

# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BOTANY SEMESTER –II

M2BOT01-CT05	PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY
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### Unit-I Credit hours: 12

**Pteridophyta:** Evolution of stelar system; Evolution of Prothallus; soral evolution; Heterospory and seed habit; Cytological evolution of ferns; Apogamy and Apospory. Telome theory.

### Unit-II Credit hours: 12

**Pteridophyta:** General account of present and past distribution with special reference to India. Study of structure, reproduction, evolution, classification and inter-relationships of the Pteridophyta with special reference to Rhyniophytosida, Psilotosida, Lycosida, Sphenosida, Pteropsida.

### Unit-III Credit hours: 12

**Gymnosperms:** General account of present and past distribution of gymnosperms with special reference to India. Economic importance of gymnosperms, phylogeny and relationships of the main groups of gymnosperms.

### Unit-IV Credit hours: 12

**Gymnosperms:** Study of structure, reproduction, evolution, classification, life history with special reference to Cycadopsida, Coniferopsida, Gnetopsida. Evolution of the female strobilus in Coniferales.

### Unit-V Credit hours: 12

**Palaeobotany:** Geological time scale, types and nomenclature of fossils, fossilization, methods of study of fossils. Study of fossil archegoniates. Brief account of contributions of Eminent Scientists, Major National and International Institutions and recent advances.

### Practicals

1. Study of temporary, double stained microscopic preparations of Root/ stem/ rhizome/ petiole/ reproductive parts of following pteridophytes:

2. *Psilotum, Lycopodium, Selaginella, Isoetes, Equisetum, Ophioglossum, Osmunda, Lygodium, Gleichenia, Cyathea, Dryopteris, Pteris, Actiniopteris, Adiantum, Marsilea, Salvinia and Azolla.*
3. Permanent double stained microscopic preparations of T.S., T.L.S. and R.L.S. of stem of *Ginkgo, Pinus, Biota, Araucaria, Taxus, Taxodium, Agathis, Picea, Cephalotaxus, Cedrus, Podocarpus, Abies, Cupressus, Juniperus, Gnetum, Ephedra*
4. T.S. Leaflet and Rachis of *Cycas* and *Zamia* and needle of *Pinus*.
5. T.S. of coralloid root of *Cycas*.
6. Microscopic preparations of male cone of *Pinus* and male and female cones of *Ephedra*.
7. Study of male cone and megasporophyll of *Cycas*.
8. Study of fossil slides and specimens.
9. Local field trip

#### **Reference books:**

1. Bhatnagar S.P and Moitra Alok 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470 pp.
2. Bierhorst D.W. 1971. Morphology of Vascular Plants. New York and London.
3. Biswas C and Johari B.M 2004. The Gymnosperms Narosa Publishing House, New Delhi. 497 pp.
4. Parihar N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
5. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press. Cambridge.

# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BOTANY SEMESTER –II

M2BOT02-CT06	PLANT DEVELOPMENTAL BIOLOGY AND RESOURCE UTILIZATION
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### Unit-I Credit hours: 12

**Meristems:** Introduction, organization of meristems, shoot development–organization of the shoot apical meristems (SAM), Cytological and molecular analysis of SAM; Control of tissue differentiation, especially xylem and phloem, wood development in relation to environmental factors. Root development - Organization of root apical meristem (RAM), Vascular tissue differentiation, lateral roots; root hairs. Root-microbe interaction.

### Unit –II Credit hours: 12

**Plant anatomy:** Primary and secondary structure of root and stem of angiosperms. Anomalous secondary growth in stem and roots of angiosperms. Leaf anatomy. Leaf development and phyllotaxy.

**Flower:** Evolution of flower, genetics of floral organ differentiation; foliar stamens; open carpels; primitive living angiosperms, floral anatomy, inferior ovary, placentation and its evolution.

### Unit –III Credit hours: 12

**Male gametophyte:** Structure of anthers, microsporogenesis, role of tapetum, pollen germination, pollen tube growth and guidance, pollen embryos.

**Female gametophyte:** Ovule development and types, placentation types and its evolution. Megasporogenesis.

**Embryo sacs:** organization of the embryo sac, types of embryo sacs.

### Unit –IV Credit hours: 12

**Pollination and Fertilization:** pollen-pistil interaction; pollination mechanisms and vectors; sporophytic and gametophytic self-incompatibility (cytological, biochemical and molecular aspect). Double fertilization, *in vitro* fertilization.

**Endosperm:** Types, ultrastructure, endosperm haustoria, their extension, persistence and function.

**Embryo-**Polarisation of Zygote, embryogenic types, organogenesis of mono and dicot embryos. Structure and function of suspensor. Polyembryony (types and significance). Apomixis.

## Unit –V

Credit hours: 12

**Ethnobotany:** Introduction, History and development of ethnobotanical study; scope and potential applications; methods in ethnobotanical study. Applied Ethnobotany and intellectual property rights.

**Economic Botany:** Origin, evolution, Botany, cultivation and uses of fibre yielding plants, cereal crops, sugar yielding plants, pulses, dye plants, gum yielding plants, oil yielding plants fruits and nuts, vegetables, spices, condiments, beverages, medicinal plant, rubber yielding plants and petrocrops, Centres of origin.

### Practicals:

1. Training in paraffin wax method for preparation of serial sections from fixation to mounting of permanent slides
2. Staining of slides using single and double stains
3. Demonstration of slides showing embryological peculiarities (male and female gametophytes, endosperm, embryo)
4. Anatomical study of the following materials:

Stem: *Boerhaavia, Achyranthes, Bignonia, Chenopodium, Leptadaenia, Nyctanthes, Salvadora, Dracaena, Triticum, Mirabilis, Aristolochia, Amaranthus, Chenopodium.*

Root: *Tinospora, Ficus.*

Floral anatomy: Buds of *Opuntia, Rosa, Calotropis, Hibiscus* and *Nerium*.

Nodal Anatomy: *Calotropis, Nerium*

5. Knowledge of at least 25 plant species of economically and traditionally important plants.

### Reference books:

Bhojwani, S.S. and Bhatnagar, S.P. Embryology of Angiosperms (4<sup>th</sup> Revised and enlarged edition), 2000.

Burgess, J. 1985. An Introduction to Plant Cell Development, Cambridge University Press, Oxford.

Fahn, A. 1982. Plant Anatomy (3<sup>rd</sup> Ed.), Pergamon Press, Oxford.

Johri, B.M., Ambegaokar, K.B. and Srivastava, P.S. Comparative Embryology of Angiosperms, Vol. I & II, SpringerVerlag.

Lyndon, R.F. 1990. Plant Development – The Cellular basis, Unnin Hyman, London.

Maheshwari, P. An Introduction to Embryology of Angiosperms, 1950.

Raghavan, V. 1999. Developmental Biology of Flowering Plants, SpringerVerlag, NewYork.

Shivanna, K.R. and Johri, B.M. The Angiosperm Pollen structure and Function, Wiley Eastern Ltd., Publications, 1989.

**MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR**

**M. Sc. BOTANY SEMESTER –II**

M2BOT03-CT07	CELL AND MOLECULAR BIOLOGY
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**Unit-I Credit hours: 12**

**Cell:** Cell types and structure. Development of intracellular compartment, Structure and functions of cellular membranes, cell wall and cell organelles (nucleus, mitochondria, chloroplasts, Golgi apparatus, lysosomes, endoplasmic reticulum, vacuoles, ribosomes, and cytoskeleton). Synthetic cell and recent developments. Genome organization, Organization, diversity, evolution and function of mitochondrial and chloroplast genome.

**Unit-II Credit hours: 12**

**Cell cycle:** mitosis and meiosis. Cell cycle regulation, role of cyclins and cyclin-dependent kinases.

**Cancer:** Molecular genetics of Cancer: oncogenes, tumor suppressor genes, metastasis, therapeutic interventions of uncontrolled cell growth, apoptosis.

**Unit-III Credit hours: 12**

**DNA:** DNA structure and types (A-, B-, Z-, DNA). DNA replication, enzymes of DNA replication, DNA repair mechanisms.

**RNA:** RNA synthesis and processing: Transcription factors and machinery, RNA polymerases, transcription initiation, elongation and termination, RNA processing: RNA editing, capping, polyadenylation, splicing, RNA transport, structure and function of different types of RNA, Reverse transcriptase.

**Unit-IV Credit hours: 12**

**Protein:** Types, Properties, Structure, function, Cellular localization, Reverse turn. Protein synthesis and processing: Genetic code, Ribosome, Translation: formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, translational proof-reading, translational inhibitors, post-translational modification of proteins. Signal hypothesis, protein sorting to mitochondria and chloroplasts. Ramchandran Plot. DNA-Protein interactions and Protein-protein interactions

## **Unit-V            Credit hours: 12**

**Gene regulation:** Regulation of gene expression in pro- and eukaryotes, the control sequences (operator, promoter, terminator, attenuator, enhancer), Operon model - lac, trp, operon, attenuation, role of chromatin in regulating gene expression and gene silencing.

**Genomics and Proteomics:** Introduction to Structural, functional genomics. Microarrays, Brief account of Proteomics. 2-D electrophoresis of proteins Concept of Transcriptomics: RNAi and Gene Silencing, Metabolomics and Metagenomics. Future directions and scope of genomics and proteomics.

### **Practicals:**

1. General study of chromosomes: Mitosis: Onion, Meiosis: Onion.
2. Ultrastructure of cells, cell organelles (study through microphotographs)
3. Isolation of genomic DNA and its visualization on Agarose gel.
4. Quantification of DNA.
5. Cot-curve preparation for given DNA sample.
6. Demonstration of function of thermal cycler and thermal program
7. Demonstration of preparation of reaction mixture for amplification of gene of interest from isolated genomic DNA
8. Horizontal gel electrophoresis for separation of amplified PCR products for marker studies
9. Demonstration of primer designing for amplification of gene of interest
10. Perform BLAST for given nucleotide sequence
11. Sequence retrieval from databases.

### **Reference Books:**

1. J.D. Watson, T.A. Baker, S.P. Bell etc., Molecular Biology of the Gene, Pearson Education, India.
2. J.W. Dale and Mv Schantz, From Genes to Genomes, John Wiley & Sons.
3. B.D. Singh, Biotechnology, Kalyani Publishers.
4. An Introduction to Molecular Biotechnology by M. Wink, Wiley-VCH.
5. Introduction to Molecular Biology, Genomics & Proteomics for Biomedical Engineers by M.R. Neuman, CRC Press.

# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BOTANY SEMESTER –II

M2BOT04-CT08	PLANT GROWTH AND DEVELOPMENT
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### Unit-I Credit hours: 12

**Water relations:** Chemical and Water potential. Absorption of water. Ascent of Sap, Transpiration, Factors affecting the rate of transpiration, Physiology of stomatal movement and regulation of transpiration. Guttation. Membrane transport: transport proteins, passive and active mechanisms.

### Unit-II Credit hours: 12

**Plant nutrition:** Nutrient requirement of plants. Essential nutrients: macro and micronutrients, Chelating agents, Nutrient deficiency (Symptoms and disorders).  
**Seed:** Seed development, germination and dormancy, bud dormancy, Ageing, Senescence and death.

### Unit –III Credit hours: 12

**Plant growth and Regulation:** Over view, Historical account, Measurement of growth and growth kinetics. Plant growth regulators: Biosynthesis, chemical nature, physiological effects and mode of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, jasmonic acid and salicylic acid.

### Unit –IV Credit hours: 12

**Photomorphogenesis:** Over view, Historical account, Photoreceptors: structure, function, properties (Phytochrome and cryptochrome), molecular mechanism of action and role in photomorphogenesis. Photoperiodism: significance, Florigen, floral induction and development, Vernalization.

### Unit –V Credit hours: 12

**Signal transduction:** Basic concept and principles, Receptors and Second messengers (types, function), Signal transduction and gene expression, Signaling involving calcium, inositol phospholipids and G proteins, Two component sensor regulator system. Plant movements and taxis; Types, role of signal transduction.



**Practicals:**

1. Study of effect of radiation on seed germination.
2. Determination of gibberellic acid by half seed (cereal) method.
3. Seed viability test.
4. Estimation of total auxins, cytokinins and Gibberellins in plant material.
5. Effect of IAA on rooting.
6. Hormonal effects on senescence.

**Reference Books:**

1. Introductory Plant Physiology, 2nd Edition G. Ray Noggle (Emeritus), George J. Fritz. Prentice Hall of India. 2002.
2. Plant Physiology; Sebanek J. Sebanek. Elsevier Science & Technology. 1992.
3. Plants Under Stress: Biochemistry, Physiology and Ecology and Their Application to Plant Improvement; Hamlyn G. Jones, T. J. Flowers, M. B. Jones. Cambridge University Press. 2008.
4. Biochemistry & Molecular Biology of Plants; Eds: Bob Buchanan, Wilhelm Gruissem, Russell Jones (Editor) Wiley; 1st. edition. 2002.
5. Physiology and Biochemistry of Metal Toxicity and Tolerance in Plants. M. N. V. Prasad, Kazimierz Strzalka, M. N. V. Prasad. Springer. 2002.
6. Plant Hormones: Physiology, Biochemistry and Molecular Biology: P. J. Davies Peter J. Davies. Kluwer Academic Publishers. 1995.
7. The Physiology of Flowering Plants; Opik, Helgi. Cambridge University Press.
8. Text book of Plant Physiology. V. Verma. Ane Books. New Delhi. 2007.
9. Plant Physiology; R.M. Devlin & Witham. Reinhold publications. 1969.