

## Core Courses Semester-I BOTANY ( Hons )

Core Course BOT. CC – I : Microbiology and Phycology- 100 marks

(Credits-6: Theory-4, Practical-2)

THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)

[75 marks (Mid Sem 15 + End Sem 60)]

Lectures: 60 [40 Theory + 20 Practical classes]

<b>Unit-I</b>	Introduction to microbial world, microbial nutrition, growth and metabolism.	<b>2 lectures</b>
	<b>Viruses:-</b> Discovery ,physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases.	<b>5 lectures</b>
<b>Unit-II</b>	<b>Bacteria: -</b> Discovery, general characteristics, types-archaebacteria, eubacteria, wall-less forms(mycoplasma and spheroplasts), cell structure, nutritional types, reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction). Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).	<b>5 lectures</b>
<b>Unit-III</b>	<b>Algae:-</b> General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; and methods of reproduction, classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups); significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry.	<b>6 lectures</b>
<b>Unit-IV</b>	<b>Cyanophyta:-</b> Ecology and occurrence, range of thallus organization, cell structure, heterocyst, reproduction. economic importance; role in biotechnology. Morphology and life-cycle of <i>Nostoc</i> .	<b>5 lectures</b>
	<b>Chlorophyta:-</b> General characteristics, occurrence, range of thallus organization, cell structure and reproduction. Morphology and life-cycles of <i>Chlamydomonas</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Coleochaete</i> . Evolutionary significance of <i>Prochloron</i> .	<b>5 lectures</b>
<b>Unit-V</b>	<b>Charophyta:-</b> General characteristics; occurrence, morphology, cell structure and life-cycle of <i>Chara</i> ; evolutionary significance.	<b>2 lectures</b>
	<b>Xanthophyta:-</b> General characteristics; range of thallus organization; Occurrence, morphology and life-cycle of <i>Vaucheria</i> .	<b>3 lectures</b>
	<b>Phaeophyta:-</b> Characteristics, occurrence, range of thallus organization, cell structure and reproduction. Morphology and life-cycles of <i>Ectocarpus</i> and <i>Fucus</i> .	<b>3 lectures</b>
	<b>Rhodophyta:-</b> General characteristics, occurrence, range of thallus organization, cell structure and reproduction. Morphology and life-cycle of <i>Polysiphonia</i> .	<b>4 lectures</b>

**BOT. CC – I Practical (20 classes, each class of 2h)**

<b>Microbiology</b>	1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/Photographs of Lytic and Lysogenic Cycle. 2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule. 3. Gram staining. 4. Endospore staining with malachite green using the (endospores taken from soil bacteria).
<b>Phycology</b>	Study of vegetative and reproductive structures of <i>Nostoc</i> , <i>Chlamydomonas</i> (electron micrographs), <i>Volvox</i> , <i>Oedogonium</i> , <i>Coleochaete</i> , <i>Chara</i> , <i>Vaucheria</i> , <i>Ectocarpus</i> , <i>Fucus</i> and <i>Polysiphonia</i> , <i>Prochloron</i> through electron micrographs, temporary preparations and permanent slides.

**Suggested Readings**

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th edition.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

## **Semester-I BOTANY ( Hons )**

**Core Course BOT. CC – II: Biomolecules and Cell Biology –  
100 marks (Credits-6: Theory-4, Practical-2)**

**THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)**

**[75 marks (Mid Sem 15 + End Sem 60)]**

**Lectures: 60 [40 Theory + 20 Practical classes]**

<b>Unit-I</b>	<b>Biomolecules:-</b> Types and significance of chemical bonds; Structure and properties of water; pH and buffers.	<b>2 lectures</b>
	<b>Carbohydrates:</b> Nomenclature and classification; Role of monosaccharides (glucose, fructose, sugar alcohols – mannitol and sorbitol); Disaccharides (sucrose, maltose, lactose), Oligosaccharides and polysaccharides (structural-cellulose, hemicelluloses, pectin, chitin, mucilage; storage – starch, insulin)	<b>3 lectures</b>
	<b>Lipids:</b> Definition and major classes of storage and structural lipids. Storage lipids. Fatty acids structure and functions. Essential fatty acids. Triacyl glycerols structure, functions and properties.	<b>2 lectures</b>
	<b>Proteins:</b> Structure of amino acids; Peptide bonds; Levels of protein structure-primary, secondary, tertiary and quaternary; Isoelectric point; Protein denaturation and biological roles of proteins.	<b>2 lectures</b>
	<b>Nucleic acids:</b> Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.	<b>4 lectures</b>
<b>Unit-II</b>	<b>Bioenergetics:</b> Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.	<b>3 lectures</b>
	<b>Enzymes:</b> Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.	<b>4 lectures</b>
<b>Unit-III</b>	<b>The cell:</b> Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).	<b>2 lectures</b>
	<b>Cell wall and plasma membrane:</b> Chemistry, structure and function of Plant Cell Wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.	<b>3 lectures</b>
<b>Unit-IV</b>	<b>Cell organelles: Nucleus;</b> Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.	<b>3 lectures</b>
	<b>Cytoskeleton:</b> Role and structure of microtubules, microfilaments and intermediary filament.	<b>2 lectures</b>
	<b>Chloroplast, mitochondria and peroxisomes:</b> Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.	<b>2 lectures</b>
	Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	<b>2 lectures</b>
<b>Unit-V</b>	<b>Cell division:</b> Eukaryotic cell cycle, different stages of mitosis and meiosis. Cell cycle, Regulation of cell cycle.	<b>6 lectures</b>

## BOT. CC – II Practical (20 classes, each class of 2h)

<b>Practical</b>	<ol style="list-style-type: none"><li>1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.</li><li>2. Study of plant cell structure with the help of epidermal peel mount of <i>Onion/Rhoeo/Crinum</i>.</li><li>3. Demonstration of the phenomenon of protoplasmic streaming in <i>Hydrilla</i> leaf.</li><li>4. Measurement of cell size by the technique of micrometry.</li><li>5. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).</li><li>6. Study of cell and its organelles with the help of electron micrographs.</li><li>7. Study the phenomenon of plasmolysis and deplasmolysis.</li><li>8. Study different stages of mitosis and meiosis using aceto carmine and aceto orcine method.</li></ol>
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### Suggested Readings

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
  2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone.
  3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
  4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
  5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
  6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
  7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
  8. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
  9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7<sup>th</sup> edition. Pearson Benjamin Cummings Publishing, San Francisco
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## **Semester-I/III (Interdisciplinary):**

**GENERIC ELECTIVE BOT. GE- 1 .: Biodiversity ( Microbes, Algae, Fungi & Archegoniate ) – 100 marks (Credits-6: Theory-4, Practical-2)**

**THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)**

**[75 marks (Mid Sem 15 + End Sem 60)]**

**Lectures: 60 [40 Theory + 20 Practical classes]**

<b>Unit-I</b>	<p><b>Microbes</b> Viruses - Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria - Discovery, General characteristics and cell structure; Reproduction - vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.</p>	8 Lectures
<b>Unit-II</b>	<p><b>Algae</b> General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Fucus, Polysiphonia. Economic importance of algae</p> <p><b>Fungi</b> Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of Rhizopus (Zygomycota) Penicillium, Alternaria (Ascomycota), Puccinia, Agaricus (Basidiomycota); Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance</p>	14 Lectures
<b>Unit-III</b>	<p><b>Introduction to Archegoniate</b> Unifying features of archegoniates, Transition to land habit, Alternation of generations.</p> <p><b>Bryophytes</b> General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of Marchantia and Funaria.(Developmental details not to be included).Ecology and economic importance of bryophytes with special mention of Sphagnum.</p>	7 Lectures
<b>Unit-IV</b>	<p><b>Pteridophytes</b> General characteristics, classification, Early land plants (Cooksonia and Rhynia). Classification (up to family), morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris.(Developmental details not to be included).Heterospory and seed habit, stelar evolution.Ecological and economical importance of Pteridophytes.</p>	6 Lectures
<b>Unit-V</b>	<p><b>Gymnosperms</b> General characteristics, classification.Classification (up to family), morphology, anatomy and reproduction of Cycas and Pinus.(Developmental details not to be included).Ecological and economical importance.</p>	5 Lectures

### **BOT. GE- 1- LAB Practical:**

1. EMs/Models of viruses - T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of Nostoc, Chlamydomonas, (electron micrographs), Oedogonium, Vaucheria, Fucus\* and Polysiphonia through temporary preparations and permanent slides. (\* Fucus - Specimen and permanent slides)
5. Rhizopus and Penicillium: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. Alternaria: Specimens/photographs and tease mounts.
7. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of Agaricus.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ectomycorrhiza and endomycorrhiza (Photographs)
11. Marchantia- morphology of thallus, w.m. rhizoids and scales, V.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. Funaria- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
13. Selaginella- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. Equisetum- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s. rhizome (permanent slide).
15. Pteris- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
16. Cycas- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
17. Pinus- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, , l. s.l. s. male cone, w.m. microsporophyll. w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

### **Suggested Readings**

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H. . Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

# BOT. - DSC-1 OF SEM-1 IS SAME AS BOT-GE-1 OF SEM- 1/ III

## Semester-II BOTANY ( Hons )

Core Course BOT. CC – III: Mycology and Phytopathology – 100 marks (Credits-6: Theory-4, Practical-2)

THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)

[75 marks (Mid Sem 15 + End Sem 60)]

Lectures: 60 [40 Theory + 20 Practical classes]

<b>Unit-I</b>	<b>Introduction to true fungi:</b> Definition, General characteristics; Affinities with plants and animals; Thallus organization; Cellwall composition; Nutrition; Classification. <b>Chytridiomycetes:</b> General account	<b>5 lectures</b>
	<b>Zygomycota:</b> General characteristics; Ecology; Thallus organisation; Life cycle with reference to <i>Rhizopus</i> .	<b>4 lectures</b>
	<b>Ascomycota:</b> General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and parasexuality; life cycle and classification with reference to <i>Saccharomyces</i> , <i>Aspergillus</i> , <i>Penicillium</i> , <i>Alternaria</i> and <i>Neurospora</i> , <i>Peziza</i> .	<b>5 lectures</b>
<b>Unit-II</b>	<b>Basidiomycota:</b> General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat <i>Puccinia</i> (Physiological Specialization), loose and covered smut (symptoms only), <i>Agaricus</i> ; Bioluminescence, Fairy Rings and Mushroom Cultivation.	<b>5 lectures</b>
	<b>Allied Fungi:</b> General characterises; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.	<b>3 lectures</b>
	<b>Oomycota:</b> General characteristic; Ecology; Life cycle and classification with reference to <i>Phytophthora</i> , <i>Albugo</i> .	<b>4 lectures</b>
<b>Unit-III</b>	<b>Symbiotic associations:</b> Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction. Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance.	<b>4 lectures</b>
<b>Unit-IV</b>	<b>Applied Mycology:</b> Role of fungi in biotechnology, Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.	<b>5 Lectures</b>
<b>Unit-V</b>	<b>Phytopathology:</b> Terms and concepts; General symptoms; Geographical distribution of diseases; etiology; symptomology; Host- Pathogen relationships; disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. Bacterial diseases – Citrus canker and angular leaf spot disease of Cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, white rust of crucifers.	<b>5 lectures</b>

### BOT. CC – III Practical (20 classes, each class of 2h)

<b>Practical 1</b>	<p>Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps &amp; basidiocarps).</p> <ol style="list-style-type: none"><li>2. <i>Rhizopus</i>: study of asexual stage from temporary mounts and sexual structures through permanent slides.</li><li>3. <i>Aspergillus</i> and <i>Penicillium</i>: study of asexual stage from temporary mounts. Study of sexual stage from permanent slides/photographs.</li><li>4. <i>Peziza</i>: sectioning through ascocarp.</li><li>5. <i>Alternaria</i>: Specimens/photographs and temporary mounts.</li><li>6. <i>Puccinia</i>: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.</li><li>7. <i>Agaricus</i>: Specimens of button stage and full grown mushroom; sectioning of gills of <i>Agaricus</i>, fairy rings and bioluminescent mushrooms to be shown.</li><li>8. <i>Albugo</i>: Study of symptoms of plants infected with <i>Albugo</i>; asexual phase study through section/ temporary mounts and sexual structures through permanent slides.</li><li>9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endo mycorrhiza (Photographs)</li><li>10. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; Viral diseases: TMV, Fungal diseases: Early blight of potato, and White rust of crucifers.</li></ol>
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#### Suggested Readings

1. Agrios, G.N. 1997 Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
5. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.



## Semester-II BOTANY ( Hons )

Core Course BOT. CC – IV: Archegoniate – 100

marks (Credits-6: Theory-4, Practical-2)

THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)

[75 marks (Mid Sem 15 + End Sem 60)]

Lectures: 60 [40 Theory + 20 Practical classes]

<b>Unit-I</b>	<b>Introduction:</b> Unifying features of archegoniate; Transition to land habit; Alternation of generations.	<b>2 lectures</b>
<b>Unit-II</b>	<b>Bryophytes:</b> General characteristics; Adaptations to land habit; Classification; Range of thallus organization. Classification (up to family). <i>Riccia, Marchantia, Peltia, Porella, Anthoceros, Sphagnum and Funaria</i> ; Reproduction and evolutionary trends in <i>Riccia, Marchantia, Anthoceros</i> and <i>Funaria</i> (developmental stages not included). Ecological and economic importance of bryophytes with special reference to <i>Sphagnum</i> .	<b>12 lectures</b>
<b>Unit-III</b>	<b>Pteridophytes:</b> General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of <i>Psilotum, Selaginella, Equisetum, Pteris</i> and <i>Marsilea</i> (Developmental details not to be included). Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution. Ecological and economic importance.	<b>10 lectures</b>
<b>Unit-IV</b>	<b>Gymnosperms:</b> General characteristics, classification (up to family), morphology, anatomy and reproduction of <i>Cycas, Pinus, Ginkgo</i> and <i>Gnetum</i> . (Developmental details not to be included). Ecological and economic importance.	<b>8 lectures</b>
<b>Unit-V</b>	<b>Fossils:</b> Geographical time scale, fossils and fossilization process. Morphology, anatomy and affinities of <i>Rhynia, Calamites, Lepidodendron, Lyginopteris</i> and <i>Cycadeoidea</i> .	<b>8 lectures</b>

### BOT. CC – IV Practical (20 classes, each class of 2h)

<b>Practical</b>	<ol style="list-style-type: none"> <li>1. <i>Riccia</i> – Morphology of thallus.</li> <li>2. <i>Marchantia</i>- Morphology of thallus, whole mount of rhizoids &amp; Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).</li> <li>3. <i>Anthoceros</i>- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).</li> <li>4. <i>Peltia, Porella</i>- Permanent slides.</li> <li>5. <i>Sphagnum</i>- Morphology of plant, whole mount of leaf (permanent slide only).</li> <li>6. <i>Funaria</i>- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.</li> <li>7. <i>Psilotum</i>- Study of specimen, transverse section of synangium (permanent slide).</li> <li>8. <i>Selaginella</i>- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).</li> <li>9. <i>Equisetum</i>- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).</li> </ol>
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|  | <p>10. <b><i>Pteris</i></b>- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).</p> <p>11. <b><i>Cycas</i></b>- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).</p> <p>12. <b><i>Pinus</i></b>- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section &amp; radial longitudinal sections stem (permanent slide).</p> <p>13. <b><i>Gnetum</i></b>- Morphology (stem, male &amp; female cones), transverse section of stem, vertical section of ovule (permanent slide)</p> <p>14. <b>Botanical excursion.</b></p> |
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### Suggested Readings

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vander-Poorteri 2009 Introduction to Bryophytes. COP.

## **Semester-II / IV (Interdisciplinary):**

**GENERIC ELECTIVE BOT. GE- 1I .: Plant Anatomy and Embryology – 100 marks**

**(Credits-6: Theory-4, Practical-2)**

**THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)**

**[75 marks (Mid Sem 15 + End Sem 60)]**

**Lectures: 60 [40 Theory + 20 Practical classes]**

**Unit –I : Meristematic and Permanent tissues** 08 Lectures

Root and shoot, apical meristem, simple and complex tissues.

### **Organs**

Structure of dicot and monocot root stem and leaf.

**Unit – II : Secondary Growth** 11 Lectures

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem. Wood ( heartwood and sapwood ).

### **Adaptive and Protective systems.**

Epidermis, cuticle, stomata; General account of adaptations in Xerophytes and hydrophytes.

**Unit – II : Structural organisation of flower** 11 Lectures

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organisation and ultrastructure of mature embryo sac.

### **Pollination and fertilisation**

Pollination mechanism and adaptation; Double fertilisation; Seed – structure appendages and dispersal mechanisms.

**Unit – IV: Embryo and endosperm** 05 Lectures

Endosperm types, structure and function; Dicot and monocot embryo; Embryo – endosperm relationship.

**Unit – V: Apomixis and Polembryony** 05 Lectures

Definition, types and practical applications

### **BOT. GE- 1I - LAB Practical**

1. Study of meristems through permanent slides and photographs.
2. Tissues ( parenchyma, collenchymas and sclerenchyma ); Macerated Xylary elements, phloem ( permanent slide, photographs).
3. Stem: monocot Zea mays; Dicot: Helianthus; secondary; Helianthus ( only permanent slides ).
4. Root- monocot Zea mays; Dicot: Helianthus; secondary; Helianthus ( only permanent slides ).
5. Leaf: Dicot and monocot leaf ( only permanent slides ).
6. Adaptive anatomy: Xerophyte ( Nerium leaf ) ; Hydrophyte ( Hydrilla stem ).
7. Structure of anther ( young and mature ), tapetum ( amoeboid and secretory ) (permanent slide ).
8. Types of ovules: anatropous, orthotropous, cicinotropous, amphitropous, campylotropous. 9. Female gametophyte: pologonum ( monosporic ) type of embryo sac development ( permanent slides / photographs ). 10. Ultra structure of mature egg apparatus cells through electron micrographs. 11. Polynations types and seed dispersal mechanisms ( including appendages, aril, caruncla ) (photographs and specimens ). 12. Dissection of embryo / endosperm from developing seeds.

### **Suggested Readings**

1. Bhojwani, S.S. & Bhatanagar, S.P. (2011) . Embryology of angiosperms. Vikas publication House Pvt. . Ltd. New Delhi. 5<sup>th</sup> Ed.
2. Mauseth, J.D. ( 1988 ). Plant Anatomy. The Benjamin Cummings Publioshers . USA.

## **Semester- II - BOTANY**

### **BOT. DSC – II : Plant Ecology and Taxonomy**

**(Credits-6: Theory-4, Practical-2)**

**THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)**

**[75 marks (Mid Sem 15 + End Sem 60)]**

**Lectures: 60 [40 Theory + 20 Practical classes]**

#### **Unit I: Introduction**

##### **Ecology Factors**

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; shelford law of tolerance. Adaption of hydrophytes and xerophytes.

##### **Plant communities**

Characters; Ecotone and edge effect; Succession; Processes and types.

#### **Unit II: Ecosystem**

Structure; energy flow trophic organization; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

##### **Phytogeography**

Principle biogeographical zones; Endemism

#### **Unit III: Introduction to plant taxonomy**

Identification, Classification, Nomenclature.

##### **Identification**

Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

**Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.**

#### **Unit IV:Taxonomic hierarchy**

Ranks, categories and taxonomic groups

##### **Botanical nomenclature**

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

#### **Unit V: Classification**

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

##### **Biometrics, numerical taxonomy and cladistics**

Characters; variations; OYUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

**BOT. DSC –II ( LAB ),Practical 25 Marks**

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/ hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).  
(b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plant).
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae- *Brassica*, *Alyssum*/*Iberis*; Asteraceae- *Sonchus*/*Launaea*, *Vernonia*/*Ageratum*, *Eclipta*/*Tridax*; Solanaceae- *Solanum nigrum*, *Withania*; Lamiaceae- *Salvia*, *Ocimum*; Liliaceae- *Asphodelus*/*Lilium*/*Allium*.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

**Suggested Reading**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4<sup>th</sup> edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8<sup>th</sup> edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics; Theory and Practice. Oxford & IBH pvt. Ltd., New Delhi. 3<sup>rd</sup> edition.

