, hibiscus, barleria, celosia, gomphrena, non-traditional flowers (Nyctanthes, Tabernaemontana, ixora, lotus, lilies, tecoma, champaka, pandanus).

**Practical**

1. Botanical description of species and varieties.
2. Propagation techniques, mist chamber operation,
3. Training and pruning techniques, practices in manuring,
4. Drip and fertigation, foliar nutrition, growth regulator application,
5. Pinching, disbudding, staking, harvesting techniques,
6. Post-harvest handling, storage and cold chain,
7. Project preparation for regionally important commercial loose flowers
8. Visits to fields, essential oil extraction units and markets.

**Suggested Readings**

- Arora JS. 2006. *Introductory Ornamental Horticulture*. Kalyani.
- Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
- Bose TK & Yadav LP. 1989. *Commercial Flowers*. Naya Prokash.
- Bose TK, Maiti RG, Dhua RS & Das P. 1999. *Floriculture and Landscaping*. Naya Prokash.
- Chadha KL & Chaudhury B. 1992. *Ornamental Horticulture in India*. ICAR.
- Chadha KL. 1995. *Advances in Horticulture*. Vol. XII. Malhotra Publ. House.
- Lauria A & Ries VH. 2001. *Floriculture – Fundamentals and Practices*. Agrobios.

**M.Sc (Ag) Horticulture (FLA)  
2nd Semester**

**FLA 506**

**VALUE ADDITIONS IN FLOWERS**

**2+1**

**Objective**

To develop understanding of the scope and ways of value addition in flowers.

**Theory**

**UNIT I**

Prospects of value addition, National and global scenario, production and exports, Women empowerment through value added products making, supply chain management.

**UNIT II**

Types of value added products, value addition in loose flowers, garlands, veni, floats, floral decorations, value addition in cut flowers, flower arrangement, styles, Ikebana, morebana, free style, bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands, etc.; Selection of containers and accessories for floral products and decorations.

**UNIT III**

Dry flowers– Identification and selection of flowers and plant parts; Raw material procurement, preservation and storage; Techniques in dry flower making – Drying, bleaching, dyeing, embedding, pressing; Accessories; Designing and arrangement – dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths; Packing and storage.

**UNIT IV**

Concrete and essential oils; Selection of species and varieties (including non-conventional species), extraction methods, Packing and storage, Selection of species and varieties, Types of pigments, carotenoids, anthocyanin, chlorophyll, betalains; Significance of natural pigments, Extraction methods; Applications.

**Practical**

1. Practices in preparation of bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands with fresh flowers.
2. Techniques in flower arrangement.
3. Techniques in floral decoration
4. Identification of plants for dry flower making
5. Practices in dry flower making Preparation of dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths, etc.
6. Visit to dry flower units, concrete and essential oil extraction units.

**Suggested Readings**

Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.

Chadha KL. 1995. *Advances in Horticulture*. Vol. XII. Malhotra Publ. House.

Lauria A & Victor HR. 2001. *Floriculture – Fundamentals and Practices* Agrobios.

Prasad S & Kumar U. 2003. *Commercial Floriculture*. Agrobios.

Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. *Hightech Floriculture*. Indian Society of Ornamental Horticulture, New

**M.Sc (Ag) Horticulture (FLA)  
2nd Semester**

**FLA 507**

**TURFING AND TURF MANAGEMENT**

**2+1**

**Objective**

To develop understanding of the principles and management of turfing.

**Theory**

**UNIT I**

Prospects of landscape industry; History of landscape gardening, siteselection, basic requirements, site evaluation, concepts of physical,chemical and biological properties of soil pertaining to turf grass establishment.

**UNIT II**

Turf grasses - Types, species, varieties, hybrids; Selection of grasses for different locations; Grouping according to climatic requirement-Adaptation; Turfing for roof gardens.

**UNIT III**

Preparatory operations; Growing media used for turf grasses – Turf establishment methods, seeding, sprigging/dibbling, plugging, sodding/turfing, turf plastering, hydro-seeding, astro-turfing.

**UNIT IV**

Turf management – Irrigation, nutrition, special practices, aerating, rolling, soil top dressing, use of turf growth regulators (TGRs) and micronutrients, Turf mowing -- mowing equipments, techniques to minimize wear and compaction, weed control, biotic and abiotic stress management in turfs.

**UNIT V**

Establishment and maintenance of turfs for playgrounds, viz. golf, football, hockey, cricket, tennis, rugby, etc.

**Practical**

1. Identification of turf grasses, Preparatory operations in turf making.
2. Practices in turf establishment, Layout of macro and micro irrigation systems,
3. Water and nutrient management; Special practices – mowing, raking, rolling, soil top dressing, weed management
4. Biotic and abiotic stress management;
5. .Project preparation for turf establishment,
6. visit to IT parks, model cricket and golf grounds, airports, corporates,
7. .Govt. organizations; Renovation of lawns; Turf economics.

**Suggested Readings**

Nick-Christians 2004. *Fundamentals of Turfgrass Management*.

[www.amazon.com](http://www.amazon.com)

**M.Sc (Ag) Horticulture (FLA)**  
**2nd Semester**

**FLA 508      CAD FOR OUTDOOR AND INDOORSCAPING**

**2+1**

**Objective**

To impart basic knowledge about the operation of Computer Aided Designing (CAD) in landscape garden designing.

**Theory**

**UNIT I**

Exposure to CAD (Computer Aided Designing) – Applications of CAD in landscape garden designing, 2D drawing by AUTOCAD, 3D drawing by ARCHICAD, 3D drawing by 3D MAX software, Creating legends for plant and non-plant components, Basics of Photoshop software in garden designing.

**UNIT II**

2D drawing methods, AUTOCAD Basics, Coordinate systems in AUTOCAD LT 2007, Point picking methods, Toolbars and Icons, File handling functions, Modifying tools, Modifying comments, Isometric drawings, drafting objects.

**UNIT III**

Using patterns in AUTOCAD drawing, Dimension concepts, Hyperlinking, Script making, Using productivity tools, e-transmit file, making sample drawing for outdoor and indoor garden by AUTOCAD 2D Drawing techniques, Drawing web format design, Making layout.

**UNIT IV**

3D drawing methods, ARCHICAD file system, Tools and Infobox, modification tools, structural elements, GDL objects (Grid Dimensional Linking), Creation of garden components through ARCHICAD.

**UNIT V**

ARCHICAD organization tools, Dimensioning and detailing of designs, Attribute settings of components, Visualization tools for landscape preview, Data management, plotting and accessories for designing, Inserting picture using photoshop, Making sample drawing for outdoor and indoor gardens.

**Practical**

1. Practices in point picking methods, Using tool bars and icons
2. Using modifying tools and modifying comments.
3. Isometric drawings, using productivity tools,
3. Drawing designs by AUTOCAD for home garden, institutional garden and special types of garden,
4. Using tools and info-box for 3D drawing, Creation of garden components with ARCHICAD.
5. Organization, dimensioning, detailing and visualization tools with ARCHICAD, Using Photoshop package for 3D picture insertion,
6. Drawing designs with ARCHICAD for home garden, interior garden designing, IT parks, Corporates, Theme parks and Ecotourism spots.

**Suggested Readings**

Christine Wein-Ping Yu 1987. *Computer-aided Design: Application to Conceptual Thinking in Landscape Architecture*. amazon.com



**M.Sc (Ag) Horticulture (FLA)**  
**2nd Semester**

Minor Courses

**FLA 605 ADVANCES IN BIOCHEMISTRY AND BIOTECHNOLOGY OF FLOWERS**

**2+1**

**Objective**

Appraisal on the advances in biochemistry of flowers and application of biotechnology in flower crops.

**Theory**

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, lilliums 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 *invitro* 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 bio-technology in flower crops.

## Practical

1. Extraction of flower pigments – xanthophylls, carotenoids and anthocyanins.
2. Plant nutrient stock- growth regulators- media preparation and sterilization- *In vitro*
3. Seed germination- callus culture and organ culture- Cell suspension culture – cell plating and regeneration- clonal propagation through Meristem culture.
4. 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.
5. Project preparation for establishment of low, medium and high cost tissue culture laboratories.
6. DNA isolation from economic flower crop varieties – Quantification and amplification,
7. DNA and Protein profiling – molecular markers for economic flower crops, restriction enzymes, vectors for cloning and particle bombardment, DNA fingerprinting of flower crop varieties .

## Suggested Readings

- Chopra VL & Nasim. 1990. *Genetic Engineering and Biotechnology – Concepts, Methods and Applications*. Oxford & IBH.
- Debnath M. 2005. *Tools and Techniques of Biotechnology*. Pointer Publ.
- Dey PM & Harborne JB. 1997. *Plant Biochemistry*. 2<sup>nd</sup> Ed. Academic Press.
- Glover MD. 1984. *Gene Cloning: The Mechanics of DNA Manipulation*. Chapman & Hall.
- Goodwin TW & Mercer EI. 2003. *Introduction to Plant Biochemistry*. CBS.
- Gorden H & Rubsell S. 1960. *Hormones and Cell Culture*. AB Book Publ.
- Keshavachandran R & Peter KV. 2008. *Plant Biotechnology: Methods in Tissue Culture and Gene Transfer*. Orient & Longman (Universal Press).
- Keshavachandran R, Nazeem PA, Girija D, John PS & Peter KV. (Eds.). 2007. *Recent Trends in Horticultural Biotechnology*. Vols. I, II. New India Publishing Agency.
- Panopoulos NJ. (Ed.). 1981. *Genetic Engineering in Plant Sciences*. Praeger Publ.
- Parthasarathy VA, Bose TK, Deka PC, Das P, Mitra SK & Mohanadas S. 2001. *Biotechnology of Horticultural Crops*. Vols. I-III. Naya Prokash.
- Pierik RLM. 1987. *In vitro Culture of Higher Plants*. Martinus Nijhoff Publ.
- Prasad S. 1999. *Impact of Plant Biotechnology on Horticulture*. 2<sup>nd</sup> Ed. Agro Botanica.
- Sharma R. 2000. *Plant Tissue Culture*. Campus Books International.
- Singh BD. 2001. *Biotechnology*. Kalyani.
- Skoog Y & Miller CO. 1957. *Chemical Regulation of Growth and Formation in Plant Tissue Culture in vitro*. Symp. Soc. Exp. Biol. 11: 118-131.
- Vasil TK, Vasi M, While DNR & Bery HR. 1979. *Somatic Hybridization and Genetic Manipulation in Plants*. *Plant Regulation and World Agriculture*. Planum Press.
- Williamson R. 1981-

## **M.Sc (Ag) Horticulture (FLA) 2nd Semester**

### **Supporting Courses**

STAT 512

**EXPERIMENTAL DESIGNS**

2+1

#### **Objective**

This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

#### **Theory**

##### **UNIT I**

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control.

##### **UNIT II**

Uniformity trials, size and shape of plots and blocks; Analysis of variance; completely randomized design, randomized block design and Latin square design.

##### **UNIT III**

Factorial experiments, (symmetrical as well as asymmetrical). Orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment.

##### **UNIT IV**

Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design-concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.

##### **UNIT V**

Bioassays- direct and indirect, indirect assays based on quantal dose response, parallel line and slope ratio assays potency estimation.

#### **Practical**

1. Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law;
2. Analysis of data obtained from CRD, RBD, and LSD;
3. Analysis of factorial experiments without and with confounding;
4. Analysis with missing data; Split plot and strip plot designs; Transformation of data;
5. Analysis of resolvable designs; Fitting of response surfaces.

#### **Book & Reference:**

Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer. Federer WT. 1985. Experimental Designs. MacMillan. Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd. Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publ. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley. Design Resources Server: [www.iasri.res.in/design](http://www.iasri.res.in/design).

**M.Sc (Ag) Horticulture (FLA)**  
**2nd Semester**

Non Credit Courses

**PGS 501:** **Library and Information Services** **1(0+1)**

**Objective:**

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

**Practical:**

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; ere sources access methods.

**Book & Reference:**

**ICTBasedLibraryandInformationServices** by **Akhtar Hussain** ESS ESS Publication  
**Foundations of Library and Information Science, Third Edition** by **Richard Rubin**

**M.Sc (Ag) Horticulture (FLA)**  
**2nd Semester**

**PGS 504: Basic Concepts in Laboratory Techniques**

**1(0+1)**

**Objective:**

To acquaint the students about the basics of commonly used techniques in laboratory.

**Practical:**

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccumets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agrochemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

**Book & Reference:**

Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press. Gabb MH & Latchem WE.1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.8. FMPE 503: Testing and Evaluation of Tractors and Farm Equipment

## PGS 505 AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES

### Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

### UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

### UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

### UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

### Suggested Readings

Bhalla GS & Singh G. 2001. *Indian Agriculture - Four Decades of Development*. Sage Publ.

Punia MS. *Manual on International Research and Research Ethics*. CCS, Haryana Agricultural University, Hisar.

Rao BSV. 2007. *Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives*. Mittal Publ.

Singh K.. 1998. *Rural Development - Principles, Policies and Management*. Sage Publ.