

OBJECTIVES: To enable the students to

1. Understand the Principles of microscopy
2. Understand the structure and functioning of various biological instruments
3. Get enlighten their knowledge in various biochemical methods

COURSE:

UNIT - I: IMAGING AND RELATED TECHNIQUES:

Principles of microscopy; Light microscopy; Fluorescence microscopy; Electron Microscopy TEM SEM (a) Flow cytometry (b) Chromosome banding,– sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

UNIT- II: pH AND CENTRIFUGATION:

pH meter: Principles and instrumentation, Centrifugation: Principles, types of centrifuges, types of rotors, differential and density gradient centrifugation, application. Sonication, Freeze drying.

UNIT- III: SPECTROPHOTOMETRY:

Principle involved in Spectrophotometer; Spectrophotometric techniques, Instrumentation: ultraviolet and visible spectrophotometry.

UNIT- IV: CHROMATOGRAPHY:

Chromatographic techniques: Principle and applications – Column - thin layer –paper, affinity and gaschromatography - Gel filtration - Basic principles of electrophoresis.

UNIT-V: Preparation of molar, molal and normal solutions, buffers, the art of scientific writing: Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

The art of scientific writing and presentation of scientific matter. Scientific writing and ethics. Writing references. Introduction to copyright- plagiarism in scientific writing.

Suggested Readings:

1. Bajpai, P.K. 2006. Biological Instrumentation and methodology. S. Chand & Co. Ltd.
2. K. Wilson and J. Walker Eds. 2005. Biochemistry and Molecular Biology. Cambridge University Press.
3. K. Wilson andKHGoulding. 1986. Principles and techniques of Practical Biochemistry. (3 edn) Edward Arnold, London.
4. Dawson, C. (2002). Practical research methods.UBS Publishers, New Delhi.
5. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
6. Ruzin, S.E. (1999). Plant micro technique and microscopy. Oxford University Press, New York, U.S.A.

Suggested activities: Preparing various laboratory reagents, operating laboratory instruments, noting instrument readings, calculating results accurately, Skills on writing scientific articles, presentation of scientific resultsthrough tables, graphs, poster presentations and practicing power point presentations.

1. Microscopy – Light microscopy: principles, parts & function
2. Micrometry- principle and measurement of microscopic objects: Low power and high power.
3. Principle and working of phase contrast microscope
4. Principle & operation of Centrifuge
5. Preparation of standard acid and alkali and their standardization.
 - b)Preparation of various solutions (normal, molar, and percent) and ppm/ppb by serial dilutions
6. Study of principle and working of pH meter and Measurement of pH of Milk, Pepsi, Lemon juice etc. using pH paper and pH meter
7. Study of principle of Chromatography and separation of amino acids mixture By ascending Paper Chromatography
8. Principle & operation of Colorimeter
9. Principle & operation of Spectrophotometer
10. Chromosome banding, (photograph demo)
11. Principle and technique of TLC (demonstration)
12. TLC separation of Amino acids from purified samples and biological materials (demonstration)
13. PCR - The Polymerase Chain Reaction (protocol) -demonstration
14. Study visit to an institute /laboratory

Domain skills expected to achieve:

Skill in operating laboratory equipment, their upkeep, and adept at various biological techniques. Ability to prepare molar, molal, normal solutions and solutions of different dilutions. Interpreting scientific results, and ability to present results in a scientific way through graphs, photographs, poster presentations and power point presentations.

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OBJECTIVES: To enable the students to

1. Understand the basic principles of plant tissue culture
2. Understand the methods in biotechnology
3. Learn different culture techniques
4. Get an insight into Recombinant DNA technology and Methods of gene transfer.
5. Gain knowledge about the applications of Biotechnology

COURSE:

UNIT- I: PLANT TISSUE CULTURE – 1

1. History of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation.
2. Methodology - sterilization (physical and chemical methods), culture media, Murashige and Skoog's (MS medium), phytohormones, medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants.
3. Callus subculture maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis.

UNIT – II: PLANT TISSUE CULTURE – 2

1. Endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique.
2. Production of secondary metabolites.
3. Cryopreservation; Germ plasm conservation.

UNIT – III: Recombinant DNA technology

1. Restriction Endonucleases (types I-IV, biological role and application); concepts of restriction mapping.
2. Cloning Vectors: Prokaryotic(pUC 18, pBR322,Ti plasmid and Lambda phage, Eukaryotic Vectors (YAC and briefly PAC)
3. Gene cloning (Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning)
4. Construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by complementation technique, colony hybridization.

UNIT – IV: Methods of gene transfer

1. Methods of gene transfer- Agrobacterium-mediated, direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment.
2. Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

UNIT – V: Applications of Biotechnology

1. Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance.
2. Genetic modification – transgenic plants for pest resistant (Bt-cotton);herbicide resistance (Round Up Ready soybean); improved agronomic traits - flavr Savr tomato, Golden rice); Improved horticultural varieties (Moon dust carnations)

Text Book: Botany-Plant tissue culture and its biotechnological applications, by B. R. C. Murthy & V. S. T. Sai, Venkateswara Publications, Guntur, 2017

Books for Reference:

1. Pullaiah. T. and M.V.Subba Rao. 2009. Plant Tissue culture. Scientific Publishers, New Delhi.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
4. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
6. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Suggested Activities: In vitro initiation of callus on artificial medium, seminars on utilization of rDNA technology, debates on applications of Biotechnology (whether it is a boon or bane to the society) studying growth patterns, vegetative characteristics of Bt.cotton and identifying the features of its pest resistance

COURSE:

1. (a) Preparation of MS medium.
(b) Demonstration of in vitro sterilization methods and inoculation methods using leaf and nodal explants of Tobacco/ Datura/ Brassica etc.
2. Study of embryo culture, micro propagation of Banana, somatic embryogenesis, artificial seeds through photographs.
3. Construction of restriction map of circular and linear DNA from the data provided.
4. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, and micro projectile bombardment.
5. Different steps involved in genetic engineering for production of Bt. cotton, Golden rice, Flavr Savr tomato through photographs.
6. Isolation of plasmid DNA.
7. Restriction digestion and gel electrophoresis of plasmid DNA (optional)
8. Field visit to a lab involved in tissue culture
9. Study project under supervision of lecturer – tissue culture/ genetic engineering

Expected domain skills to be achieved: Ability to prepare artificial nutrient media, preparing independently, applying various sterilization procedures for media, glassware and biological materials, in vitro propagation of Banana callus, morphogenesis--s, clonal propagation methods, isolation of plasmid DNA individually and as a group.

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OBJECTIVES: To enable the students to

1. Understand the importance of Medicinal plants in primary health care
2. Understand the role of medicinal plants in modern medicine
3. Learn different systems of traditional medicine
4. Get an insight into identify drug adulteration and methods of drug evaluation
5. Gain knowledge about the production and applications of secondary metabolites

COURSE

UNIT – I: Importance of Medicinal Plants.

1. History, Scope and Importance of Medicinal Plants.
2. Significance of the following plants in primary health care practices along with their habitat and morphology
 - a) *Azadirachta indica*,
 - b) *Ocimum sanctum*,
 - c) *Vitex negundo*,
 - d) *Tribulus terrestris*,
 - e) *Phyllanthus niruri*,
 - f) *Aloe vera*
 - g) *Senna auriculata*
 - h) *Curcuma longa*,
 - i) *Andrographis paniculata*

UNIT – II: Role of Medicinal Plants in modern Medicine

Role of Medicinal plants in modern medicine with special examples of

- a) *Rauvolfia serpentina*,
- b) *Trichopus zeylanicus*,
- c) *Artemisia annua*,
- d) *Withania somnifera*,
- e) *Catharanthus roseus*,
- f) *Gymnima sylverstris*

UNIT-III: Traditional Medicinal Systems

1. **Ayurveda** : Definition and Scope, History, origin. panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments.
2. **Unani**: History, Basic concepts: treatments/ therapy, polyherbal formulations (in brief).
3. **Homeopathy**: History, Basic concepts, Treatment/ Therapy, Drugs & dosage

UNIT – IV: Pharmacognosy:

1. Pharmacognosy-Definition, Importance,
2. Classification of drugs - Chemical and Pharmacological,
3. Drug Adulteration,
4. Drug evaluation methods

UNIT– V: Organoleptic studies and Secondary metabolites

1. Organoleptic and microscopic studies with reference to nature of active principles and common adulterants of
 - a) *Alstonia scholaris*(bark),
 - b) *Adhatoda vasica*(leaf),
 - c) *Strychnos nuxvomica*(seed), and
 - d) *Zinziber officinalis*
2. Secondary Metabolites: Definition of primary and secondary metabolites and their differences, major types - terpenes, phenolics, alkaloids, terpenoids, steroids.
3. A brief idea about extraction of alkaloids.
4. Origin of secondary metabolites – detailed account of mevalonate pathway.

Suggested Activities: Isolation techniques of active principles from various parts of popular medicinal plants, debates on the efficacy of plant medicines and palliative cure, volatile oils from plants-extraction methods, project work on crude drugs

BOOKS FOR REFERENCE:

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981.
- 3) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 4) Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India
- 5) Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
- 6) Wallis, T. E. 1946. Text book of Pharmacognosy, J & A Churchill Ltd. 2. Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.
- 7) Gurdeep Chatwal, 1980. Organic chemistry of natural productis. Vol.I.Himalaya Publishing house.
- 8) Kalsi, P. S. and Jagtap, S., 2012. Pharmaceutical medicinal and natural product chemistry N.K. Mehra . Narosa Publishing House Pvt. Ltd. New Delhi.
- 9) Agarwal, O. P. 2002. Organic chemistry–Chemistry of organic natural products. Vol. II. Goel publishing house , Meerut.
- 10) Harborne, J. B. 1998. Phytochemical methods –a guide to modern techniques of plant analysis 3 rd edition, Chapman and Hall.
- 11) Datta & Mukerji, 1952. Pharmacognosy of Indian roots of Rhizome drugs. Bulletin No.1 Ministry of Health, Govt. of India.

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OBJECTIVES: To enable the students to-

- Identify various locally available medicinal plants
- Test unorganised drugs
- Identification of plant drugs of different sources
- Gain hands on experience in using instruments used in drug extraction

1. Identification of plants in Primary health care
2. Identification of plants used in modern medicine
3. Physical and chemical tests for evaluation of unorganized drugs- Asaphoetida.
Honey, Castor oil. Acacia
4. Identification of bark drugs – cinchona, cinnamom
5. Identification of fruit drugs – Cardamom, Coriander
6. Identification of root and rhizome drugs- Ginger, Garlic, Turmeric
7. Identification of whole plant – Aloes, Punarnava catharanthus
8. Instruments used in plant drug extraction
9. Herbarium of medicinal plants (minimum of 20 platns)
10. Collection of locally available crude drugs from local venders (minimum of 20)

Domain skills expected to achieve: Identification of various plant parts used as medicines, extraction of active principles from them, isolation by chromatographic techniques, learning callus culture techniques for secondary metabolite enrichment and understanding ethno-pharmacological principles

OBJECTIVES: To enable the students to –

- Understand the tissues, tissue system in plant body and the anatomy.
- Know the wood structure and the features of some local timber yielding plants
- Gain knowledge in Nursery management, Gardening and Landscaping methods
- Learn methods of propagation and Bonsai technique
- Know different types of plants and understand cultivation and harvest practices of flowering crops

UNIT – I: Anatomy: Tissues and Tissue systems

1. Meristems - Root and Shoot apical meristems and their histological organization.
2. Tissues – Meristematic and permanent tissues outlines of (simple, complex, secretory)
3. Tissue systems – Epidermal, ground and vascular.

UNIT – II: Secondary growth

1. Anomalous secondary growth in *Boerhaavia* and *Dracaena*.
2. Study of local timbers of economic importance Teak, Rosewood, Red sanders and Arjun (Tella maddi).

UNIT – III: Nursery & Gardening

1. Definition, scope and Planning of nursery.
2. Nursery Management – Management of Soil , water, manures and fertilizers, pests & diseases
3. Different types of gardening; Some Famous gardens of India
4. Gardening operations: soil laying, manuring, watering.
5. Landscaping and home gardening - parks and its components, plant materials and design.

UNIT – IV: Methods of Propagation

1. Sowing/ raising of seeds and seedlings, transplanting of seedlings.
2. Air-layering, cutting, selection of cutting , propagule collecting season, treatment of cutting, rooting medium and planting of cuttings – Hardening of plants.
3. Propagation of ornamental plants by rhizomes, corms tubers, bulbs and bulbils
4. Green house - mist chamber, shed root, shade nets and glass house for propagation.
5. Bonsai Technique.

UNIT – V: Floriculture:

1. Ornamental Plants: Flowering annuals, perennials; Divine vines; Shade and ornamental trees.
2. Ornamental bulbous and foliage plants; Ferns, Cacti and succulents, Ornamental palms.
3. Production and packaging of cut flowers; Flower arrangements; Methods to prolong freshness of flowers
4. Cultivation of Important cut flowers - Carnation, Aster, Dahlia, Anthuriums, Gladiolous, Marigold, Rose, Liliun
5. Methods of harvesting.

Books for Reference:

1. Eames, A.J., & Mc Daniels, L.H.(1979) : An Introduction to Plant anatomy Tata-McGraw-Hill Publishing Co., (P) Ltd. Bombay, New Delhi.
2. Esau. K.(1980) : Plant Anatomy, (2nd Edition) Wiley Eastern Ltd., New Delhi.
3. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
4. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
5. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
6. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

Suggested Activities: Raising a nursery, managing it, studying and drawing various land scaping designs, practicing layering methods, using shade nets to protect horticultural crops, practicing indoor gardening techniques, visiting florists and recording their methods of prolonging vase life of commercial cut flowers.

OBJECTIVES : To enable the students to –

- Make suitable preparations / handmade slides in the laboratory for the study of the anatomy of the plant organs.
- Identify important timbers
- Develop practical skills in various propagation methods
- Design gardens and land scapes
- Understand cultivation methods of important Flower crops

COURSE

ANATOMY:

1. Shoot apex organization.
2. Tissues-Simple, complex and special
3. Stomatal types-Dicot and Monocot
4. Secondary structure of Stem : Pongamia
5. Demonstration of double staining technique
6. Study of anomalous secondary growth by double stained slides of Achyranthus, Boerhavia, Bignonia, Dracaena; Important timber plants

NURSERY:

7. Tools, implements and containers used for propagation and nursery techniques.
8. Propagation by cutting, layering, budding and grafting
9. Seed propagation- preparation of portable trays, seed treatments, sowing and seedling production
10. Identification and description of annuals, biennials, perennials, climbers, creepers, foliage and flowering shrubs, palms, ferns, succulents, ornamental grasses

GARDENING:

11. Planning and designing of gardens, functional uses of plants in the landscape
12. Preparation of land for lawn and planting.

FLORICULTURE:

13. Identification of commercially important flower crops and their varieties.
14. Propagation practices in flower crops, sowing of seeds and raising of seedlings .
15. Use of chemicals and other compounds for prolonging the shelf life of cut flowers.

FIELD VISITS & PROJECT:

16. Visit to commercial nurseries and Gardens
17. Study project under supervision of lecturer – nursery/ornamental flowers/plants/lawn designing/ landscape designing

EXPECTED DOMAIN SKILLS TO BE ACHIEVED: Ability to identify different tissues and anomalous secondary growth in stems, important timber yielding plants, use a variety of garden tools and implements, proficiency in layering and grafting techniques (cleft grafting and bud grafting), land scape drawings using computers, raising of healthy nurseries of flowering plants, managing vase life of cut flowers etc.

PRACTICAL MODEL PAPER

Paper-VII-(B): Nursery, Gardening and Floriculture

Q1. Project report (A) - 15 marks

Viva-voce on study project -05 marks

Q2. Identify and write notes on B, C, D, and E (4x5) -20 marks

B- Tool/instrument/container used in nursery

C-Seed propagation technique

D- Plant used in lawn (plant specimen/photograph)

E-ornamental flower (photograph/live specimen)

Q4. Field report - 05 marks

Q5. Record

- 05 marks

50 marks