DURGAPUR GOVERNMENT COLLEGE
DEPARTMENT OF BOTANY
Programme Outcome, Course Outcome and Program Specific Outcome

Aims of the Bachelors' Degree Program in Botany [As per the UGC LOCF Template(2019)]

- Intrinsic knowledge in plant science in addition to understanding of key plant life concepts and basic principles.
- To enhance the efficacy and skill of the students for increasing their expertise to solve both theoretical and practical problems in plant life.
- To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects.
- To provide the latest subject matter, both theoretical as well as practical, such away to foster their core competency and discovery learning. A botany graduate asenvisioned in this framework would be sufficiently competent in the field toundertake further discipline-specific studies, as well as to begin domain-relatedemployment.
- To mould a responsible citizen who is aware of most basic domain-independentknowledge, including critical thinking and communication.
- To enable the graduate prepare for national as well as international competitiveexaminations, especially UGC-CSIR NET, UPSC Civil Services Examination, WBCS and GRE Examination.
- To provide adequate knowledge and skill to the students' which might be enabled them to pursue further studies in Botany and related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.

Program Learning Outcomes [As per the UGC LOCF Template (2019)]

PLO1. **Knowledge and understanding of:**

- ✓ The range of plant diversity in terms of structure, function and environmental relationships.
- ✓ The evaluation of plant diversity.
- ✓ Plant classification and the flora of West Bengal.
- ✓ The role of plants in the functioning of the global ecosystem.
- ✓ A selection of more specialized and optional topics.
- ✓ Statistics as applied to biological data.

PLO2. **Intellectual skills – able to:**

- ✓ Think logically and organize tasks into a structured form.
- ✓ Assimilate knowledge and ideas based on wide reading and through the internet.
- ✓ Transfer of appropriate knowledge and methods from one topic to another within the subject.

- ✓ Understand the evolving state of knowledge in a rapidly developing field.
- ✓ Construct and test hypothesis.
- ✓ Plan, conduct and write a report on an independent term project.

PLO3. **Practical skills:** Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules.

- ✓ Interpreting plant morphology, anatomy and identification.
- ✓ Vegetation analysis techniques.
- ✓ A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry.
- ✓ Plant tissue culture and chromosome study.
- ✓ Analyse data using appropriate statistical methods and computer packages.

PLO4. **Transferable skills:**

- ✓ Use of IT (word-processing, use of internet, statistical packages and databases).
- ✓ Communication of scientific ideas in writing and orally.
- ✓ Ability to work as part of a team.
- ✓ Ability to use library resources.
- ✓ Time management.
- ✓ Career planning.

PLO5. **Scientific Knowledge:** Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyse any plant form.

PLO6. **Problem analysis**: Identify the taxonomic position of plants, formulate the research literature, and analyse non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

PLO7. **Design/development of solutions**: Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

PLO8. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.

PLO9. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

PLO10. **The Botanist and society**: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

PLO11. **Environment and sustainability**: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PLO12. **Ethics**: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

PLO13. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PLO14. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO15. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PLO16. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes

CO1. Critically evaluation of ideas and arguments by collection relevant information about the plants, so as recognize the position of plant in the broad classification and phylogenetic level.

CO2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.

CO3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.

CO4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.

CO5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.

CO6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.

CO7. Students will be able to apply fundamental statistical tools and physical principles to the analysis of relevant biological situations.

CO8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and from other forms of life.

CO9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.

CO10. Students will be able to explain how Plants function at the level of the gene, genome, cell, tissue, flower development. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.

CO11. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.

CO12. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within botany.

Programme Specific Outcomes: **PSOs of B.Sc. Botany:**
Prescribed in KaziNazrul University Syllabus (2020-2021) after introduction of LOCF within the CBCS
Semester – 1
Course code - BSCHBOTC101
Course name: Phycology and Microbiology

Knowledge on the followings:
Introduction to microbial world

- ✓ Histroy and development of microbiology (In brief) – contributions of Antoni van Leuwenhoek, Edward Jenner, Loius Pasteur, Robert Koch, De Bary and A. Flemming.

- ✓ Principles and modern approaches of bacterial taxonomy, General idea about Bergey'sMannual, Three domain system by C. Woese (1991).
- ✓ Microbial nutrition, nutritional types, growth and metabolism.
- ✓ Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).
- ✓ Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases.

Viruses and Bacteria

- ✓ Viruses: General characteristics of viruses (size, symmetry, culture characteristics, general structure including concept of capsomere and peplomere, chemical composition), structure of TMV and T2
- ✓ Viral multiplication – Lytic cycle and Lysogeny (excluding regulation). Classification (by Baltimore)
- ✓ Brief idea about Prions and Viroids.
- ✓ Bacterial structure and function - Capsule, flagella, pili, cell wall (chemical composition and characteristics), plasma membrane, ribosomes, cytoplasmic inclusions (PHB, Volutin). Plasmids and bacterial chromosome, endospore (structure only)
- ✓ General characteristics of domain Archaea, wall-less forms (Mycoplasmas)
- ✓ Basics of genetic recombination in bacteria: Transformation, Conjugation and Transduction. Artificial transformation.
- ✓ Basic immunology (only outline) – Innate and acquired immunity, active and passive immunity, humoral (antibody mediated) and cellular (cell mediated) immunity, primary and secondary response, general structure of antibody and its types.

Algae, Cyanophyta and Xanthophyta

- ✓ Introduction; Habitat and distribution; thallus organization; origin and evolution of sex in algae; Life cycle patterns.
- ✓ Broad outline of classification of Fritsch (1935) and Lee (2008) up to class and divisions respectively. Phylogenetic consideration.
- ✓ Comparative account of: Cyanophyceae, Chlorophyceae, Charophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae.
- ✓ Cell structure and reproduction of Cyanophyceae and Diatoms.
- ✓ Life histories of *Oedogonium*, *Trentepohlia*, *Chara*, *Vaucheria*, *Ectocarpus*and *Polysiphonia*.

Algal Biotechnology

- ✓ Economic importance of algae; Algal cultivation methods, Commercial cultivation and economic importance of green algae, brown and red algae.
- ✓ Algae in pollution control (sewage treatment), Biofertilizer, Single Cell Protein (SCP), Biofuel, β-catotene production.

COURSE CODE - BSCHBOTC102

Course name: Biomolecules and Cell Biology

Knowledge on the followings:

Bioenergetics

- ✓ Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions.
- ✓ ATP: structure, its role as an energy currency molecule. Types and significance of chemical bonds; Structure and properties of water; significance of pH and buffers.

Biomolecules

- ✓ Carbohydrates: Nomenclature and classification and isomeric form; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides.
- ✓ Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacylglycerols structure, functions and properties; Phosphoglycerides.
- ✓ Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins.
- ✓ Nucleic acids: 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.

Enzymes

- ✓ 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, Lineweaver–Burk equation, enzyme inhibition and factors affecting enzyme activity.

Cell Biology and Signal transduction

- ✓ Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Plant and animal cells; Origin of eukaryotic cell (Endosymbiotic theory).
- ✓ 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.
- ✓ Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.
- ✓ Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament; Intracellular trafficking. Chloroplast, mitochondria and peroxisomes
- ✓ Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast. Lysosomes and Vacuoles.
- ✓ Endomembrane system: Endoplasmic Reticulum – Types and Structure. Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Phases of eukaryotic cell cycle, mitosis and meiosis
- ✓ Regulation of cell cycle - checkpoints and regulation; role of protein kinases.
- ✓ Signal Transduction: Receptors and primary and secondary signal transduction.

Program Specific Outcome of Botany

Under-graduate Honours Course

Core Course: Botany Honours

Semester.	Papers	Name of the subject	Teaching Scheme In hours per week			Credit
			L	T	P	
I	1	Phycology and Lichenology	4		2	6
I	2	Mycology and Phytopathology	4		2	6
II	3	Bryology, Palaeobotany and Palynology	4		2	6
II	4	Morphology and Plant Anatomy	4		2	6
III	5	Plant systematic	4		2	6
III	6	Phytogeography and Eco. Botany	4		2	6
III	7	Pteridology and Gymnosperms	4		2	6
IV	8	Biochemistry and Plant Metabolism	4		2	6
IV	9	Ecology and Pharmacognosy	4		2	6
IV	10	Microbiology	4		2	6
V	11	Plant Physiology	4		2	6
V	12	Cell Biology and Genetics	4		2	6
VI	13	Molecular Biology	4		2	6
VI	14	Plant Biotechnology and Tissue culture	4		2	6
			Total Credit			84

[i.e. Skill Enhancment Course (SEC)]

[Two papers are to be taken and each paper will have 2 credit]:

Discipline Specific Elective Courses

(DSE):

(Four papers are to be taken each carrying 6 credit)

DSE- I : Stress Physiology/Ethnobotany

DSE-II: Plant Breeding/ Horticultural Practices

DSE III: Bioinformatics/Research Methodology

DSEIV: Biostatistics/ Cryopreservation

SEMESTER I

Paper code– BSCHBOTC101

Paper name- Phycology and Lichenology

Theory

Phycology

1. History and Development in Algae (Contribution of Fritsch and MOP Iyengar)
2. Introduction; Habitat and distribution; thallus organization; origin and evolution of sex in algae; Life cycle patterns.
3. Theory of endosymbiosis with respect to chloroplast evolution in algae.
4. Broad outline of classification of Fritsch (1935) and Lee (2008) up to class and divisions respectively.
5. Cyanophyceae: Salient features, ultrastructure of cell, structure and function of heterocyst;reproduction.

6. Chlorophyceae: Salient features; life history of *Chlamydomonas, Oedogonium* and *Trentepohlia.*
7. Charophyceae: Salient features; life history of *Coleochate* and *Chara*.
8. Xanthophyceae: Salient features; life history of *Vaucheria.*
9. Bacillariophyceae: *S*alient features, cell structure and reproduction.
10. Phaeophyceae: *S*alient features; life history of *Ectocarpus.*
11. Rhodophycee: Salient features; life history of *Polysiphonia*.
12. Economic importance — Beneficial: food. phycocolloids (agar, algin and carrageenan),diatomaceous earth; Harmful: algal as pathogen in plants and algal toxins.
13. Algal Biotechnology- Pollution control (sewage treatment), Biofertilizer, Single Cell Protein (SCP), Biofuel, β-catotene production.

Lichenology

Lichen: Classification, thallus structures, reproduction; ecological and economic significance.

Practical – BSCHBOTC101

Algae/Phycology –

1. Study of the following genera: Oscillatoria, Gloeotrichia, Scytonema,Oedogonium,Vaucheria and Chara.
2. Identification of all the genera included in the theoretical syllabus by their vegetative and reproductive structures.

Paper code– BSCHBOTC102

Paper name- Mycology and Phytopathology

Theory

Mycology

1. Status of fungi in living system.
2. Introduction, Salient features - fungal tissue organization, modification of hyphae, structure of fungal cell, flagella, habit, septum, homothallism and heterothallism, parasexuality, cell division.
3. Broad outline Classification of Gwynne-Vaughan and Barnes (1937) and Ainsworth and Bisby (1983).
4. Phycomycetes: Salient features, life histories of *Synchytrium, Saprolegnia* and *Rhizopus.*
5. Ascomycetes: Salient features, Ascus development, types of ascocarps; life histories of.*Saccharomyces* and *Ascobolus.*
6. Basidiomycetes: Salient features (dikaryotization, clamp connection); development of Basidium (holobasidium and phragmobasidium), fruit body types, life histories of *Puccinia*, *Ustilago* and *Polyporus.*
7. Deuteromycetes: Salient features with special reference to conidial fruit body types.
8. Economic importance of fungi – As food (Mushroom – types; procedure of spawn production and cultivation of Oyster and Button mushroom); Mycorhizae (importance in agriculture and forestry);

Phytopathology

1. Plant Diseases: Definition; concepts of parasitism and saprophytism, Koch's

postulate.

2. Classification of plant diseases based on symptoms.
3. Pathotoxins (HV toxin and Wild-fire toxin).
4. Structural and biochemical defense mechanism of plants.
5. Control of Plant diseases: Physical, chemical and biological methods.
6. Symptoms, disease cycles and control measures of White rust of crucifer, Brown spot of rice, Late blight of potato, Rust of wheat.

Paper code– BSCHBOTC102
Paper name- Mycology and Phytopathology
Practical
Fungi/ Mycology -

1. Study of the following genera: Rhizopus, Ascobolu, Agaricus (gill) and Polyporus.
2. Identification of all the macroscopic and microscopic genera included in the theoretical syllabus.
3. (It should also include Alternaria and Fusarium of Deuteromycetes).

Phytopathology -

4. Study of the following diseases: White rust, Rust of wheat/Justicia, smut of wheat (or any member of Poaceae)
5. Demonstration on isolation and subculturing of pathogen.

SEMESTER II
Paper code– BSCHBOTC201
Paper name- Bryology, Palaeobotany and Palynology
Theory
Bryology

1. Origin and evolution of Bryophytes.
2. Introduction, General habit and distribution, Broad outline of Classification according to Proskauer, (1957) and Crandall-Stotler and Stotler (2008); Comparative study of Hepaticopsida, Anthocerotpoida and Bryopsida.
3. Life histories of Marchantia, Pellia, Porella, Anthoceros, Sphagnum and Funaria.
4. Evolutionary trends in the gametophyte and sporophytes of bryophytes.

Palaeobotany and Palynology

1. Contributions of Birbal Sahni in Indian Palaeobotany.
2. Introduction, importance of Paleobotany.
3. Definition of fossil, process of fossilization, types of fossils on the basis of their preservation; concept of Form Genus, conditions for fossilization.
4. Introductory idea of correlation and stratigraphy; stratigraphic deductions based on plant fossils.
5. Origin of life, Geologic Time Scale, major events of plant life through geologic time.
6. Spore/pollen morphology with reference to polarity, size, shape, symmetry, aperture and sculpture.
7. Importance of Palynology; Melittopalynology.

Paper code– BSCHBOTC201

Paper name- Bryology, Palaeobotany and Palynology
Practical
Bryophyta-

1. Study of the gametophytic and sporophytic structures of the following genera: Marchantia, Anthoceros and Funaria.
2. Spot identification of genera that are included in the theoretical syllabus.

Palaeobotany and Palynology –

1. Study (including mode of preservation) of the following: Lepidodendron, (stem in T. S.), Calamites (stem in T. S.), Bucklandia (stem, specimen), Glossopteris (leaf, specimen), Lyginopteris (stem in T. S.),Vertebraria(root, specimen).

Paper code– BSCHBOTC202
Paper name- Morphology and Plant Anatomy
Theory
Morphology and embryology of Angiosperms

3. Leaves: Types, phyllotaxy, modifications of leaves, stipules.
4. Inflorescence: Types with examples.
5. Flower – General characteristics, as a modified shoot; aestivation; placentation and its evolution; floral formulae, floral diagram; adhesion and cohesion of floral parts.
6. Fruits: Definition and types.
7. Dispersal of fruits and seeds.
8. Organization of orthotropous ovule, types of ovules; megasprogenesis.
9. Development of male and female gametophytes (Polygonum type)
10. Pollination: Types and contrivances.
11. Fertilization.
12. Development of typical dicot embryo (Crucifer - type).
13. Endosperm: Types, development of free nuclear type.

Plant Anatomy

1. Cell wall: Structure, growth and thickenings.
2. Tissue: Definition, organization of shoot and root apices, mechanical tissue and their distribution in plant bodies.
3. Tissue system – Epidermal (multiple epidermis, bulliform cells, stomatal types, trichoblasts, glandular hairs), vascular (leaf gap, branch gap, types of vascular bundles) and ground tissue system (Genral features of cortex, pith and medullary rays); Stele types.
4. Root-stem transition.
5. Secondary growth: normal secondary growth in dicot shoot and root, concept of growth ring, ring and diffused porus wood, heart wood and sap wood, Periderm, Lenticel, commercial cork, bark, polyderm and rhytidome.
6. Anomalous secondary growth in stems of Bignonia, Boerhaavia, Strychnosand Dracaena (Cordyline), significance.

Paper code– BSCHBOTC202
Paper name- Morphology and Plant Anatomy
Practical
Morphology –

1. Morphological study of the plant organs included in the theoretical syllabus (No Submission is required)

Plant Anatomy -

1. Study of the anomalous structures of stems of the following genera: Bignonia, Dracaena, Boerhaavia and Strychnos.
2. Microscopic identification of the followings: Primary structure of Sunflower and maize stem and gram and Canna root, Bulliform cells, stomatal types, lenticels, raphides (acicular and sphaeraphides), Cystolith.
3. Maceration of wood elements of Cucurbita and Pinus stem and their microscopic examination.

SEMESTER III

Paper code– BSCHBOTC 301

Paper name- Plant Systematics

Theory

Plant Systematics

1. Position of Plant kingdom in living system (Five kingdom concept),
2. Plant classification - artifitial, natural and phylogenetic approach, concept of molecular chronometers, Basic concept of Numerical taxonomy (Definition of Operational Taxonomic Units (OTU), Phenon, Phenogram).
3. Outline of the system of classification – Linnaeus (1753), Bentham and Hooker (1862-83), Takhtajan (1997). Brief idea about APG.
4. Definition of Taxonomy (alpha & omega), concept of hierarchy and categories.
5. ICN (ICBN) and Principles of ICN, Effective and Valid publication, Principle of priority, authors citation, rejection of names, Nomenclatural types; Importance of herbaria and botanical gardens.
6. Salient features of the following families with examples from common Indian species and economic importance. [Evolutionary trends need to be briefly discussed in case of families marked with astericks].

   Dicotyledons: Magnoliaceae*, Malvaceae, Brassicaceae, Fabaceae, Euphorbiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Scrophulariaceae, Lamiaceae, Verbinaceae, Acanthaceae, Rubiaceae, Asteraceae (Compositae)*.

   Monocotyledons: Alismataceae*, Liliaceae, Poaceae, Orchidaceae*.

Paper code– BSCHBOTC 301

Paper name- Plant Systematics

Practical

1. Study of the morphology of locally available plants of the families included in the theoretical syllabus (excluding, magnoliaceae, euphorbiaceae, and all monocots included in the syllabus) including floral formula and floral diagrams, identification up to genus following published keys (Bengal Plants by David Prain 1903 or any other Published Key)

Paper code– BSCHBOTC 302

Paper name- Economic Botany and Pharmacognosy

Theory

Economic Botany

1. Method of cultivation, processing and utilities of the products of the following: Rice, Tea, Potato and Jute.
2. Morphological nature and major uses of the economically important parts of the following products: Cotton (fibre), Sal (wood), Sugarcane (sugar), Mustard (oil) and Pegion Pea (Pulse), Jatropha curcas (Biodiesel).

Pharmacognosy

1. Introduction; definition of drugs, folk medicine, active principles; Pharmacy, Pharmacognosy, Pharmacopeia and drug adulteration (sophistication), drug evaluation.
2. Study of the following drug plants (Diagnostic features, active principles and uses): Rauwolfia serpentina (root), Adhatoda vasica (leaf), Strychnos nuxvomica (seed), Catharanthus roseus (Whole plant), Taxus sp. (bark).

Paper code– BSCHBOTC 302
Paper name- Economic Botany and Pharmacognosy
Practical

Economic Botany

1. T.S. of potato tuber to show localization of starch grains, qualitative test for starch using either rice/potato, Identification of jute fibre through maceration technique, Qualitative test for lipid in crushed seeds of mustard, Whole mount of cotton seed to show lint and fuzz fibres.

Pharmacognosy

1. Organoleptic and microscopic examination of following plant drugs to be supplied fresh and powdered form – Adhatoda vasica (leaf), Strychnos (seed), Zinger (rhizome).

Paper code– BSCHBOTC303
Paper name- Pteridology and Gymnosperms
Theory

Pteridophyta

1. Introduction to Pteridophyta – Concept of sporophyte (evolutionary steps leading to independent sporophyte), stellar organization and evolution, microphyll vs megaphylls, exsporic vs endosporic, exscopic vs endoscopic, soral types; Apogamy and apospory.
2. Outline of Smith et al. (2006) system of classification of pteridophytes up to family.
3. Telome theory of Zimmerman and Enation theory of Bower.
4. A comparative morphology and evolution of Rhynia, Zosterophyllum and Psilophyton,
5. A comparative account of the living genera: Psilotum. Lycopodium, Selaginella, and Equisetum with respect to vegetative and reproductive structures.
6. Geological history and morphoanatomical features of Lepidodendron,(Lepidodendron, Lepidocarpon) v) Calamites (stem and strobilus- Eurostachys and Palaeostachya).
7. Distribution, vegetative structure and reproduction of Pteris,and Marsilea.

Gymnosperm

1. General features, evolution of seed habit; outline classification as adopted by Stewart & Rothwell (1993).
2. Progymnospermopsida: General features, General account of Archaeopteris
3. Pteridospermales: General account of Lyginopteris plant (Crossotheca male organ and Lagenostoma female organ).
4. Glossopteridales: General account of Glossopteris plant (Vertebraria root, Araucarioxilon trunk, Glossopteris leaf,Glossothecamale organ, Denkania (female organ).
5. Cycadales: Structure and life history of Cycas and its distribution in India.
6. Bennettitales: General account of Williamsonia plant (Bucklandia stem, Ptilophyllum leaf, Weltrichia male organ, Williamsoniafemale organ).
7. Ginkgoales: Structure and life history of Ginkgo; brief mention of the morphology of collar.
8. Coniferales: Structure and life history of Pinus; brief mention of the morphology of ovuliferous scale.
9. Gnetales: Structure and life histories of Ephedra and Gnetum; their distribution in India.
10. Economic importance of gymnosperms.

Paper code– BSCHBOTC303
Paper name- Pteridology and Gymnosperms
Practical

Pteridophytes –

1. Study of external morphology and anatomical features of leaf, stem and reproductive
2. parts of the following: Lycopodium, Selaginella, Equisetum, Pteris and Marsilea.
3. Macroscopic and microscopic identification of specimens of all extant genera included in the theoretical syllabus,

Gymnosperms –

1. Study of the morphological and anatomical features of the following: Cycas (leaflet, rachis, microsporophyll), Pinus (needle, stem, male cone), Ephedra (stem, morphology of male flower).
2. Macroscopic and microscopic identification of specimens of all the extant genera included in the theoretical syllabus –(male and female cones of all genera, leaves of Ginkgo and Gnetum, Coralloid root of Cycas, t.s of ovule of all genera, v.s of cones of all genera in theory syllabus).

Paper code– BSCHBOTSEC301
Paper name- Biofertilizer
Theory

Unit-1: General account about the microbes used as biofertilizer.

Rhizobium – isolation, identification, mass production, Commercialization.

Unit -2: General idea about Plant growth promoting rhizobacteria (PGPR) and Phosphate solubilizing bacteria (PSB)

Unit- 3: Cyanobacteria (blue green algae) and Azolla as biofertilizer; Blue green algae and Azolla production.

Unit -4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution; VAM fungi, and their influence on growth and yield of crop plants.

Unit -5: Organic farming – Green manuring and organic fertilizers; Organic Compost and Vermicompost - production and application.

SEMESTER IV
Paper code– BSCHBOTC 401
Paper name- Biochemistry and Plant Metabolism
Theory

Biochemistry (22) –

1. Structure of water molecule and its biological role, Concept of pH, Ionic product of water, acid-base and buffers in biological system, chemical bonds; concept of radioisotopes; Biomolecules.
2. Carbohydrates: Outline classification, reducing and non-reducing sugars. Structures of mono-, di- and polysaccharides, properties of monosaccharides; Concept of Optical isomerism (L and D forms), mutarotation.
3. Amino acids: Basic structure and outline classification with examples; concept of zwitterions and isoelectric point (pI).
4. Protein: Primary, secondary (∞ - helix & ß-pleated sheet), tertiary and quaternary structures; Interactions involved in these conformations.
5. Lipid: Structure and nomenclature of fatty acids.
6. Nucleic acid – Chemical nature of DNA and RNA, Structure of Nitrogenous bases, Nucleotides and Nucleosides. Structure of B-DNA (Watson-Crick model), types of DNA and RNA, Structure of tRNA.
7. Enzymes: Definition, co-factors and prosthetic group with examples. Nomenclature and classification of enzymes (IUB system, 1961). Preliminary idea about the mechanism of enzyme action and kinetics, factors affecting enzyme action, Ribozyme, allosteric enzyme.

Plant Metabolism (18) –

1. Carbon Metabolism – Respiration, Respiratory quotient (RQ), Glycolysis, oxidative decarboxylation, Krebs cycle, electron transport system, oxidative phosphorylation and chemiosmotic system, Glyoxylate cycle, Gluconeogenesis.
2. Nitrogen metabolism - nitrate assimilation, nitrogen fixing organisms (free living, symbiotic and associative diazotrophs), Mechanism of nitrogen fixation – both asymbiotic and symbiotic. Mechanism of nodule formation and concept of nod and nif genes. GS-GOGAT pathway for ammonia assimilation. Definition and examples of transamination, deamination and decarboxylation reactions of amino acids.
3. Lipid Metabolism – β-oxidation of even carbon fatty acids (Palmitic acid).

Paper code– BSCHBOTC 401
Paper name- Biochemistry and Plant Metabolism

Practical

Biochemistry and Plant Metabolism

1. Qualitative tests – General test for carbohydrate (Molish test), tests for reducing and non reducing sugar (Fehling's test), Specific tests for glucose (monosaccharide), starch (Iodine test); General tests for protein (Biuret test and xanthoproteic test), General test for organic acid (Citric acid and Oxalic acid); General tests for essential elements- Fe and phosphorus.
2. Quantitative test – Quantitative estimation of sugar in an unknown sample with the help of known standards (DNS method); Quantitative estimation of protein in an unknown sample with the help of known standards (Lowry test); Concentration should be determined by plotting standard curve.
3. Determination of respiratory substrate of germinating seeds of a carbohydrate, protein and oil rich seed by RQ method
4. Determination of rate of respiration in different plant parts.
5. Determination of seed viability by TTC test.

Paper code– BSCHBOTC 402

Paper name- Ecology and Phytogeography

Theory

Ecology

1. Ecology: Concept of Autecology and Synecology.
2. Environmental factors: Climatic, edaphic and biotic factors.
3. Biogeochemical cycle – N2 and P cycle.
4. Ecosystem: Definition, concept of ecological pyramids and energy flow.
5. Ecological succession (Hydrosere, Xerosere).
6. Morphological, anatomical and physiological adaptations of xerophytes, hydrophytes and halophytes.
7. Biodiversity (hot spots, megadiversity zones, IUCN threatened species), conservation (in-situ-, ex-situ conservation and cryopreservation).
8. Pollution: Definition, causes and remedies with respect to air, water and noise pollution.

Phytogeography

1. Phytogeographical classification of India (D. Chatterjee- 1960).
2. Vegetation characteristic of Eastern Himalayas and Sunderbans.
3. Endemism : Definition, theories and types.
4. Concept and brief description of Major terrestrial biomes.

Paper code– BSCHBOTC 402

Paper name- Ecology and Phytogeography

Practical

Ecology and Phytogeography –

1. Ecological adaptations with respect to anatomy of: Iponoea aquatica stem, Phyllode of Acacia auriculoformis, Nerium leaf and Vanda root.
2. Concept of minimum species area curve according to quadrate method.
3. Determination of Biodiversity of an area by Shannon index method.

Paper code– BSCHBOTC 403

Paper name- Microbiology

Theory

Microbiology

1. Histroy and development of microbiology – contributions of Antoni van Leuwenhoek, Edward Jenner, Loius Pasteur, Robert Koch, De Bary and A. Flemming.
2. Principles and modern approaches of bacterial Taxonomy, General idea about Bergey's Mannual, Three domain system by C. Woese (1991).
3. Bacterial structure and function - Capsule, flagella, pili, cell wall (chemical composition and characteristics), plasma membrane, ribosomes, cytoplasmic inclusions (PHB, Volutin). Plasmids and bacterial chromosome, endospore (structure only); General characteristics of domain Archaea.
4. Economic importance of microorganisms i) Agricultural Microbiology (Biofertilizer, biopesticides), ii) Industrial Microbiology (in fermentation and Pharmaceuticals), iii) Medical Microbiology (air borne – Influenza; Water borne – Cholera; Food borne – Boutulism; Brief idea about epidemiology, causal organism and control).
5. Basics of genetic recombination in bacteria: Transformation, Conjugation and Transduction. Artificial transformation.
6. Viruses: General characteristics of viruses (size, symmetry, culture characteristics, general structure including concept of capsomere and peplomere, chemical composition), structure of TMV, T2 and HIV; Viral multiplication – Lytic cycle and Lysogeny (excluding regulation).
7. Brief idea about Prion and Viroid.
8. Basic immunology (only outline) – Innate and acquired immunity, active and passive immunity, humoral (antibody mediated) and cellular (cell mediated) immunity, primary and secondary response, general structure of antibody and its types.

Paper code– BSCHBOTC 403

Paper name- Microbiology

Practical

Microbiology -

1. Aseptic methods
   a) Sterilization technique by Autoclaving, Hot air oven and surface sterilization.
   b) Preparation of standard bacteriological medium (Nutrient agar and Nutrient broth).
   c) Preparation of slant and plates.
   d) Subculturing of pure bacteriological culture.
2. Microscopic examination of bacteria from natural habitats: curd and root nodules of leguminous plants (using simple staining)
3. Enumeration of culturable bacteria (Colony Count) from air.
4. Differential staining: Gram staining.
5. MBRT test.

Paper code– BSCHBOTSE401

Paper name- MUSHROOM CULTURE TECHNOLOGY

Theory

Unit 1: Introduction and history. Types of edible mushrooms available in India - Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus; Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms..

Unit 2: Methods of cultivation of edible mushrooms. Diseases of Mushroom fungi and methods of remedy

Unit 3: Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions.

Unit 4: Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

SEMESTER V

Paper code– BSCHBOTC 501

Paper name- Plant Physiology

Theory

Unit 1: Plant-water relations

Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure,

Unit 4: Translocation in the phloem

Experimental evidence in support of phloem as the site of sugar translocation; Source–

sink relationship; Phloem loading and unloading, Pressure–Flow Model.

Unit 5: Photosynthesis, Carbon dioxide concentrating mechanisms (CCMs) and Photorespiration

Photosynthesis: Definition, photosynthetic pigments, basic concept about mechanism of light-dependent and light independent reactions; C 3 -, C4 - and CAM pathways of CO2 fixation;

Photorespiration - definition, sites, mechanism and significance

Unit 6: Plant growth regulators

Definition and types, bioassay (auxin only), Chemical nature and physiological roles of: Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene.

Unit 7: Physiology of flowering

Photoperiodism, flowering stimulus, physicochemical nature of phytochrome, role of phytochromes in flowering, florigen concept, vernalization;

Unit 8: Seed Physiology

Seed germination - different phases of seed germination, seed dormancy (types, significance and breaking of seed dormancy).

Paper code– BSCHBOTC 501

Paper name- Plant Physiology

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method (using Rhoeo epidermal peel).
2. Determination of amount of water absorption, retention and transpiration.
3. Study of the effect of humidity and light on the rate of transpiration in excised twig/leaf.
4. Study the effect of KNO3 on stomatal opening.
5. Determination of the effect of CO2 concentration on the rate of photosynthesis

using molar solution of bicarbonate and by measurement of volume of O2 liberation.

6. 6. Determination of soil (a) pH, (b) Moisture Content and (c) Water Holding Capacity.

Paper code– BSCHBOTC502
Paper name- Cell Biology and Genetics
Theory

Cell Biology:

Unit1: The cell

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).

Unit 2: Cell wall and plasma membrane

Chemistry, structure and function of Plant cell wall and Cell membrane. Overview of membrane function; fluid mosaic model; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Unit 3: Cell organelles

Nucleus: Structure of nucleus, nuclear envelope, nuclear pore complex, Mitochondria and Chloroplast: Structural organization; functions; Endomembrane system: Endoplasmic Reticulum – Structure and functions of RER and SER, Signal hypothesis; Golgi Apparatus – organization and functions; Lysosomes; Ribosome – structure and function.

Unit 4: Cell division

Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle-checkpoints (role of cyclins and Cdks).

Genetics:

Unit 5: Mendelian genetics and its extension

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance, concept of homozygousity, heterozygousity, Incomplete dominance and co-dominance; Gene interactions - Epistasis, Lethal genes, Complementary genes, Inhibitory genes; Basic concept of Pleiotropy and Polygenic inheritance.

Unit 6: Linkage, crossing over and chromosome mapping

Linkage and crossing over- Coupling and Repulsion hypothesis; Linkage group, types of linkages; Crossing over and Recombination - definitions. types and mechanism, Cytological basis of crossing over in plants; Recombination frequency, three point cross and linkage mapping.

Unit 7 Numerical and structural aberration of chromosomes

Structural aberrations: Deletion, Duplication, Inversion, Translocation; Non-disjunction, Robertsonian translocation and Isochromosomes, Position effect;
Numerical aberrations: Euploidy – Haploid and Monoploid, Auto and allopolyploidy, Induction of polyploidy, Significance of polyploidy; Aneuploidy – different types of aneuploids, types of trisomics.

Unit 8: Fine Structure of Gene and gene mutation mutations

Classical vs molecular concepts of gene; Cis-Trans complementation test; Mutation

– Definition and types, molecular basis of mutations (spontaneous and induced); Point mutations and Frame-shift mutation; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); DNA repair-mechanisms (photoreactivation and excision repair only); Transposable elements (IS element and Tn transposons), Ac-Ds elements in Maize.

Paper code– BSCHBOTC502
Paper name- Cell Biology and Genetics
Practical

1. Study of mitotic cell division and chromosome complement in Allium cepa by aceto- orcein squash technique.
2. Determination of mitotic index in Allium cepa root tip by aceto-orcin squash technique.
3. Study of meiotic division in Allium cepa or Rhoeo spathacea / R. discolor by aceto carmine staining technique.
4. Testing of goodness of fit with Mendelian mono- and dihybrid ratios.

Paper code– BSCHBOTDSE501
Paper name- Analytical Techniques in Plant Sciences
Theory
Unit 1: Imaging and related techniques

Basic Principles of - Light microscopy, Phase-contrast microscopy, SEM and TEM.

Unit 2: Cell fractionation

Basic Principle of Centrifugation: Differential and density gradient centrifugation.

Unit 3: Radioisotopes

Use of radioisotopes in biological research, auto-radiography, pulse chase experiment

Unit 4: Colorimeter and Spectrophotometry

Basic Principle and its application in biological research.

Unit 5: Chromatography

Basic Principles and application in brief of - Paper chromatography, Column chromatography (Gel filtration, Ion-exchangeand Affinity chromatography), Gas Chromatography

Unit 6: Electrophoresis

Basic principle and application of agarose gel and poly acryl amide gel electrophoresis (native PAGE and SDS-PAGE).

Paper code– BSCHBOTDSE501
Paper name- Analytical Techniques in Plant Sciences
Practical

1. Separation of amino acids by paper chromatography and identification of unknown sample.
2. Preparation of permanent slides (double staining) for microscopic studies of any plant tissue.
3. Demonstration of some Instruments: Centrifuge, Colorimeter/Spectrophotometer and Electrophoresis.

Paper code– BSCHBOTDSE504
Paper name- Plant Breeding
Theory

Unit 1: Plant Breeding

Introduction, aims and objectives of plant breeding; Plant introduction, acclimatization and domestication.

Unit 2: Methods of crop improvement

Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

Unit 3: Quantitative inheritance

Concept, mechanism, examples of inheritance of Kernel colour in wheat, Skin colour in human beings.Monogenic vs polygenic Inheritance.

Unit 4: Inbreeding depression and heterosis

History, genetic basis of inbreeding depression and heterosis; Applications.

Unit 5: Crop improvement and breeding

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

Paper code– BSCHBOTDSE504
Paper name- Plant Breeding
Practical

1. Calculation of central tendency – mean, mode and median of a data obtained from natural population.
2. Normal distributon curve using a continuous variation (Data May be provided).
3. Chi square test of goodness of fit for Mendelian ratios.
4. Demonstration of Breeder's kit.

SEMESTER VI
Paper code– BSCHBOTC 601
Paper name- Molecular Biology
Theory
Unit 1: Nucleic acids : Carriers of genetic information

Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.

Unit 2. The Structures of DNA and RNA / Genetic Material

DNA Structure: DNA structure, Salient features of double helix (As per Watson and Crick's Model), Types of DNA, Organization of genetic materials – eukaryotes, prokaryotes and of viruses; RNA - Types and Structure; Chemical nature of DNA and RNA; Chromosome packaging in eukaryotes (nucleosome and solenoid model to metaphase chromosome); Euchromatin and Heterochromatin.

Unit 3:The replication of DNA

DNA Replication – General principles, bidirectional, semi-conservative and semi discontinuous replication; Replication of linear ds-DNA, Enzymes involved in theprocess of DNA replication.

Unit 4: Central dogma and genetic code

Concept of central dogma and reverse transcription; RNA world concept; Genetic code
– Characteristics, evidences and deciphering of codon dictionary.

Unit 5: Transcription and post transcriptional modification

Transcription in prokaryotes, Enzymes involved and process (Initiation, elongation and termination – rho dependent and rho independent), Split genes-concept, splicing – self splicing and spliceosome mediated splicing, end- modifications (5' capping and 3' polyadenylation).

Unit 6: Translation

Protein synthesis - Charging of tRNA, initiation, elongation and termination of protein synthesis; Inhibitors of protein synthesis.

Unit 7: Gene Regulation in Prokaryotes

Operon Concept, Anabolic and Catabolic operons, Lac Operon (Negative and Positive Control), Glucose effect.

Paper code– BSCHBOTC 601

Paper name- Molecular Biology

Practical

1. Isolation of chromosomal DNA from E. Coli.
2. Isolation of Plant DNA (CTAB method).
3. Estimation of isolated DNA by agarose gel-electrophoresis.
4. Blood Grouping

Paper code– BSCHBOTC 602

Paper name- Plant Biotechnology And Tissue Culture

Theory

Unit 1: Plant Tissue Culture

Historical perspective; Composition of media (General concept with respect to MS medium)); role of vitamins and hormones; Totipotency, organogenesis, embryogenesis (somatic and zygotic), protoplast isolation, culture and fusion;
Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids;
Cryopreservation; Germplasm Conservation).

Unit 2: Recombinant DNA technology

Restriction Endonucleases (History, Types I-IV, biological role and application);
Restriction Mapping; Cloning Vectors – plasmid vectors, phage vectors, cosmids, phagemids, YAC and BAC; Ti-plasmid based vectors (simple map and characteristics).

Unit 3:Gene Cloning

Recombinant DNA, basic cloning strategy in plasmid vector, selection of recombinant clones (insertional mutagenesis and blue white screening); Southern blotting; Construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; Probe.
PCR (polymerase chain reaction) – method and applications.

Unit 4: Methods of gene transfer

Transformation, Liposome mediated gene transfer, Agrobacterium-mediated gene transfer, Electroporation, Microinjection, Microprojectile bombardment.

Unit 5: Applications of Biotechnology

Agricultural (Flvr-Savr tomatoes by antisense RNA technology, Bt-cotton, Golden rice), Medical (Insulin and subunit vaccines) and Environmental (Pseudomonas

putida – Chakraborty's bug) aspects of genetic engineersing.

Paper code– BSCHBOTC 602

Paper name- Plant Biotechnology And Tissue Culture

Practical

1. Demonstration of MS Medium preparation, Aseptic culture of seed (mustard), shoot tip culture as a process of micropropagation.
2. Demonstration of Callus development using apical meristem
3. Isolation of plasmid DNA (Alkali lysis methoid)
4. Restriction digestion and gel electrophoresis of plasmid DNA.

Paper code– BSCHBOTDSE602

Paper name- Horticultural Practices and Post-Harvest Technology

Theory

Unit 1: Introduction

Scope and importance, Branches of horticulture; Role in rural economy.

Unit 2: Ornamental plants

Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental plants [rose, marigold, tuberose], Ornamental flowering trees (Gulmohar, Lagerstroemia and areca palms).

Unit 3: Fruit and vegetable crops

Description of plants and their economic products; Management and marketing of vegetable (Potato and Brinjal) and fruit crops (Mango and Banana).

Unit 4: Horticultural Practices

Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Bonsai Production.

Unit 5: Post-harvest Technology

Harvesting and handling of fruits, vegetables and cut flowers.

Unit 6: Tissue culture

Role of micropropagation and tissue culture techniques in horticultural crops.

Paper code– BSCHBOTDSE602

Paper name- Horticultural Practices and Post-Harvest Technology

Practical

1. Methods of Vegetative propagation – Cuttings, grafting, gooting and layering.
2. Disease Management – Integrated Pest Management practices (A field study).
3. Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at IARI or other suitable locations.

Paper code– BSCHBOTDSE604

Paper name- Industrial and Environmental Microbiology

Theory

Unit 1: Scope of microbes:

In industry and environment.

Unit 2: Microbial production of industrial products

Microorganisms involved, media, fermentation conditions for the production of Enzyme: (amylase), Organic acid (citric acid), alcohol (Ethanol) and antibiotic (Penicillin).

Unit 3: Microbial flora of water.

Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality.

Unit 4: Microbes in agriculture and remediation of contaminated soils.

Biological fixation; Mycorrhizae; Bioremediation of contaminated soils.

Paper code– BSCHBOTDSE604

Paper name- Industrial and Environmental Microbiology

Practical

1. Principles and functioning of instruments in microbiology laboratory
2. Hands on sterilization techniques and preparation of culture media.
3. Isolation and enumeration of microorganisms from soil, air and water.

Semester.	Papers	Name of the subject	Teaching Scheme In hours per week			Credit
			L	T	P	
I	1	Algae, Fungi and Bryophyta	Not offered			
II	2	Pteridophyta, Gymnosperms and Palaeobotany	Not offered			
III	3	Plant Taxonomy and Plant Anatomy	4		2	6
IV	4	Plant Physiology and Ecology	4		2	6

GENERIC ELECTIVE

SEMESTER III

Paper code– BSCHBOTGE301

Paper name- Morphology, Embryology, Plant Taxonomy and Plant Anatomy

Theory

Morphology and Embryology –

1. Leaf – Types, modifications of leaf lamina, Phyllotaxy,
2. Stipule – Types and modifications Inflorescences – Types with examples
3. Flower – Flower is a modified shoot, Morphology of different parts of a flower, Cohesion and adhesion.
4. Pollination and fertilization – Types and contrivances; fertilization – double fertilization/triple fusion; General structure of dicot and monocot embryo; endosperm types.
5. Fruits – Types with example.

Plant Taxonomy –

1. Introduction to plant taxonomy – Identification, Classification, Nomenclature; Definition: - Artificial, natural and phylogenetic classification; Concept of Binomial Nomenclature; Classification by Bentham & Hooker (upto series).
2. Functions of Herbarium and Botanical Gardens, Important Herbaria and Botanical Gardens of the world and India.
3. Taxonomic hierarchy – Ranks, Categories and Taxonomic Groups

Plant Anatomy –

1. Tissue – Meristematic and Permanent tissue, Their types; Root and shoot apical meristems; Simple and Complex Tissues
2. Tissue system – General idea of epidermal, vascular and ground tissue systems, Types of vascular bundles.

3. Organs – Primary structure of Stem, Root and Leaf.
4. Secondary growth – Secondary growth in typical stem and root (dicot only), Seasonal activity of cambium; Wood – heartwood and sapwood

Paper code– BSCHBOTGE301

Paper name- Morphology, Embryology, Plant Taxonomy and Plant Anatomy

Practical

1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formulae/ and Identification): – Brassicaceae, Solanaceae, Malvaceae, Fabaceae, Lamiaceae, Verbenaceae, Apocyanaceae and Asteraceae
2. Anatomical study of the sections of – Stem (Sunflower and Maize), Root (Chick Pea and Canna) and Leaf (Nerium)
3. Identification of types of fruits (berry, pome, capsule, pepo, hesperidium), inflorescences (verticillastor, cyathium, spikes, hypanthodium) and stipules (Adnate, interpetiolar, intrapetiolar, free lateral and ochreate) of angiosperms.
4. Identification from permanent slides – Stomata, Cystolith, Raphides, Stone Cells and Lenticels
5. Submission - Herbarium sheets – Maximum 10 from local flora with proper labeling and field record

SEMESTER IV

Paper code– BSCHBOTGE401

Paper name- Plant Physiology, Metabolism and Ecology

Theory

Plant Physiology, Metabolism and Ecology-

1. Plant-water relations, Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.
2. Mineral nutrition- Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements;
3. Translocation in phloem - Composition of phloem sap, General idea about Phloem loading and unloading.
4. Photosynthesis – Light Reaction (Photosynthetic Electron transport System and mechanism of ATP synthesis); Outline of C3, C4 and CAM pathways of carbon fixation; Photorespiration.
5. Respiration – Introduction, Glycolysis, Oxidative decarboxylation and TCA cycle; Oxidative phosphorylation.
6. Enzymes - Definition and properties; Mechanism of enzyme catalysis and enzyme inhibition.
7. Nitrogen metabolism - Biological nitrogen fixation – symbiotic and asymbiotic examples, mechanism of symbiotic N2 fixation.
8. Plant growth regulators - Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Ecology –

1. Definition – Autecology and Synecology; Concept of energy flow; Food chain and food web. Ecological pyramids – pyramids of biomass, energy and numbers.
2. Ecological Succession - Hydrosere

3. Ecological adaptations and adaptive characteristics of hydrophytes, xerophytes and halophytes Phytogeography – Phytogeographical classification of India (D. Chatterjee, 1962); Concept of endemism. Pollution – Air and water – Causes, effects and Remedies.

Paper code– BSCHBOTGE401
Paper name- Plant Physiology, Metabolism and Ecology
Practical

1. Determination of isotonic concentration of cell sap by plasmolytic method.
2. To find the essentiality of CO2 in photosynthesis using Hydrilla/ any other aquatic plant. To study the effect of two environmental factors (light and humidity) on transpiration using Colocasia leaf.
3. Comparison of the rate of respiration in any two parts of a plant.
4. Study of the anatomical adaptations of xerophytes (Casuarina stem) and hydrophytes (Anhydra stem)