SEMESTER - IV

Semester- IV

Course Type: MAJOR

Course Code: UBOTMAJ24006

Course Name: Pteridology, Gymnology & Palaeobotany

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ24006 deals with the various types of earlier vascular plants viz. pteridophytes and gymnosperms, along with their fossil forms. It discusses and also emphasizes the characteristics and classification of these plant groups, along with the fossil record of the extinct members of these groups. It also includes a primary idea on the field of palaeobotany.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:
(1) Basic and Applied Concepts of Pteridophytes
(2) Basic and Applied Concepts of Gymnosperms, and,
(3) Different groups of fossils and working knowledge of paleobotany.

Skills gained:

(1) Handling Microscopy, Staining and Mounting of pteridophytic and gymnospermic specimens, and,
(2) Methods of Collection, Identification and Preservation of plant specimens of these plant groups.
(3) Study of natural ecological systems and writing of reports.
(4) Evolutionary trends of pteridophytes, gymnosperms and allied plants (both extant and extinct).

Competency Developed:

(1) Schematic knowledge of collection and subsequent plant specimens.
(2) Proper arrangement of preserved plant specimens.
(3) Choosing suitable staining and mounting protocols for study of plant specimens.

Maj-6

THEORY

Total Lectures: 45

Unit 1: Introduction (7 Lectures)

Unifying features of archegoniates; Similarities & dissimilarities between Bryophytes, Pteridophytes and Gymnosperms; Paleobotany – General account of fossil groups and their importance.

Unit 2: Pteridophytes (15 Lectures)

Classification (Gifford & Foster, 1989 – up to Divisions), distribution, morphology, anatomy, reproduction and life cycle of *Psilotum, Lycopodium, Selaginella, Equisetum* and *Pteris* (Developmental details not to be included).; Ecological and economic importance; Stelar evolution; Telome theory; Heterospory & Seed Habit.

Unit. 3: Gymnosperms (15 lectures)

Classification (Gifford & Foster, 1989 – up to Divisions), distribution, morphology, anatomy, reproduction and life cycle of *Cycas, Pinus, Ginkgo* and *Gnetum* (Developmental details not to be included); Ecological and economic importance; Ontogeny & structure of Seed; Apogamy, and apospory.

Unit. 4: Progymnosperms and other fossil plants (4 Lectures)

General Features of Progymnosperms, Characteristic features of different relevant Form Genera like Rhynia, Lepidodendron, Calamites, Archaeopteris, Williamsonia, Cordaites, Glossopteris.

Unit 5: Paleobotany (7 Lectures)

Nomenclature; Taphonomy and the process of fossilization, Methods of determination of age of fossils; Geological time scale, TimeTree 5 (2022), Tree of Life Web Project, The Open Tree of Life; and major events of plant life through geological times.

PRACTICALS

1. *Psilotum*- Study of specimen, transverse section of synangium (permanent slide).
2. *Selaginella*- Study of specimen, transverse section of stem, longitudinal section of strobilus.
3. *Equisetum*- Study of specimen, longitudinal section of strobilus, transverse section of strobilus, transverse section of rhizome.
4. *Pteris*- Study of specimen, transverse section of rachis, vertical section of sporophyll, transverse section of rhizome.
5. *Cycas*- Study of specimen (coralloid roots, leaf), vertical section of leaflet, vertical section of microsporophyll, longitudinal section of ovule, transverse section of root.
6. *Pinus*- Study of specimen (long and dwarf shoots, male and female cones), transverse section of Needle, longitudinal section of / transverse section of male cone, longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections.
7. *Ginkgo*- Study of specimen, longitudinal section of ovule.
8. *Gnetum*- Study of specimen (stem, male & female cones), transverse section of stem, vertical section of ovule.
9. Paleobotany – Study of (at least two) fossil slides of *Lepidodendron, Lepidocarpon, Sphenophyllum, Lyginopteris, Medullosa* & *Glossopteris*.
10. Botanical Excursion and preparation of field note book.

Suggested Readings

1. Gerald Audesirk, Teresa Audesirk, Bruce E Byers, 2019. Biology: Life on earth. (Twelfth Edition). Pearson.
2. James D Mauseth, 2019. Botany: An Introduction to Plant Biology. Jones & Bartlett.
3. Michael G Simpson, 2019. Plant Systematics (Third Edition). Academic Press.
4. P.C Vashistha, A.K Sinha, & Anil Kumar. Gymnosperms. S. Chand. Delhi, India.
5. P.C Vashistha, A.K Sinha, & Anil Kumar. Pteridophyta. S. Chand. Delhi, India.
6. Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos and Tod Duncan, 2023. Biology (Thirteenth Edition). McGraw Hill.
7. Timothy Walker, 2012. Plants: A Very Short Introduction. Oxford.

SEMESTER - IV

Semester- IV

Course Type: MAJOR

Course Code: UBOTMAJ24007

Course Name: Morphology and Anatomy

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ24007 deals with the morphology and anatomy of the flowering plants. It focuses on the external and internal organization of the plants and plant organs, tissues and tissue systems. It also highlights the origin, distribution patterns and specific structural and functional modifications of the vegetative and reproductive organs of the plant body.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Organization of the flowering plant body

(2) Introduction to the structure and functions of vegetative and reproductive organs

(3) Origin, development and distribution of plant tissues and organs

Skills gained:

(1) Practical knowledge of the morphological and anatomical features of plant tissues and organs

(2) Tissue-specific staining techniques.

Competency Developed:

(1) Structural and functional differentiation between dicots and monocots

(2) Understanding the process of secondary growth and its anomalies in plants.

(3) Practical knowledge about the modifications of vegetative and reproductive plant organs.

THEORY

Total Lectures: 45

Unit-1: Introduction **(8 Lectures)**

Organization of vascular plant body – root, stem, leaf, flower, and fruit: their characteristic features, types, and modifications; Concept of phyllotaxy; Inflorescence types, Concept of "Flower as a modified shoot", Aestivation, cohesion and adhesion of floral parts; Types of ovule and placentation.

Unit-2: Internal Organization of Plant Body **(5 Lectures)**

Development of plant body – Polarity, cytodifferentiation, and organogenesis; Structures, functions, and modifications of different types of plant cells and tissues - simple and complex (no phylogeny); Structure of dicot and monocot root, stem, and leaf.

Unit-3: Apical Meristems **(5 Lectures)**

Structure and Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, Continuing meristematic residue, Cytohistological zonation); Structure and Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory), structure and function of root cap and quiescent center.

Unit-4: Tissue System **(14 Lectures)**

Epidermal tissue system - Structural organization and function, multiple epidermis, epiblema, bulliform cells, cuticle, epicuticular waxes, epidermal outgrowths – trichomes - types and functions, root hairs, stomata- classification and ontogeny, hydathodes, lithocysts, adcrustations and incrustations. Ground Tissue System - Structural organization and function, endodermis and exodermis, passage cell, origin of lateral roots, mesophyll tissue, laticifers and cavities. Vascular Tissue System - Xylem and phloem - structure and function, cytodifferentiation of tracheary elements and sieve elements, root-stem transition. Principles governing the construction and distribution of mechanical tissues.

Unit-5: Secondary Growth **(10 lectures)**

Secondary growth in root and stem; Anomalous secondary growth; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses and tylosoids; Structure, function, and seasonal activity of cambium, Development and composition of periderm, rhytidome and lenticels.

Unit-6: Scope of Plant Morphology and Anatomy **(3 lectures)**

Applications in systematics, forensics, and pharmacognosy; Dendrochronology.

PRACTICAL

1. Study of cohesion and adhesion of floral parts through photographs/ fresh specimens.
2. Study of phyllotaxy and aestivation through photographs/ fresh specimens.
3. Study of inflorescence and fruit types through photographs/ fresh specimens.
4. Study of anatomical features of dicot and monocot root, stem, and leaf through temporary slide preparations.
5. Study of distribution of parenchyma, sclerenchyma, and collenchyma through photographs/ fresh or preserved specimens.
6. Study of stomatal types through temporary slides.
7. Study of trichomes, lithocyst, and laticifers through temporary/permanent slides.
8. Study of apical meristems of root and shoot through photographs/permanent slides.
9. Study of normal and anomalous secondary growth through temporary slide preparations.
10. Study of xylem and phloem elements through temporary/permanent slides.

Suggested Readings

1. Kaplan, D., Specht, C.D. Kaplan's Principles of Plant Morphology. CRC Press.
2. Bell, A.D. Plant Form: An Illustrated Guide to Flowering Plant Morphology. Timber Press.
3. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
4. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
5. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
6. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

TEMPLATE FOR COURSE SYLLABUS FOR NEP IMPLEMENTATION

Discipline: Science √ Arts, Humanities & Social Science ☐

Commerce ☐ BBA ☐ BCA ☐

Subject Name: **Botany**

Subject Code: ☐ (Will be provided by the University)

Semester: Semester I ☐ Semester II ☐ Semester III ☐ Semester IV √

Semester V ☐ Semester VI ☐ Semester VII ☐ Semester VIII ☐

Course Name: **Taxonomy of Angiosperms**

Course Code: **UBOTMAJ23008** (Will be provided by the University)

Course Credit: Theoretical **3** Practical/Tutorial **1**

Marks Allotted: Theoretical **40** Practical/Tutorial **20**

Continuing Evaluation **10** Attendance **5**

Course Type (tick the correct alternatives):

Major Core	√	AEC	☐
Interdisciplinary/ DSE	☐	SEC	☐
Minor / Generic Elective	☐	VAC	☐
Research Project/Dissertation	☐	Vocational	☐

Is the course focused on employability / entrepreneurship? YES ☐ NO √

Is the course focused on imparting life skill? YES ☐ NO √

Is the course based on Activity ? YES √ NO ☐

Remarks by Chairman, UG BOS, if any

Syllabus finalized and approved by all the UGBOS Botany members

UG BOS Meeting Reference Number: **450 /UG-23** Date: **09-10-2023**

Prepared by CIRM

SEMESTER - IV

Semester- IV

Course Type: MAJOR

Course Code: UBOTMAJ24008

Course Name: Taxonomy of Angiosperms

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description:

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

1. To realize the position of angiosperms in plant kingdom.
2. To make understand the features to identify plants.
2. To make them understand how naming of plants done.
3. To know various angiosperm families emphasizing their morphology, distinctive features and importance.
4. To realize the origin and evolution of Angiosperms.
5. To know various system of classification.

Knowledge acquired:

1. Clear idea about the identification, classification and analysis of different group of plants and their origin and evolution and terminologies related to them.

2. Detail knowledge of different classification system from past to recent for categorisation of plants.

Skills gained:

1. Identification of plant species by using different keys.

2. Preparation of plant specimen for identification.

Competency Developed:

1. Come to know about different key to identify and positioning of plants.

2. Come to know about method of work out and preparation of specimen for identification.

3. Come to know about ancient and present system of classification of plants.

THEORY

Lecture:45

Unit 1: Introduction **(8 lectures)**

Plant identification, Classification, Nomenclature; alpha and omega taxonomy; Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.

Unit 2: Botanical nomenclature **(10 lectures)**

History of botanical nomenclature; Brief outline, ICN-Principles; Rules & recommendations; Typification, Author Citation, Valid & effective publications, Rejection of Names, Principle of Priority and its Limitations; Names of hybrids.

Unit 3: Classification systems **(10 lectures)**

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (1862-1883) (upto series) and Takhatajan (1997) with merits and demerits; Brief reference of Angiosperm Phylogeny Group (APG IV) classification (Major clades)

Unit 4: Diagnostic features, exceptional characters and economic importance of Families

(10 lectures)

Magnoliaceae, Brassicaceae, Solanaceae, Lamiaceae, Fabaceae, Euphorbiaceae, Cucurbitaceae, Asteraceae, Poaceae, Araceae, Zingiberaceae, Liliaceae, Verbenaceae, Orchidaceae.

Unit 6: Phylogeny of Angiosperms **(7 lectures)**

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

PRACTICAL

1. Study of vegetative and floral characters of the families mentioned in the theory syllabus (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and their identification up to genus by following published keys in Bengal Plants by David Prain/Flora of Bhutan)
2. Spot identification up to genera, mentioning families of all locally available plants included under the theoretical syllabus,
3. Field visit (local/outside) – Enlistment of plants observed in the field and submission of field note book with 10-25 photographs.
4. Submission of properly dried and pressed specimen of wild plant (not less than 10 and not more than 25) with herbarium label.

Suggested Readings

1. Singh G. (2012). *Plant Systematics:* Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
2. Jeffrey C. (1982). An Introduction to *Plant Taxonomy*. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J. K. (1963). *Flora* of Delhi. CSIR, New Delhi.
5. Radford, A. E. (1986). Fundamentals of *Plant Systematics*. Harper and Row, New York.
6. Singh G. (2021) Plant systematics: An Integrated approach. CRC Press. 4th Edition.
7. Sharma O. P. (2017) Plant Taxonomy. Mc Graw Hill. 2nd Edition.
8. Mitra J. N., Mitra D. Chaudhuri S. K. Studies in Botany. Moulik Library. Vol-1.
9. Datta S. C. (2018) Systematic Botany. New Age International Publisher. 5th Edition.