**POST GRADUATE DEPARTMENT OF AGRICULTURE**

**SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2026**

**Programme Code: MHFS**

**Programme Name:M.Sc. Ag. Horticulture (Floriculture and Landscaping) (Semester I-IV)**

# Examinations: 2024-26

# KhalsaCollege Amritsar

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**(b)Subject to change in the syllabi at any time.**
**(c) Please visit the University website time to time**

# M.Sc. Ag. Horticulture (Floriculture and Landscaping)

## SEMESTER-I

| Course Code | Course Title | Credit Hours | Marks | Total Marks |
|---|---|---|---|---|
| | | | Theory+Practical+ I. Assessment | |
| FLS-511 | Systematics of Ornamental Plants | 3(2+1) | 50+25+25 | 100 |
| FLS-512 | Commercial Production of Cut Flowers | 3(2+1) | 50+25+25 | 100 |
| FLS-513 (Minor) | Protected Cultivation of Flower crops | 3(2+1) | 50+25+25 | 100 |
| STAT-511 (Supporting) | Statistical Methods for Applied Sciences/Social Sciences | 4(3+1) | 57+18+25 | 100 |
| *PGS-511 | Technical Writing and Communication Skills | 1(0+1) | 100 (Pr) | 100 |
| *PGS-512 | Library and Information Services | 1(0+1) | 100(Pr) | 100 |
| *FLS-599 | Masters Research | 5(0+5) | - | S/US |
| | **Total** | 20(9+11*) | | |

* Non - credit course

Total Internal Assessment = 25% (House Test - 10%; Attendance - 10%; Conduct &Academic, Extra Curricular Activities - 5%).

# M.Sc. Ag. Horticulture (Floriculture and Landscaping)

## SEMESTER-II

| Course Code | Course Title | Credit Hours | Marks | Total Marks |
|---|---|---|---|---|
| | | | Theory+Practical+ I.Assessment | |
| FLS-521 | Breeding of Ornamental Plants | 3(2+1) | 50+25+25 | 100 |
| FLS-522 | Commercial Production of Loose Flowers | 3(2+1) | 50+25+25 | 100 |
| FLS-523 (Minor) | Value Addition in Floriculture | 3(2+1) | 50+25+25 | 100 |
| STAT-521 | Experimental Designs | 3(2+1) | 50+25+25 | 100 |
| *PGS-521 | Agricultural Research, Research Ethics and Rural Development Programmes | 1(1+0) | 100(Th) | 100 |
| *FLS-599 | Masters'- Research | 5(0+5) | -- | S/US |
| | **Total** | **18 (9+9*)** | | |

* Non - credit course

Total Internal Assessment = 25% (House Test - 10%; Attendance - 10%; Conduct &Academic,Extra Curricular Activities - 5%).

## M.Sc. Ag. Horticulture (Floriculture and Landscaping)

## SEMESTER-III

| Course Code | Subject | Credit hours | Marks | Total Marks |
|---|---|---|---|---|
| | | | Theory+Practical + I.Assessment | |
| FLS-531 | Ornamental Gardening and Landscaping | 3(2+1) | 50+25+25 | 100 |
| FLS-532 | CAD for Landscaping | 3(1+2) | 25+50+25 | 100 |
| FLS-533 (Minor) | Nursery Management in Ornamental Plants | 3(2+1) | 50+25+25 | 100 |
| FLS-591 | Credit seminar | 1(1+0) | 100 | 100 |
| *PGS-531 | Intellectual Property and its management in Agriculture | 1(1+0) | 100(Th) | 100 |
| *FLS-599 | Master's Research | 10(0+10) | -- | S/US |
| **Total** | | **21(7+14*)** | | |

Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

* Represent the non-credit courses

# M.Sc. Ag. Horticulture (Floriculture and Landscaping)

## SEMESTER-IV

| Course Code | Subject | Credit hours | Marks | Total Marks |
|---|---|---|---|---|
| | | | Theory+Practical + I.Assessment | |
| FLS-541 | Indoor Plants and Interiorscaping | 3(2+1) | 50+25+25 | 100 |
| *PGS-541 | Basic concepts in Laboratory Techniques | 1(0+1) | 100 (Pr) | 100 |
| *FLS-599 | Master' s Research | 10(0+10) | - | S/US |
| | **Total** | **14(2+12*)** | | |

Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

* Represent the non-credit courses

## SEMESTER-I

### FLS-511: Systematics of Ornamental Plants

**Maximum marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 Hours** **Credit hours: 3(2+1)**

**Instructions for the paper setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All questions will carry equal marks (10).

**Course Objective**

- To familiarize students about the taxonomy, classification, nomenclature and descriptors of different ornamental crops.

**Theory**

**Section-A**: Nomenclature: History, origin, hotspots, classification and nomenclature systems.
**Section-B:**International systems: International Code, Treaties, International and National Organisations, Biodiversity Act, Identification features, descriptors.Red Book, Registration (NBPGR, PPVFRA, NBA).
**Section-C:**Families: Description and families and important genera. Rosaceae, Asteraceae, Caryophyllaceae, Orchidaceae, Aracaceae, Liliacae. Acanthaceae, Palmaceae, Asparagaceae, Malvaceae, Musaceae, Oleaceae, Iridaceae.
**Section-D:**Molecular techniques in modern systematics.

**Practical**

Different nomenclature systems of plants. Floral biology and taxonomic description of rose, chrysanthemum, orchids, carnation, gerbera, anthurium, marigold, tuberose, Jasmine, China aster, lilium, gypsophila.Cyropreservation and tissue culture repository.Molecular techniques.

**Suggested Reading**


- Bhattacharya B and Johri BM. 2004. Flowering Plants: Taxonomy and Phylogeny. Narosa Publ. House, New Delhi, India. pp.753.
- Dutta AC. 1986. A Class Book of Botany. Oxford Univ. Press, Kolkata, India.
- Pandey BP. 2013. Taxonomy of Angiosperms. S. Chand & Co. pp. 608.
- Rajput CBS and Haribabu RS. 2014. Citriculture, Kalyani Publishers, New Delhi, India.
- Spencer RR, Cross R and Lumley P. 2007. Plant Names. 3rd Ed. A Guide to Botanical

Nomenclature. CSIRO Publ., Australia., 176 p.
- Vasistha BB. 1998. Taxonomy of Angiosperms. Kalyani Publishers, New Delhi, India.

**Course Title: Systematics of Ornamental Plants** **Course Code: FLS 511**

| Sr.no. | On completing the course, the students will have |
|---|---|
| **CO1** | An in-depth knowledge of nomenclature, description of important genera and use of molecular techniques in systematics of flower crop |

## SEMESTER-I

## FLS-512:Commercial Production of Cut Flowers

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 Hours** **Credithours: 3(2+1)**

**Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

**Course Objective**

- To impart basic knowledge about the importance and production dynamics of cut flowers grown in India

**Theory**

Scope and scenario: National and International scenario, importance and scope of cut flower trade, constraints for cut flower production in India. Growing environment: Soli analysis, soil health card, Growing environment, open cultivation, protected cultivation, soil/ media requirements, land preparation, planting methods, influence of light, temperature, moisture, humidity and microclimate management on growth and flowering. Crop management: Commercial Flower production –Commercial varieties, water and nutrient management, fertigation, weed management, crop specific practices, ratooning, training and pruning, pinching, deshooting, bending, desuckering, disbudding. Use of growth regulators, physiological disorders and remedies, IPM and IDM. Flower regulation: Flower forcing and year-round/ offseason flower production through physiological interventions, chemical regulation, environmental manipulation. Post-harvest management: Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Methods of delaying flower opening, Pre-cooling, pulsing, packing, storage and transportation. Marketing: Marketing, export potential, institutional support, Agri Export Zones, 100% Export Oriented units, Crop Insurance.

**Section-A:**Rose, chrysanthemum, gladiolus, tuberose, carnation, gerbera
**Section-B:**Orchids Lilium, anthurium, china aster, alstroemeria, bird of paradise.
**Section-C:**Heliconia alpinia, ornamental ginger, dahlia, gypsophila,
**Section-D:**Solidago, limonium, stock, cut greens and fillers

**Practical:**

Identification of varieties. Propagation. Microclimate management.Training and pruning techniques. Pinching, deshooting, disbudding, desuckering.Practices in manuring, drip and fertigation, foliar nutrition, growth regulator application. Harvesting techniques, post-harvest handling, cold chain. Economics, Project preparation for regionally important cut flowers, crop specific guidelines for project financing (NHB guidelines).Visit to commercial cut flower units. Case studies.

**Suggested Reading**


- Arora JS. 2010. Introductory Ornamental Horticulture. Kalyani Publishers. 6th edition, pp. 230.
- Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
- Bose TK, Maiti, RG, Dhua RS and Das P. 1999. Floriculture and Landscaping. Prokash, Kolkata, India.
- Bose TK and Yadav LP. 1989. Commercial Flowers. NayaProkash, Kolkata, India.
- Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp. 533, pp. 574. Malhotra Publ. House, New Delhi, India.
- Chadha KL and Chaudhury B. 1992. Ornamental Horticulture in India. ICAR, New Delhi, India.
- Dole JM and Wilkins HF. 2004. Floriculture-Principles and Species. Prentice Hall. 2nd edition, pp. 1048.
- Larson RA. 1980. Introduction to Floriculture. New York Academic Press. pp. 628.
- Laurie A and Rees VH. 2001. Floriculture-Fundamentals and Practices. Agrobios Publications, Jodhpur. pp.534.
- Prasad S and Kumar U. 2003. Commercial Floriculture. Agrobios Publications, Jodhpur.
- Randhawa GS and Mukhopadhyay A. 2001. Floriculture in India. Allied Publ. pp 660.
- Reddy S, Janakiram T, Balaji Kulkarni S and Misra RL. 2007. Hi- Tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi, India.
- Singh AK. 2006. Flower Crops: Cultivation and Management. New India Publ. Agency, New Delhi, India. pp. 475


**Course Title: Commercial Production of Cut FlowersCourse Code: FLS 512**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| CO1 | Understand the scope and scenario of floriculture |
| CO2 | Understand the production and post-harvest management of flower crops |
| CO3 | Acquire the required skills to prepare project reports on different crops for financing |

## SEMESTER-I

### FLS-513: Protected Cultivation of Flower Crops (Minor)

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 Hours** **Credit hours: 3(2+1)**

**Instructions for the Paper Setters:**
**1.**Question paper should be set strictly according to the syllabus.
2.The language of questions should be straight & simple.
3.In all nine questions should be asked, of which first question of 10 marks (Comprising of short answer type questions covering the whole syllabus) will be compulsory.
4.Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

**Course Objective**

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

**Theory**

**Section-A:**Prospects and types of protected structures: Prospects of protected floriculture in India; Types of protected structures – Glasshouse/ polyhouse, shadenet houses, mist chambers, lath houses, orchidarium, fernery, rain shelters, etc. Principles and design: Principles of designing and erection of protected structures; Low cost/ Medium cost/ High cost structures; Location specific designs; Structural components; Suitable flower and foliage plants for protected cultivation
**Section-B:** Control of environment: Microclimate 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, water harvesting
**Section-C:** Intercultural operations and crop regulation: Containers and substrates, media, soil decontamination, layout of drip and fertigation system, water and nutrient management, IPM and IDM, Crop regulation by chemical methods and special horticultural practices (pinching, disbudding, deshooting, deblossoming, etc.); Staking and netting,Photoperiod regulation.
**Section-D:**Automation and standards: Automation in greenhouses, sensors, solargreenhouses and retractable greenhouses, GAP/ Flower labels, Exportstandards, EXIM policy, APEDA regulations for export, Non-tariffbarriers. Crops: Rose, Chrysanthemum, Carnation, Gerbera, Orchids, Anthuriums, Lilium,Limonium, Lisianthus, heliconia, Cala lily, Alstromeria, etc

**Practical**
Study of various protected structures; Design, layout and erection of different types of structures; Practices in preparatory operations, growing media, soil decontamination techniques; Microclimate management; Practices in drip and fertigation techniques, special horticultural

practices; Determination of harvest indices and harvesting methods; Postharvest handling, packing methods; Economics of cultivation, Project preparation; Project Financing guidelines; Visit to commercial greenhouses

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**Suggested Reading**


- Bhattacharjee SK. 2018. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
- Bose TK, Maiti RG, Dhua RS and Das P. 1999. *Floriculture and Landscaping*. NayaProkashKolkata, India.
- Bose TK and Yadav LP. 1989. *Commercial Flowers*. NayaProkash, Kolkata, India.
- Chadha KL and Bhattacharjee SK. 1995. *Advances in Horticulture: Ornamental Plants.* Vol.XII, Parts 1 & 2. pp.533 and pp.574. Malhotra Publ. House, New Delhi, India.
- Lauria A and Victor HR. 2001. *Floriculture-Fundamentals and Practices.*Agrobios Publ., Jodhpur.
- Nelson PV. 2011. *Green House Operation and Management*. Pearson Publ. 7th edition, pp. 624.
- Prasad S and Kumar U. 2003. *Commercial Floriculture*. Agrobios Publ., Jodhpur.
- Randhawa GS and Mukhopadhyay A. 1986. *Floriculture in India*. Allied Publ.
- Reddy S, Janakiram T, Balaji T, Kulkarni S and Misra RL. 2007. *Hi- Tech Floriculture*. IndianSociety of Ornamental Horticulture, New Delhi, India


**Course Title: Protected cultivation of Flower crops** **Course Code: FLS-513**

| Sr.no. | On completing the course, the students will have |
|---|---|
| **CO1** | Knowledge on types, design and principles of protected structures |
| **CO2** | Thorough understanding of principles of microclimate management and crop management |
| **CO3** | Develop the required skills for designing a greenhouse |
| **CO4** | Acquire skills on microclimate management, production management |

## SEMESTER-I

### STAT-511: Statistical Methods for Applied Sciences/ Social Sciences

**Maximum marks: 100**
**Theory: 57**
**Practical: 18**
**Internal assessment: 25**
**Time: 3 Hours Credit hours: 4(3+1)**

**Instructions for the Paper Setters:**
1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 9 marks (Comprising of 9 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All questions will carry equal marks (12).

**Course Objectives**
• The aim of this course is to understand the basics of statistical methods and their applications in agriculture.
• It helps the students in understanding, analyzing and interpreting the agricultural data.
• It also helps in making appropriate decisions in agricultural research findings.

**Theory**

**Section-A:** Box-plot, Descriptive statistics:- measures of central tendency, dispersion, Theory of probability:- types and introduction, Introduction to Random variable and Mathematical expectation and their properties
**Section-B:** Discrete and continuous probability distributions:- Binomial, Poisson, Normal distribution 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.
**Section-C:** Simple and multiple correlation coefficient, partial correlation, rank correlation, Simple and multiple linear regression model, test of significance of correlation coefficient and regression coefficients, Coefficient of determination.
**Section-D:** Non-parametric tests:- sign, Mann-Whitney U-test, Run test for the randomness of a sequence, Median test:- introduction and their applications. Introduction to ANOVA: One way and Two Way, Introduction to Sampling Techniques:- SRS, cluster, stratified, systematic sampling:- introduction and their applications, Transformation of Data.

**Practical**

Fitting of distributions ~ Binomial, Poisson, Normal. Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi-square, t and F. Correlation and regression analysis. Non-parametric tests. ANOVA: One way, Two Way.

**Suggested Reading**


- Goon A.M, Gupta M.K and Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I. TheWorld Press.
- Goon A.M, Gupta M.K. and Dasgupta B. 1983. Fundamentals of Statistics. Vol. I. The WorldPress.
- Hoel P.G. 1971. Introduction to Mathematical Statistics. John Wiley.
- Hogg R.V and Craig T.T. 1978. Introduction to Mathematical Statistics. Macmillan.
- Morrison D.F. 1976. Multivariate Statistical Methods. McGraw Hill.
- Hogg RV, McKean JW, Craig AT. 2012. Introduction to Mathematical Statistics 7th Edition.
- Siegel S, Johan N &Casellan Jr. 1956. Non-parametric Tests for Behavior Sciences. JohnWiley.
- Anderson TW. 2009. An Introduction to Multivariate Statistical Analysis, 3rd Ed. John Wiley
- http://freestatistics.altervista.org/en/learning.php.
- http://www.statsoft.com/textbook/stathome.html.


**Course Title: Statistical Methods for Applied/Social scienceCourse Code: STAT-511**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| **CO1** | Understand the concept of probability, sampling techniques, standard error etc |
| **CO2** | Apply correction and regression techniques |
| **CO3** | Know the use of T-Test, chi-square and large sample tests |

## SEMESTER-I

## *PGS 511: Technical Writing & Communication Skills

**Maximum Marks: 100**
**Practical: 100**
**Time:3 hours** **Credit hours:1 (0+1)**

**Instructions for the paper setters:**
1. The question paper will consist of ten skill-oriented questions.
2. The first 5 questions carry 8 marks each. There will be internal choice wherever possible. The answer should be in 50-80 words. (5x8=40 marks).
3. There will be four essay type questions from the entire syllabus. There will be internal choice wherever possible. The answer should be in 250words.(4x15=60 marks).

**Course Objectives**
• To equip the students with skills and techniques to write dissertations, research papers, review paper, book chapter and articles etc.
• To equip the students with skills to communicate and articulate in English and scientific language (verbal as well as writing).

**Practical**
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.

**Suggested Readings**


- Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
- Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
- Collins' Cobuild English Dictionary. 1995.
- Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed.
- Holt, Rinehart and Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
- James HS. 1994. Handbook for Technical Writing. NTC Business Books.
- Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
- Mohan K. 2005. Speaking English Effectively. MacMillan India.

- Richard WS. 1969. Technical Writing. 10. Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
- Wren PC and Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.


**Course Title: Technical Writing & Communication SkillsCourse Code: *PGS 511**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| **CO1** | Understand the basic components like definitions, descriptions, process explanations and other common forms of technical writing |
| **CO2** | Understand how to follow the stages of the writing process and apply them to technical and workplace writing tasks |
| **CO3** | Synthesize material collected from primary and secondary sources with their own ideas while writing research papers |

## SEMESTER-I

## *PGS 512: Library and Information Services

**Maximum marks: 100**
**Practical: 100**

**Time:3 hours Credit hours:1 (0+1)**

**Course objectives**

• 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
• To use modern tools (Internet, Stat software, OPAC, search engines, etc.) of information search**.**

**Practical:**

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; resources access methods.

## SEMESTER-I

***FLS-599 Master's Research**

**S/US**
**Credit hours: 5(0+5)**

## SEMESTER-II

## FLS-521: Breeding of Ornamental Plants

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 HoursCredit hours: 3(2+1)**

**Instructions for the paper setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All questions will carry equal marks (10).

**Course Objective**

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

**Theory**

Principles of plant breeding: Principles of plant breeding; Origin, evolution,distribution, introduction, domestication and conservation of ornamental crops. Intellectual Property and Plant Breeders Rights: Introduction and initiatives in IPR and PBR of ornamental crops. Genetic mechanisms and inheritance: Breeding objectives, reproductive barriers (Male sterility, incompatibility) in major ornamental crops. Inheritance of important traits, Genetic mechanisms associated with flower colour, size, form, doubleness, fragrance, plant architecture, post-harvest life, abiotic and biotic stress tolerance/ resistance. Breeding methods: Breeding methods suitable for sexually, asexually propagated flower crops, self andcross- pollinated crops- pedigree selection, backcross, clonal selection, polyploidy and mutation breeding, heterosis and F1 hybrids.Role of biotechnology: Role of biotechnology in improvement of flower crops including somaclonal variation, in-vitro mutagenesis, in-vitro selection, genetic engineering, molecular markers, etc.

**Section-A:**Rose, chrysanthemum, carnation, gerbera, gladiolus, orchids, anthurium.
**Section-B:** Lilium, marigold, jasmine, tuberose, dahlia, gaillardia, crossandra, aster, etc
**Section-C:**Flowering annuals: Petunia, zinnia, snapdragon, stock, pansy, calendula, balsam, dianthus.
**Section-D:**Important ornamental crops like aglaonema, diffenbachia, hibiscus, bougainvillea, kalanchoe, etc.

**Practical:**

Floral biology of important ornamental crops.Cytology and cytogenetics. Selfing and crossing procedures for important ornamental crops. Evaluation of hybrid progenies. Induction of mutants through physical and chemical mutagens. In-vitro selection, genetic engineering. Induction of polyploidy.DUS testing.

**Suggested Reading**


- Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Pointer Publ., Reprint, 6 vols, pp. 2065.
- Bose TK and Yadav LP. 1989. Commercial flowers. NayaProkash, Kolkata, India.
- Callaway DJ and Callaway MB. 2009. Breeding Ornamental Plants. Timber Press. Revised edition, pp. 359.
- Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp. 533, pp. 574. Malhotra Publ. House, New Delhi, India.
- Chadha KL and Choudhury B. 1992. Ornamental Horticulture in India. ICAR, New Delhi, India.
- Chaudhary RC. 1993. Introduction to Plant Breeding. Oxford & IBH Publ.
- Misra RL and Misra S. 2017. Commercial Ornamental Crops: Cut Flowers. Kruger Brentt Publisher UK Ltd. pp.584.
- Misra RL and Misra S. 2017. Commercial Ornamental Crops: Traditional and Loose Flowers.
- Kruger Brentt Publisher UK Ltd. Singh BD. 2016. Plant Breeding Principles and Methods.
- Kalyani Publishers, New DelhiLudhiana, India.
- Vainstein A. (Ed). 2002. Breeding for ornamental crops: Classical and Molecular Approaches. Springer-Science-Business Media, B.V. Edition 1. pp. 392.
- Watts L. 1980. Flower and Vegetable Plant Breeding. Unilever Research, Sharnbrook, Bedford, UK. pp 182. Grower Books, London, UK.


**Course Title:Breeding of Ornamental PlantsCourse Code:FLS-521**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| CO1 | Understand principles of plant breeding and genetic mechanisms in different ornamental plants and flowers. |
| CO2 | Apply different breeding methods for improvement of ornamental crops |
| CO3 | Develop the required skills in conventional and advanced breeding |

## SEMESTER-II

### FLS-522: Commercial Production of Loose Flowers

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 HoursCredit hours: 3(2+1)**

**Instructions for the paper setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

**Course Objective**

- To impart basic knowledge about the importance and management of loose flowers grown in India

**Theory**

Scope and scenario: Scope, scenario and importance of loose flowers, constraints and opportunities in loose flower production. Growing environment: Nursery management, pro-tray nursery under shade nets, soil and climate requirement, Field preparation, systems of planting.Crop management: Soli analysis, soil health card, water and nutrient management, weed management, training and pruning, special horticultural practices such as pinching and disbudding, use of growth regulators, physiological disorders and remedies, INM, IPM and IDM. Crop regulation: Flower forcing and year-round flowering, production for special occasions through physiological interventions, chemical regulation. Post-harvest management: Harvest indices, harvesting techniques, post-harvest handling and grading, pre-cooling, packaging and storage. Marketing: Important local markets, Export potential, transportation and marketing, APMC and online trading, institutional support, Crop Insurance.

**Section-A**: Rose, jasmine, chrysanthemum, marigold, tuberose, china aster
**Section-B:**Crossandra, gaillardia, spider lily, hibiscus, nerium, barleria
**Section-C:**Celosia, gomphrena, Madar(*Calotropis gigantea*), Nyctanthes (Harsingar), Tabernaemontana (Chandni)
**Section-D:**Lotus, water lily, michelia (Champa), gardenia, ixora and balsam

**Practical**

Identification of species and varieties. Propagation and nursery management. Training and pruning techniques. Fertigation, foliar nutrition, growth regulator application. Crop protection.Pinching, disbudding, staking, harvesting techniques, Post-harvest handling, storage and cold chain, Project preparation for regionally important commercial loose flowers. Crop specific guidelines for project financing (NHB guidelines). Cost Economics. Exposure Visits to fields.

**Suggested Reading**


- Arora JS. 2010. Introductory Ornamental Horticulture. Kalyani Publi. 6th Edition, pp. 230.
- Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
- Bose T K, Maiti RG, Dhua RS and Das P. 1999. Floriculture and landscaping. NayaProkash, Kolkata, India.
- Bose TK and Yadav LP. 1989. Commercial Flowers. NayaProkash, Kolkata, India.
- Chadha KL and Bhattacharjee S K. 1995. Advances in Horticulture: Ornamental Plants. Vol.XII, Parts 1 & 2. pp. 533, pp. 574. Malhotra Publ. House, New Delhi, India.
- Chadha KL and Chaudhury B.1992. Ornamental Horticulture in India. ICAR, New Delhi, India.
- Laurie A and Rees VH. 2001. Floriculture-Fundamentals and Practices. Agrobios Publ., Jodhpur.pp.534.
- Prasad S and Kumar U. 2003. Commercial Floriculture. Agrobios Publ., Jodhpur.
- Randhawa GS and Mukhopadhyay A. 2001. Floriculture in India. Allied Publ. pp 660.
- Sheela VL. 2008. Flowers for Trade. Horticulture Science Series, vol.10, pp. 392. New India Publ. Agency, New Delhi, India.


**Course Title: Commercial Production of Loose Flowers** **Course Code: FLS-522**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| CO1 | A thorough understanding of production and post-harvest management of loose flowers |
| CO2 | Develop the required skills on commercial production management |

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## SEMESTER-II

## FLS-523: Value Addition in Floriculture (Minor)

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 Hours Credit hours: 3(2+1)**

**Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

**Course Objective**

- To understand the avenues for value addition in floriculture

**Theory**

**Section-A:** Scope and scenario: Scope and prospects of value addition, National and global scenario, production and exports. Types of value-added products, techniques of value addition including tinting. Value addition in loose flowers: Value addition in loose flowers andproduct development- Gulkhand, floral tea, rose oil, rose water,Pankhuri, floral dyes, rose sherbet, floral ice creams, sweets, etc.

**Section-B:** Floral Arrangements: Selection of containers and accessories for floralproducts and decorations. Flower arrangement, styles, ikebana schools, (*ikenobo, ohara, sogetsu,* etc.), Ikebana- moribana, nagiere,contemporary style.

**Section-C:**Dry flowers: Dry flowers– Identification and selection of flowers andplant parts; Raw material procurement, preservation and storage; tipsfor collecting dry flower making, selection of stages for picking offlowers for drying, Techniques in dry flower making – Drying,glycerising, bleaching, dyeing, embedding, pressing; Accessories;Designing and arrangement – dry flower baskets, bouquets, pot-pourri,wall hangings, button holes, greeting cards, wreaths; petal embeddedhandmade papers, Packaging and storage. Post drying managementincluding moisture, pests and molds.

**Section-D:**Essential oils: Essential oils; Selection of species and varieties(including non-conventional species), extraction methods, Packing andstorage, Aromatherapy. Pigments and nutraceuticals: Types of pigments, carotenoids,anthocyanins, chlorophyll, betalains; Significance of natural pigmentsas nutraceuticals, Extraction methods and applications in food,pharmaceutical and poultry industries. Dying: Synthetic and Natural dyes, dying techniques, colour retention.

**Practical**

Practices in preparation of different type of flower arrangements including bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands with fresh flowers. Techniques in flower arrangement and floral decoration. Identification of plants for dry flower making. Practices in dry flower making. Preparation of dry flower baskets, bouquets, potpourri,wall hangings, button holes, greeting cards, wreaths, etc.Essential oil extraction units. Extraction of pigments. Visit to dry flower units. Economics of value- added products.

**Suggested Reading**


- Bhattacharjee SK. 2018. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
- Chadha KL and Bhattacharjee SK. 1995. *Advances in Horticulture: Ornamental Plants.* Vol. XII, Parts 1 & 2. pp.533 and pp.574. Malhotra Publ. House, New Delhi, India.
- Lauria A and Victor HR. 2001. *Floriculture-Fundamentals and Practices.*Agrobios Publ., Jodhpur.
- Nowak J and Rudnicki RM. 1990. *Postharvest handling and storage of cut flowers, florist greens, and potted plants*. Timber Press, USA. pp. 210.
- Prasad S and Kumar U. 2003. *Commercial Floriculture*. Agrobios Publ., Jodhpur.
- Reddy S, Janakiram T, Balaji T, Kulkarni S and Misra RL. 2007. *Hi- Tech Floriculture*. IndianSociety of Ornamental Horticulture, New Delhi, India.


**Course Title: Value Addition in Floriculture** **Course Code: FLS-523**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| **CO1** | Understand and prepare different value-added products from flowers |
| **CO2** | Develop entrepreneurial acumen |
| **CO3** | Imbibe the skills for making various value-added products |

## SEMESTER-II

## STAT-521: Experimental Designs

**Maximum marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 Hours Credit hours: 3(2+1)**

**Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

**Course Objective**

- To understand the basics of statistical methods and their applications in agriculture
- It helps the students in understanding, analyzing and interpreting the agricultural data.
- It also helps in making appropriate decisions in agricultural research findings**.**

**Theory**

**Section-A:** Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control.
**Section-B:** Uniformity trials, size and shape of plots and blocks, Analysis of variance, Completely randomized design, randomized block design and Latin square design.
**Section-C:** Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom. Concept of confounding.
**Section-D:** Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces.Combined analysis.

**Practical**

Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law, Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments, Analysis with missing data, Split plot and strip plot designs

**Note**: Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students are allowed to use scientific calculators to analysis is the data.

**Note:**Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

**Suggested Reading:**


- Cochran WG and Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
- Dean AM and Voss D. 1999. Design and Analysis of Experiments. Springer.
- Montgomery DC. 2012. Design and Analysis of Experiments, 8th Ed. John Wiley.
- Federer WT. 1985. Experimental Designs. MacMillan.
- Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.
- Nigam AK and Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRIPubl.
- Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theoryand Practice. John Wiley.
- www.drs.icar.gov.in.


**Course Title:Experimental DesignsCourse Code: STAT-521**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| **CO1** | Get knowledge on the designs, their principles, analysis of variance and interpretation of data |
| **CO2** | Study various mechanical errors in field experiments, methods of reducing them and presentation of research results |

## SEMESTER-II

### *PGS-521: Agricultural Research, Research Ethics and Rural Development Programmes

**Maximum Marks: 100**
**Theory: 100**
**Time: 3.00 Hours** **Credit hours: 1 (1+0)**

**Instructions for the paper setters:**
1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. There will be total of nine questions out of which first question of 20 marks (Comprising of 10 short answer type questions of 2 marks each) covering the whole syllabus willbe compulsory.
4. Out of remaining eight questions, two questions will be asked from each
Section out of which the candidates are required to attempt one question from each section. All questions will carry equal marks (20).

**Course Objective**

- To understand the moral judgment and reactions.
- Identify the publication misconduct, scientific misconduct, complaints and appeals.

**Theory**

**Section-A:** 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)
**Section-B:**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. Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.
**Section-C:**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,
**Section-D:** 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 and 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.


**Course Title: Agricultural Research, Research Ethics and Rural Development Programmes**
**Course Code: *PGS-521**

| Sr.no. | On completing the course, the students will be able to |
|---|---|
| **CO1** | Understand the moral judgment and reactions |
| **CO2** | Identify the publication misconduct, scientific misconduct, complaints and appeals |

## SEMESTER-II

***FLS-599Masters' Research**

**S/US**
**Credit hours: 5(0+5)**

## SEMESTER-III

### FLS-531: Ornamental Gardening and Landscaping

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment :25**
**Time: 3 Hours Credit hours: 3(2+1)**

**Instructions for the Paper Setters:**

**1**. Question paper should be set strictly according to the syllabus.
**2.** The language of questions should be straight & simple.
**3.** In all nine questions should be asked, of which first question of 10 marks (Comprising of 10short answer type questions covering the whole syllabus) will be compulsory.
**4**. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. Each question will carry equal marks (10).

**Course Objective**

- Familiarization with principles and practices of landscaping

**Theory**

**Section-A:**Styles and types of gardens: Historical background of gardening, Importance and scope of ornamental gardening, styles and types of gardens, formal and informal style gardens. English, Mughal, Japanese, Persian, Spanish, Italian, French, Hindu and Buddhist gardens. Garden components: Garden components (living and non-living): 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, colour wheels, clock garden, bamboo groves, bonsai.

**Section-B:**Non -living garden components like path, garden gate, fencing, paving and garden features like fountains, garden seating, swings, lanterns, basins, bird baths, sculptures, waterfalls, bridge, steps, ramps, Lawn -genera and species, establishment and maintenance. Specialized gardens: Specialised gardens such as vertical garden, roof garden, terrace garden, water garden, sunken garden, rock garden, shade garden, temple garden, sacred gardens (with emphasis on native plants), Zen garden.

**Section-C:**Principles and elements of landscaping: Basic drawing skills, use of drawing instruments garden symbols, steps in preparation of garden design, programmes phase, design, phase, etc. Elements and principles of landscape design. Organization of spaces, visual aspects of plan arrangement- view, vista and axis. Principles of circulation, site analysis and landscape, water requirement, use of recycled water.

**Section-D:**Landscaping for different situations:Urban landscaping, Landscaping for specific situations such as residential, farm houses, institutions, corporate sector, industries, hospitals, roadsides, traffic islands, Children parks, public parks, xeriscaping, airports, railway station and

tracks, river banks and dam sites and IT/ SEZ parks. Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening.

**Practical**

Graphic language and symbols in landscaping, study of drawing instruments, viz.,'T' square, setsquare, drawing board, etc. Identification of various types of ornamental plants for different gardens and occasions. Preparation of land, planning, layout and planting, deviations from landscape principles. Case study. Site analysis, interpretation of map of different sites, use of GIS for selection. Enlargement from blue print. Landscape design layout and drafting on paper as per the scale. Preparation of garden models for home gardens, farm houses, industrial gardens, institutional gardens, corporate, avenue planting, practices in planning and planting of special types of gardens. Burlapping, lawn making, planting of edges, hedges, topiary, herbaceous and shrubbery borders. Project preparation on landscaping for different situations, creation of formal and informal gardens.Visit to parks and botanical gardens.

**Suggested Reading**


- Bose TK, Chowdhury B and Sharma SP. 2011. Tropical Garden Plants in Colour. Hort. And Allied Publ.
- Bose TK, Maiti RG, Dhua RS and Das P. 1999. Floriculture and Landscaping. NayaProkash, Kolkata, India.
- Grewal HS and Singh P. 2014. Landscape Designing and Ornamental Plants. Kalyani Publishers, New Delhi.
- Lauria A and Victor HR. 2001. Floriculture-Fundamentals and Practices.AgrobiosPubl.,Jodhpur.
- Misra RL and Misra S. 2012. Landscape Gardening. Westville Publ. House, New Delhi, India.
- Nambisan KMP. 1992. Design Elements of Landscape Gardening. Oxford & IBH Publ. Co.,New Delhi, India.
- Randhawa GS and Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
- Sabina GT and Peter KV. 2008. Ornamental Plants for Gardens. New India Publ. Agency, New Delhi, India.
- Singh A and Dhaduk BK. 2015. A Colour Handbook: Landscape Gardening. New India Publ.Agency, New Delhi, India.
- Valsalakumari PK, Rajeevan PK, Sudhadevi PK and Geetha CK. 2008. Flowering Trees. New India Publ. Agency, New Delhi, India.
- Woodrow MG.1999. Gardening in India. Biotech Books, New Delhi, India.


**Course Title: Ornamental Gardening and LandscapingCourse Code: FLS-531**

| Sr.no. | On completing the course, the students will be able to be |
|---|---|
| CO1 | Apprised of different types of gardens and have a thorough understanding of principles of landscape gardening |
| CO2 | Develop skills for landscaping under different situations and layout of garden components |

## SEMESTER-III

## FLS -532:CAD for Landscaping

**Maximum Marks: 100**
**Theory: 25**
**Practical: 50**
**Internal assessment:25**
**Time: 3 Hours** **Credit hours: 3(1+2)**

**Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. Each question will carry equal marks (10).

**Course Objective**

- To impart basic knowledge about the Computer Aided Designing (CAD) of landscape.

**Theory**

**Section-A**: CAD basics and applications:Principles of integrating the architecture and landscaping, Exposure to CAD (Computer Aided Designing) –Applications of CAD in landscape garden designing, 2D drawing by AUTOCAD, Creating legends for plant and non-plant components, Basics of Photoshop software in garden designing.

**Section-B:**2D drawing: 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. 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.

**Section-C:**3D drawing: 3D drawing methods, 3D drawing by ARCHICAD, 3D drawing by 3D MAX software, ARCHICAD file system, Tools and Infobox, modification tools, structural elements, GDL objects (Grid Dimensional Linking), Creation of garden components through ARCHICAD.

**Section-D:**Dimensioning and visualization: ARCHICAD organization tools, Dimensioning and detailing of designs, Landscape designing softwaresand CD ROM for ornamental plant material (TRES, HIMFLORA, CAPSSA, etc), 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**

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

**Suggested Reading**


- Christine, Wein-Ping Yu. 1987. Computer-aided Design: Application to Conceptual Thinking in Landscape Architecture. amazon.com.
- Misra RL and Misra S. 2012. Landscape Gardening. Westville Publ. House, New Delhi, India.


**Course Title: CAD for Landscaping** **Course Code: FLS-532**

| Sr.no. | On completing the course, the students will be able to be |
|---|---|
| CO1 | Use CAD and ARCHICAD for landscape planning and designing |
| CO2 | Develop the adequate skills to create 3 D model to showcase interaction of different factors in landscape gardening |
| CO3 | Develop the entrepreneurial acumen |

## SEMESTER-III

### FLS-533: Nursery Management in Ornamental Plants (Minor)

**Maximum Marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 HoursCredit hours: 3(2+1)**

**Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. Each question will carry equal marks (10).

**Course Objective**

- Familiarization with principles and practices of propagation and nursery management for Ornamental plants

**Theory**

**Section-A:**Scenario of nursery industry and sexual propagation: Importance and present scenario and status of nursery industry in India and in the world, life cycles in plants, Propagation methods, Factors influencing seed germination of flower crops, dormancy, seed quality, packing, storage, certification, testing. Hormonal regulation of germination and seedling growth.
**Section-B**: Asexual propagation: Methods of asexual propagation, rooting of softand hard wood cutting under mist. Role of Plant growth regulators.Physiological, anatomical and biochemical aspects of root induction incuttings. Layering – principles and methods, budding and grafting – selection of elite mother plants. Stock, scion and inter stock,relationship – Incompatibility.
**Section-C:**Micropropagation: Micro-propagation – principles and concepts,commercial exploitation in flower crops. Techniques – *in-vitro* clonalpropagation, direct organogenesis, embryogenesis, micrografting,meristem culture. Hardening, packing and transport of micro-propagules
**Section-D:**Growing structures: Growing structures like mist chambers, tunnels,lath house, net house, growing media types, soil less culture andcontainers. Automation in nursery management. Sanitary and phyto-sanitary issues: Nursery – types, components,planning and layout. Nursery management practices for healthypropagule production. Nursery Act, PPV&FR act and Quarantinesystem in India. Important quarantine pests and diseases, sanitaryand phyto-sanitary issues threats to nursery Industry. Standards: Nursery standards, Hi-tech nurseries, garden centers

**Practical**

Anatomical studies in rooting of cutting and graft union. Identification and production of plug plants, seedlings and saplings. Preparation of growing media and use of PGRs. Practice of propagation through specialized structures cuttings, layering, budding and grafting. Case studies.Micropropagation of ornamental crops and hardening. Visit to tissue culture labs and nurseries. Economics.

**Suggested Reading**


- Adriance GW and Brison FR. 2000. *Propagation of Horticultural Plants*. Biotech Books, New Delhi, India.
- Bose TK, Mitra SK and Sadhu M K. 1991. *Propagation of Tropical and Subtropical Horticultural Crops*. NayaProkash, Kolkata, India.
- Chadha KL, Ravindran PL and Leela Sahijram. 2000. *Biotechnology in Horticulture and Plantation Crops*. Malhotra Publ. House, New Delhi, India.
- Davies Fred T Jr., Geneve RL, Wilson SB, Hartmann HT and Kester DL. 2018. *Hartmann and Kester's Plant Propagation: Principles and Practices.* Pearson Publ. 9th Edition.
- Peter KV. 2008. *Basics of Horticulture*. New India Publ. Agency, New Delhi, India.
- Rajan S and Baby LM. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency, New Delhi, India. pp. 251.
- Singh SP. 1989. *Mist Propagation*. Metropolitan Book Co., New Delhi, India.


**Course Title: Nursery Management in Ornamental Plants** **Course Code: FLS-533**

| Sr.no. | On completing the course, the students will be able to be |
|---|---|
| CO1 | Develop thorough understanding of nursery management in flower crops |
| CO2 | Empower the students with the knowledge to start an enterprise |
| CO3 | Have adequate skill in propagation and management |

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## SEMESTER-III

**FLS-591Credit Seminar**

**Maximum Marks: 100**
**Credits hours: 1(1+0)**

## SEMESTER-III

### *PGS-531: Intellectual Property and its management in Agriculture

**Maximum marks: 100**
**Theory: 100**

**Time: 3 HoursCredit hours: 1 (1+0)**

**Instructions for the Paper Setters**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. There will be total of five questions, out of which first question of 20 marks (Comprising of 10 short answer type questions of 2 mark each) covering the whole syllabus will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All questions will carry equal marks (20).

**Course objectives**

• To equip students with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance
• Use of IPR as a tool for wealth and value creation in a knowledge based economy.

**Theory**

**Section A:** Historical perspectives and need for the introduction of Intellectual Property Right TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;
**Section B:** 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;
**Section C:** Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity;
**Section D:** International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement,LicenseAgreement.

**Suggested Reading**


- Erbisch FH and 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 and Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues.Academic Foundation.

- Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding andGenetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: ACompendium on Law and Policies. Daya Publ. House.


**CourseTitle: Intellectual Property& its Management in Agriculture Course Code: PGS 504**

| Sr.no. | On completing the course, the students will be able to be |
|---|---|
| **CO1** | The students will have acquaintance of intellectual property rights |
| **CO2** | Will have knowledge of National and international laws on biodiversity and sustainable use of plant genetic resources through transfer and sharing |
| **CO3** | Can assist in follow up of various treatises and laws for research collaborations at international levels |

## SEMESTER-III

***FLS-599Masters' Research**

**S/US**
**Credits hours: 10(0+10)**

# SEMESTER-IV

## FLS-541: Indoor Plants and Interiorscaping

**Maximum marks: 100**
**Theory: 50**
**Practical: 25**
**Internal assessment: 25**
**Time: 3 HoursCredit hours: 3(2+1)**

**Instructions for the paper setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. Each question will carry equal marks (10).

**Course Objective**

- To facilitate deeper understanding of the benefits of indoor plants, selection, designing and their management.

**Theory**

**Section-A**: Importance and scope: Importance and scope of indoor plants and Interiorscaping, Indoor plants and Indoor air quality. Classification and principles: Factors affecting growth, development and flowering of Indoor plants. Classification of indoor plants based on light, temperature, humidity and pollution tolerance. Description and cultivation of various indoor plants. Principles of Interiorscaping. Role in pollution mitigation.

**Section-B**:Cultural operations: Containers and substrates, preparation of growing media, propagation, training, grooming, nutrition, management of disease, pests and weeds. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. Media standards, Nursery and Export standards for potted plants, Nursery standards.

**Section-C:**Special gardens: Special gardens including miniature gardens and plant stand. Presentations like dish, terrarium, bottle gardens, hanging baskets, window boxes and Bonsai.

**Section-D:**Vertical gardens: Vertical gardens- History, planting material, structures, containers, substrate, water and nutrient management, supplemental lighting. Marketing: Marketing channels, Business models including plant rentals.

**Practical**

Identification of important house plants. Media and containers.Propagation. Cultural operations, maintenance and economics of indoor plants. Models for Interiorscaping. Familiarization with different indoor gardens. Making of terrariums, bottle garden, dish garden and their economics. Making of vertical gardens and economics. Exposure visits.

**Suggested Reading**


- Barbara P. 2005. The Complete Houseplant Survival Manual. Storey Publ., New Adams.
- Randhawa GS and Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
- Wallach C. 1995. Interior Decorating with Plants. McMillan Seed Production Co. Inc., New York.


**Course Title: Indoor Plants and Interiorscaping** **Course Code: FLS-541**

| Sr.no. | On completing the course, the students will be able to be |
|---|---|
| **CO1** | Deep understanding and knowledge of principles affecting indoor cultivation including vertical gardens |
| **CO2** | Develop required skills in interiorscaping |
| **CO3** | Develop required entrepreneurial acumen |

## SEMESTER-IV

## *PGS-541: Basic Concepts in Laboratory Techniques

**Maximum marks: 100**

**Practical: 100**

**Time: 3 Hours** **Credit hours: 1(0+1)**

**Instructions for the Paper Setters:**

1. The question paper will consist of nine skill-oriented questions.
2. The first 5 questions carry 8 marks each. There will be internal choice wherever possible. The answer should be in 50-80 words. (5×8=40 Marks)
3. There will be four essay type questions from the entire syllabus. There will be internal choice wherever possible. The answer should be in 250 words. (4×15= 60 Marks)

**Course Objective**

- To acquaint the students with the basics of commonly used techniques in the 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 agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation 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, sandbath, waterbath, 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.

**Suggested Reading**


- Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press
- Gabb MH and Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.


**CourseTitle: Basic Concepts in Laboratory TechniquesCourse Code: PGS-541**

| Sr.no. | On completing the course, the students will be able to be |
|---|---|
| **CO1** | Know about the use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers and micropipettes. |
| **CO2** | Know about different solutes, solvents and agrochemicals |
| **CO3** | Know about media preparation, handling techniques of solutions and preparation of media and methods of sterilization |

## SEMESTER-IV

***FLS-599Masters' Research**

**S/US**
**Credits hours: 10(0+10)**