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 2015-17 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

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

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:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course code</th>
<th>Title of Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FLA.502*</td>
<td>PRODUCTION TECHNOLOGY OF CUT FLOWERS</td>
<td>2+1</td>
</tr>
<tr>
<td>2</td>
<td>FLA.505</td>
<td>PROTECTED FLORICULTURE</td>
<td>2+1</td>
</tr>
<tr>
<td>3</td>
<td>FLA.504*</td>
<td>LANDSCAPING AND ORNAMENTAL GARDENING</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total <strong>11 (7+4)</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FLA.501*</td>
<td>BREEDING OF FLOWER CROPS AND ORNAMENTAL PLANTS</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total <strong>3 (2+1)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>STAT 511</td>
<td>Statistical Methods in applied science</td>
<td>2+1=3</td>
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<td></td>
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<td>Total <strong>3 (2+1)</strong></td>
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### Second Semester:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course code</th>
<th>Title of Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FLA.503**</td>
<td>PRODUCTION TECHNOLOGY OF LOOSE FLOWERS</td>
<td>2+1</td>
</tr>
<tr>
<td>2</td>
<td>FLA.506**</td>
<td>VALUE ADDITION IN FLOWERS</td>
<td>2+1</td>
</tr>
<tr>
<td>3</td>
<td>FLA.507*</td>
<td>TURFING AND TURF MANAGEMENT</td>
<td>2+1</td>
</tr>
<tr>
<td>4</td>
<td>FLA.508</td>
<td>CAD FOR OUTDOOR AND INDOORSCAPING</td>
<td>2+1</td>
</tr>
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<td></td>
<td></td>
<td>Total <strong>12 (8+4)</strong></td>
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<tr>
<td>1</td>
<td>FLA605</td>
<td>ADVANCES IN BIOCHEMISTRY AND BIOTECHNOLOGY OF FLOWERS</td>
<td>2+1=3</td>
</tr>
<tr>
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<td></td>
<td>Total <strong>3 (2+1)</strong></td>
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### Supporting Courses

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course code</th>
<th>Title of Course</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>STAT 512</td>
<td>Experimental Design</td>
<td>2+1=3</td>
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</table>

### Non Credit Courses

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course code</th>
<th>Title of Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PGS 502</td>
<td>Technical Writing &amp; Communication</td>
<td>N.C.</td>
</tr>
<tr>
<td>2</td>
<td>PGS 503</td>
<td>Intellectual Property &amp; its management in Agriculture</td>
<td>N.C.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
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</table>
## Third Semester

### A. Major courses*

<table>
<thead>
<tr>
<th>S.No</th>
<th>Courses Code</th>
<th>Title of Course</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FLA 591</td>
<td>Master Seminar</td>
<td>1(0+1)</td>
</tr>
<tr>
<td>2</td>
<td>FLA 599</td>
<td>Master’s Research</td>
<td>10(0+10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>11 (1+10)</td>
</tr>
</tbody>
</table>

**B. Non Credit Course**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Courses Code</th>
<th>Title of Course</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PGS 506</td>
<td>Disaster Management</td>
<td>N.C.</td>
</tr>
<tr>
<td>2</td>
<td>PGS 505</td>
<td>Agricultural Research, Research Ethics and Rural Development Programmes</td>
<td>N.C.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grand Total</td>
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## Fourth Semester

### A. Major courses*

<table>
<thead>
<tr>
<th>S.No</th>
<th>Courses Code</th>
<th>Title of Course</th>
<th>Credit hours</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>FLA 599</td>
<td>Master’s Research Seminar</td>
<td>10(0+10)</td>
</tr>
<tr>
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<td></td>
<td>Total</td>
<td>10(0+10)</td>
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</table>
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 CO₂ 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 foliages and fillers.

Practical
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
Chadha KL & Chaudhury B. 1992. Ornamental Horticulture in India. ICAR.
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 CO₂; 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
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, liliums, 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

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.

Suggested Readings
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, avenue planting,
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
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 flower crops 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, liliums, nerium.

UNIT V
Breeding constraints and achievements made in ornamental plants –petunia, hibiscus, bougainvillea, Flowering annuals (zinnia, cosmos, dianthus, snap dragon, pansy) and ornamental foliages-- 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
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 F distributions. 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;
5. Correlation and regression analysis, fitting of orthogonal polynomial regression;
6. Applications of dimensionality reduction and discriminant function analysis.
7. Nonparametric tests.

Book & Reference:

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

Non Credit Courses

PGS 502: Technical Writing and Communications Skills (0+1)

Objective
To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills:
Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech; Participation in group discussion: Facing an interview; presentation of scientific papers.

Book & Reference:
- High School English Grammar and Composition. S. Chand & Co.
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 knowledge-based economy.

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:
**Major Courses**

**FLA 503 PRODUCTION TECHNOLOGIES FOR LOOSE FLOWERS**  

**Objective**
To impart basic knowledge about the importance and management of loose flowers 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-tray nursery 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**
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, buttonholes, 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, buttonholes, 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
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 dryflower 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
Objective
To develop understanding of the principles and management of turfing.

Theory
UNIT I
Prospects of landscape industry; History of landscape gardening, site selection, 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

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,
4. Drawing designs by AUTOCAD for home garden, institutional garden and special types of garden.
5. Using tools and info-box for 3D drawing, Creation of garden components with ARCHICAD.
6. Organization, dimensioning, detailing and visualization tools with ARCHICAD, Using Photoshop package for 3D picture insertion,
7. Drawing designs with ARCHICAD for home garden, interior garden designing, IT parks, Corporates, Theme parks and Ecotourism spots.

Suggested Readings
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

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

UNIT VI

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.
5. Project preparation for establishment of low, medium and high cost tissue culture laboratories.
6. DNA isolation from economicflower 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
Goodwin TW & Mercer EI. 2003. Introduction to Plant Biochemistry.CBS.
Williamson R. 1981-
**M.Sc (Ag) Horticulture (FLA)**  
**2nd Semester**

**Supporting Courses**

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<tr>
<th>Course Code</th>
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<td>STAT 512</td>
<td>EXPERIMENTAL DESIGNS</td>
<td>2+1</td>
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**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:**

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; Peer sources access methods.

Book & Reference:
[ICTBasedLibraryandInformationServices](#) by [Akhtar Hussain](#) ESS ESS Publication
[Foundations of Library and Information Science, Third Edition](#) by [Richard Rubin](#)
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 vaccupets; 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:
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