**Name of the Department: Botany**

**Academic Calendar**

**Session: 2025-2026**

**Semester- Odd**

| **Semester (CBCS/NEP)** | **(Major/Minor)** | **Syllabus Module/Unit** | **Topic** | **No. of lectures (Hours)** | **Teachers** | **Tentative Distribution** |
| --- | --- | --- | --- | --- | --- | --- |
| I | Major |  |  |  |  |  |
|  |  |  | **Microbiology - 25 Marks** | 30 |  |  |
|  |  | Unit:1 | **Introduction to the microbial world**  Binomial nomenclature, difference between Prokaryotic and Eukaryotic microorganisms, development of microbiology as a discipline, spontaneous generation vs biogenesis, contribution of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming. Germ theory of disease, Role of microbiology in fermentation, Development of the field of soil microbiology. Primary concept of microorganism – 3 domain concept. |  | MD | July – August |
|  |  | Unit:2 | **Viruses**  Physiochemical and biological characteristics; general structure with special reference to subviral particles (Satellite virus, Viroids and Prions); groups of virus, DNA virus (T-phage, λ phage), lytic and lysogenic cycle, RNA virus (TMV) – physico-chemical characteristics and its mode of multiplication |  | MD | July - August |
|  |  | Unit:3 | **Bacteria**  General characteristics, Microbial nutrition, growth and metabolism. Types - archaebacteria, eubacteria, and mycoplasma; cell structure; nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction). |  | MD | September - November |
|  |  | Unit:4 | **Industrial and Environmental Microbiology** Bioreactors/Fermenters and fermentation processes, different types of fermentation processes, parts of Fermenters and their functions, downstream processing and industrial production of ethanol, penicillin, citric acid and amylase. Economic importance of bacteria with reference to their role in agriculture and role of viruses in vaccines. |  | MD | September - November |
|  |  | Unit:5 | **Microbes and quality of environment**  Distribution of microbes in air, water and soil; water pollution, role of microbes in sewage and domestic waste water systems; Microorganisms as indicator of water quality; Microbes in agriculture and remediation of contaminated soil. |  | MD | September - November |
|  |  |  | **Phycology** | 20 |  |  |
|  |  | Unit:1 | General characteristics; ecology and distribution; range of thallus organization; cell structure and components; cell wall, pigment system, reserve food (only groups represented in the syllabus), flagella and flagellar roots; DSC-1 BOTDSC101P methods of reproduction; classification; criteria, evolution of sex in algae; SET (serial endo symbiotic) theory; classification of Lee 2018 (only up to class); significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, M.O.P. Iyengar). |  | TM | July – August |
|  |  | Unit:2 | Cyanophyta and Xanthophyta Ecology and occurrence; range of thallus organization; cell structure; reproduction, morphology and life-cycle of Nostoc and Vaucheria. |  | TM | July – August |
|  |  | Unit:3 | Chlorophyta and Charophyta General characteristics; occurrence; range of thallus organization; cell structure; reproduction. Morphology and life-cycles of Volvox, Oedogonium, Chara. Evolutionary significance of Prochloron. |  | TM | July - August |
|  |  | Unit:4 | Bacillariophyta General characteristics; occurrence; range of thallus organization; cell structure; reproduction and life cycle of Diatom. Economic importance. |  | TM | September - November |
|  |  | Unit:5 | Phaeophyta and Rhodophyta Characteristics; occurrence; range of thallus organization; cell structure; reproduction. Morphology and life-cycles of Ectocarpus, Fucus and Polysiphonia. |  | TM | September - November |
|  |  | Unit:6 | Applied Phycology Role of algae in environment, agriculture, biotechnology, biofuels, industry and bioremediation. |  | TM | September - November |
|  |  |  | **Practical** |  |  |  |
|  |  | 1 | **Microbiology**  Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle. |  | MD | July – August |
|  |  | 2 | Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root nodule. |  | MD | July – August |
|  |  | 3 | Demonstration of the preparation of media, sterilization and sub culturing. |  | MD | September - November |
|  |  | 4 | Gram staining of bacteria from curd sample; Endospore staining with malachite green using the (endospores taken from soil bacteria). |  | MD | September - November |
|  |  | 5 | Principles and functioning of instruments in microbiology laboratory |  | MD | September - November |
|  |  | 6 | Hands on sterilization techniques and preparation of culture media. |  | MD | September - November |
|  |  | 7 | Isolation of bacteria from soil, water and air; Isolation of antibiotic producing microbes from soil; Determination of BOD, COD, TDS and TOC of water sample. |  | MD | September - November |
|  |  | 8 | Visit to any educational institute/ industry to see an industrial fermenter, |  | MD | September - November |
|  |  | 9 | **Phycology**  Study of vegetative and reproductive structures of Nostoc, Volvox, Oedogonium, Chara, Vaucheria, Ectocarpus, Fucus (Preserve specimen/ permanent slides) and Polysiphonia, through temporary preparations and permanent slides. Prochloron through electron micrographs. |  | TM | July - August |
|  |  | 10 | Illustration through drawing prism with magnification of vegetative and reproductive structure of Oedogonium, Chara, Vaucheria. |  | TM | September - November |
|  |  |  | **SEC (SKILL ENHANCEMENT COURSE)** | 30 |  |  |
|  |  |  | FLORICULTURE AND GARDENING  Course Code: BOTHSEC101M |  |  |  |
|  |  | Unit:1 | Introduction to Nursery and Gardening | 5 | RSD | July – August |
|  |  | Unit:2 | Definition and types of nurseries; Physical resources for nurseries; selection of nursery site, ecological conditions, important nursery operations. | 5 | RSD | July – August |
|  |  | Unit:3 | Definition and components of gardens; Types of gardening (landscape and home gardening). Scope and objective of gardening; garden landscaping with specific reference to Kew Botanical garden, AJC Bose Indian Botanic Garden, Kolkata | 10 | IC | September - November |
|  |  | Unit:4 | Plant Propagation Methods- Seed dormancy ‒ causes and methods of breaking it; seed germination, types and factors affecting it. Vegetative propagation; artificial and natural methods; Concept of soilless cultivation with special reference to sand culture and hydroponics. | 10 | RA | September - November |
|  |  | Unit:5 | Training/ Workshop/ Field visit, establishment of nursery |  | IC+RA+RSD |  |
| l | Minor |  | **Biodiversity (Microbes, Algae, Fungi and Archegoniate) Theory** | 30 |  |  |
|  |  |  | **Microbiology** |  |  |  |
|  |  | Unit:1 | **Microbes**  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. | 10 | RSD | July - August |
|  |  | Unit:2 | **Algae**  General characteristics; ecology and distribution; range of thallus organization and reproduction; classification of algae (Lee 1989); morphology and life-cycles of Nostoc, Oedogonium, Fucus, Polysiphonia. Economic importance of algae. | 12 | RA | July – August |
|  |  | Unit:3 | **Fungi and PhytoPathology**  Introduction - General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification (Hawksworth et al1995); true Fungi- general characteristics, ecology and significance, life cycle of Rhizopus (Zygomycota) Penicillium (Ascomycota), Puccinia, Agaricus (Basidiomycota); symbiotic associations – Lichens - general account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance **PhytoPathology**:Terms & Definitions - Pathogen, Propagule, Vector, Inoculum, Infection, Symptoms (necrosis, wilt, spot, blight, hypoplastic & hyperplastic).// Disease & Disease Cycle, Disease Triangle, Disease Management // Koch’s postulates // Phytoalexins.// Symptoms, Causal organisms, Disease cycle & Control measures of - (a) Tungro virus disease of rice & (b) Late blight of potato. | 12 | TM | September - November |
|  |  | Unit:4 | **Introduction to Archegoniate**  Unifying features of archegoniates, transition to land habit, alternation of generations. | 2 | RA | September - November |
|  |  |  |  |  |  |  |
|  |  | Unit:5 | **Bryophytes**  General characteristics, adaptations to land habit, classification (Proskauer 1954, up to class), range of thallus organization. Systematic position, morphology, anatomy and reproduction of Marchantia, Anthoceros and Funaria (developmental details not to be included). Ecology and economic importance of bryophytes with special mention of Sphagnum. | 10 | RSD | July – August |
|  |  | Unit:6 | **Pteridophytes**  General characteristics, classification (Sporne 1975), early land plants (Cooksonia and Rhynia). Systematic position, morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris (developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economic importance of Pteridophytes | 8 | TM | July - August |
|  |  | Unit:7 | **Gymnosperms** General characteristics, classification (Sporne), systematic position, morphology, anatomy and reproduction of Cycas and Pinus. (developmental details not to be included). Ecological and economic importance. | 6 | RA | September - November |
|  |  |  | **Practical 50 Marks** |  |  |  |
|  |  | 1 | Gram staining of bacteria from curd sample. |  | IC | July – August |
|  |  | 2 | Study of vegetative and reproductive structures of Nostoc (electronmicrographs), Oedogonium (Preparation of temporary slides), Fucus and Polysiphonia through permanent slides. |  | IC | July – August |
|  |  | 3 | Rhizopus and Penicillium - Asexual stage from temporary mounts and sexual structures through permanent slides. |  | IC | July – August |
|  |  | 4 | Puccinia - herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves (permanent slides) of both the hosts. |  | IC | July – August |
|  |  | 5 | Agaricus - specimens of button stage and full-grown mushroom; sectioning of gills of Agaricus. |  | IC | July – August |
|  |  | 6 | Lichens - study of growth forms of lichens (crustose, foliose and fruticose). |  | IC | July - August |
|  |  | 7 | Mycorrhiza - ectomycorrhiza and endomycorrhiza (Photographs). |  | IC | September - November |
|  |  | 8 | Marchantia - morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae, v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides). |  | MK | September - November |
|  |  | 9 | Funaria- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores, permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema. |  | MK | September - November |
|  |  | 10 | Selaginella- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll, l.s. strobilus (permanent slide). |  | MK | September - November |
|  |  | 11 | Equisetum - morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m.spores (wet and dry), t.s rhizome (permanent slide). |  | MK | September - November |
|  |  | 12 | Pteris - morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores, t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide). |  | MK | September - November |
|  |  | 13 | Cycas - morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores, l.s. ovule, t.s. root (permanent slide). |  | MK | September - November |
|  |  | 14 | Pinus - morphology of long and dwarf shoots, male and female cone, t.s. needle, stem, w.m. microsporophyll, w.m. microspores, l.s. female cone, female cone (permanent slide). |  | MK | September - November |
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| III | Major |  |  |  |  |  |
|  |  |  | **BOTDSC303T+ BOTDSC303P** |  |  |  |
|  |  |  | **Archegoniatae I**  **[Bryophytes, Pteridophytes]** |  |  |  |
|  |  |  | **Bryophytes** | 25 |  |  |
|  |  | Unit:1 | Introduction Unifying features of archegoniates; transition to land habit; alternation of generations. |  | RSD | July – August |
|  |  | Unit:2 | Bryophytes General characteristics; adaptations to land habit; classification in eds book by Goffinet and Shaw 2009 (up to class); range of thallus organization. |  | RSD | July – August |
|  |  | Unit:3 | Type studies - Bryophytes Systematic position, morphology, anatomy and reproduction of Riccia, Marchantia, Pellia, Porella, Anthoceros, Sphagnum and Funaria; reproduction and evolutionary trends in Bryophytes (sporophyte and gametophyte) |  | RSD | July - August |
|  |  | Unit:4 | Ecological and economic importance of bryophytes; environmental Indicator and pollution indicator. Model plant - Physcomitrium patens. |  | TM | September - November |
|  |  |  | **Pteridophytes** | 25 |  |  |
|  |  | Unit:5 | General characteristics; classification – earlier concept by Pichi Sermolli; modern concept-molecular phylogeny; pteridophyte phylogeny group I 2016; early land plants - Aglaophyton, Rhynia, Cooksonia, Lepidodendron, Calamites. |  | TM | July - August |
|  |  | Unit:6 | Type Studies- Pteridophytes Systematic position, morphology, anatomy and reproduction of Psilotum, Lycopodium, Selaginella, Equisetum Pteris and Marsilea (developmental details not to be included). |  | IC | September - November |
|  |  | Unit:7 | Apogamy and apospory, Heterospory and origin of seed habit, telome theory, stelar evolution; ecological and economic importance; fern gametophyte and sporophyte culture and uses. Model plant Ceratopteris. |  | IC | September - November |
|  |  |  |  |  |  |  |
|  |  |  | **PRACTICAL Bryophytes** |  |  |  |
|  |  | 1 | Riccia – Morphology of thallus. |  | MD | July – August |
|  |  | 2 | Marchantia - Morphology of thallus, whole mount of rhizoids & scales, vertical section of thallus through gemma cup, whole mount of gemmae (all 9 temporary slides), vertical section of antheridiophore, archegoniophore, longitudinal section of sporophyte through temporary slides. |  | MD | July – August |
|  |  | 3 | Anthoceros - Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella), vertical section of thallus through temporary and permanent slides. |  | MD | July – August |
|  |  | 4 | Sphagnum - Morphology of plant, whole mount of leaf (permanent slide only). |  | MD | September - November |
|  |  | 5 | Funaria - Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores, longitudinal section of capsule (temporary slides); permanent slides showing antheridial and archegonial heads. |  | MD | September - November |
|  |  |  | **Pteridophytes** |  |  |  |
|  |  | 1 | Psilotum - Study from preserved specimen- transverse section of synangium (permanent slide). | 1 | RA | July – August |
|  |  | 2 | Selaginella - 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). | 2 | RA | July – August |
|  |  | 3 | Equisetum - Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (temporary slide). | 2 | RA | July - August |
|  |  | 4 | Pteris - Morphology, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), | 2 | RA | September - November |
|  |  | 5 | One Botanical excursion to an appropriate location and time schedule to be suitably adjusted. | 2 | RA | September - November |
| lll | Minor |  | **BOT MIN303T/ BOTCOR303T**  **Plant Anatomy and Embryology** | 50 |  |  |
|  |  | Unit:1 | Meristematic and permanent tissues- Root and shoot apical meristems;  Simple and complex tissues. |  | IC+MD | July – August |
|  |  | Unit:2 | Organs- Structure of dicot and monocot root stem and leaf. |  | MD | July – August |
|  |  | Unit:3 | Secondary Growth -Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood). |  | MD | July – August |
|  |  | Unit:4 | Adaptive and protective systems-Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes. |  | IC | July - August |
|  |  | Unit:5 | Structural organization of flower- Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac. |  | IC | September - November |
|  |  | Unit:6 | Pollination and fertilization-Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms. |  | TM | September - November |
|  |  | Unit:7 | Embryo and endosperm -Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship. |  | TM | September - November |
|  |  | Unit:8 | Apomixis and polyembryony-Definition, types and practical applications. |  | TM | September - November |
|  |  |  | **PRACTICAL BOT MIN303P/ BOTCOR303P Plant Anatomy and Embryology** |  |  |  |
|  |  | 1 | Study of meristems through permanent slides and photographs. |  | IC | July – August |
|  |  | 2 | Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs) |  | IC | July – August |
|  |  | 3 | Stem: Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus (only Permanent slides). |  | IC | July – August |
|  |  | 4 | Root: Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus (only Permanent slides). |  | IC | September - November |
|  |  | 5 | Leaf: Dicot and Monocot leaf (only Permanent slides). |  | IC | September - November |
|  |  | 6 | Adaptive anatomy: Xerophyte (Nerium leaf); Hydrophyte (Nymphaea petiole). |  | IC | September - November |
|  |  | 7 | Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides). |  | TM | July – August |
|  |  | 8 | Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/campylotropous from permanent slides. |  | TM | July – August |
|  |  | 9 | Ultrastructure of mature egg apparatus cells through electron micrographs. |  | TM | July – August |
|  |  | 10 | Pollination types and seed dispersal mechanisms (including appendages, aril,caruncle)(Photographs and specimens). |  | TM | September - November |
|  |  | 11 | Dissection of embryo/endosperm from developing seeds |  | TM | September - November |
|  |  | 12 | Calculation of percentage of germinated pollen in a given medium. |  | TM | September - November |
|  |  |  |  |  |  |  |
| V | Major |  | **BOTDSC508T Plant ecology& Phytogeography** |  |  |  |
|  |  |  | **Plant Ecology** | 40 |  |  |
|  |  | Unit:1 | Introduction: Basic concepts; Levels of organization. Homeostasis. |  | RSD | July – August |
|  |  | Unit:2 | Soil: Importance; origin; ; composition; physical; chemical and biological properties;soil profile; role of climate in soil development. |  | RSD | July – August |
|  |  | Unit:3 | Water: Importance; states of water in the environment; atmospheric moisture; hydrological cycle; water in soil; water table. |  | RSD | July – August |
|  |  | Unit:4 | Adaptations of plants to variations of light, temperature, wind and fire. |  | RSD | July - August |
|  |  | Unit:5 | Biotic interactions:Trophic organization, basic sources of energy and energy flow in ecosystem, symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop. |  | TM | September - November |
|  |  | Unit:6 | Population ecology: Characteristics and Dynamics, r and k selection, Ecological Speciation |  | TM | September - November |
|  |  | Unit:7 | Plant communities and successions: Concept of ecological amplitude; habitat and niche; characters- analytical and synthetic; ecotone, |  | TM | September - November |
|  |  | Unit:8 | Functional aspects of ecosystem: Energy sources and principles and models of energy flow; production and productivity; ecological efficiencies; biogeochemical cycles; cycling of carbon, nitrogen and phosphorus. |  | TM | September - November |
|  |  |  | **Phytogeography** | 10 |  |  |
|  |  | Unit:9 | Principles; continental drift and theory of tolerance (brief account); endemism; brief description of major terrestrial biomes – Tropical rain forest, Temperate grassland and Tundra; Phytogeographical division of India (BSI 1996); Local Vegetation. |  | TM | September - November |
|  |  |  | **PRACTICAL** |  |  |  |
|  |  | 1 | Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter |  | RSD | July – August |
|  |  | 2 | Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper). |  | RSD | July – August |
|  |  | 3 | Analysis for carbonates, chlorides, nitrates, organic matter and base deficiency from two soil samples by rapid field tests. |  | RSD | July – August |
|  |  | 4 | Determination of organic carbon of different soil samples by Walkley & Black rapid titration method. |  | RSD | July – August |
|  |  | 5 | Determination of dissolved oxygen and carbon dioxide of water samples from polluted and unpolluted sources. |  | TM | July - August |
|  |  | 6 | (a). Study of anatomical adaptations of hydrophytes and xerophytes – by preparation of temporary slides of Nymphaea petiole, Hydrilla stem, Nerium or Casuarina leaf.  (b). Study of biotic interactions of the following: Stem parasite (Cuscuta), Epiphytes (Vanda root), Predation (Insectivorous plants) – from permanent slides and preserved specimens. |  | TM | July - August |
|  |  | 7 | Determination of minimum size of quadrate for the study of herbaceous vegetation by species area curve method (species to be listed). |  | TM | September - November |
|  |  | 8 | Quantitative analysis of herbaceous vegetation for frequency and comparison with Raunkiaer’s frequency distribution law. |  | TM | September - November |
|  |  | 9 | Quantitative analysis of herbaceous vegetation for density and abundance. |  | TM | September - November |
|  |  | 10 | Field visit to familiarize students with ecology of different sites. |  | TM | September - November |
|  |  |  | **BOTDSC509T Cell Biology & Genetics** |  |  |  |
|  |  |  | **Cell Biology** | 25 |  |  |
|  |  | Unit:1 | The cell - Cell as a unit of structure and function; characteristics of prokaryotic and eukaryotic cells; origin of eukaryotic cell (Endosymbiotic theory). |  | IC | July – August |
|  |  | Unit:2 | Cell wall and plasma membrane - 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. |  | IC | July – August |
|  |  | Unit:3 | Nucleus: Structure - nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleosome concept, nucleolus (ultrastructure and development).  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.  Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. Chloroplast, mitochondria and peroxisomes: Structural organization; function; semiautonomous nature of mitochondria and chloroplast.  Endomembrane system: Endoplasmic reticulum – structure, targeting and insertion of proteins in the ER, protein folding, processing; smooth ER and lipid synthesis, export of proteins and lipids; Golgi apparatus – organization, protein glycosylation, protein sorting and export from Golgi apparatus; lysosomes. |  | RA | September - November |
|  |  | Unit:4 | Cell division- Phases of eukaryotic cell cycle, mitosis and meiosis; regulation of cell cycle - checkpoints, role of protein kinases. |  | RA | September - November |
|  |  |  | **Genetics** | 25 |  |  |
|  |  | Unit:5 | Mendelian genetics and its extension Mendelism: Principles of inheritance; chromosome theory of inheritance; autosomes and sex chromosomes; probability and pedigree analysis; incomplete dominance and co dominance; multiple alleles, lethal alleles, epistasis, pleiotropy, recessive and dominant traits, penetrance and expressivity, numericals; polygenic inheritance. |  | IC | July – August |
|  |  | Unit:6 | Extrachromosomal Inheritance - Chloroplast mutation: Variegation in Four o’clock plant; mitochondrial mutations in yeast; maternal effects-shell coiling in snail; infective heredity- kappa particles in Paramecium. | 2 | RA | July – August |
|  |  | Unit:7 | Linkage, crossing over and chromosome mapping - Linkage and crossing over-cytological basis of crossing over; recombination frequency, two factor and three factor crosses; interference and coincidence; numericals based on gene mapping; sex Linkage. |  | RA | July - August |
|  |  | Unit:8 | Variation in chromosome number and structure - Deletion, duplication, inversion, translocation, position effect, euploidy and aneuploidy |  | IC | July - August |
|  |  | Unit:9 | Gene mutations Types of mutations; molecular basis of mutations; mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); detection of mutations: ClB method. Role of transposons in mutation; DNA repair mechanisms |  | RA | September - November |
|  |  | Unit:10 | Fine structure of gene- Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; structure of phage T4, rII locus. |  | RA | September - November |
|  |  | Unit:11 | Population and Evolutionary Genetics - Allele frequencies, genotype frequencies, Law of probability, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and speciation. |  | IC | September - November |
|  |  |  | **PRACTICAL**  **BOTDSC509P Cell Biology & Genetics** |  |  |  |
|  |  | 1 | Study of cell and its organelles with the help of electron micrographs. |  | IC | July – August |
|  |  | 2 | Study of staining technique, pretreatment chemical, fixation, mordant and stain and their types. |  | RA | July – August |
|  |  | 3 | a. Mitosis through temporary squash preparation (Allium cepa, Lens esculentus, Aloe vera).  b. Meiosis through temporary smear preparation (Allium cepa, Rhoeo discolor). |  | RA | July – August |
|  |  | 4 | Mendel’s laws through seed ratios (3:1, 1:1, 9:3:3:1, 1:1:1:1). Laboratory exercises in probability and chi-square. |  | IC | July – August |
|  |  | 5 | Chromosome mapping using point test cross data. |  | IC | July - August |
|  |  | 6 | Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4). |  | IC | September - November |
|  |  | 7 | Study of aneuploidy: Down’s, Klinefelter’s and Turner’s syndromes (demonstration through pictures). |  | IC | September - November |
|  |  | 8 | Photographs and permanent slides showing translocation ring, Laggards and Inversion Bridge, Multipolarity, Sticky Bridge, Fragmentation and Pollen mitosis. |  | IC | September - November |
|  |  | 9 | Study of human genetic traits: Sickle cell anemia, xeroderma pigmentosum, albinism, red-green colour blindness, widow’s peak, rolling of tongue, Hitchhiker’s thumb and attached ear lobe. (Demonstration through pictures). |  | IC | September - November |
|  |  |  | **Plant Physiology BOTDSC6010T** |  |  |  |
|  |  |  | **Plant Physiology-** | 50 |  |  |
|  |  | 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, guttation. Ascent of sap– cohesion-tension theory; transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement. |  | MD | July – August |
|  |  | Unit:2 | Mineral nutrition- Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents. |  | IC | July – August |
|  |  | Unit:3 | Nutrient Uptake -Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport. |  | IC | July - August |
|  |  | Unit:4 | Translocation in the phloem- Experimental evidence in support of phloem as the site of sugar translocation; pressure flow model; phloem loading and unloading; source- sink relationship. |  | MD | July - August |
|  |  | Unit:5 | Plant growth regulators- Discovery, chemical nature (basic structure), bioassay and molecular aspects of the physiological roles of auxin, gibberellins, cytokinin, abscisic acid, ethylene. Brief account of Brassinosteroids and Jasmonic acid. |  | IC | September - November |
|  |  | Unit:6 | Physiology of flowering- Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy and germination. |  | MD | September - November |
|  |  | Unit:7 | Phytochrome, cryptochromes and phototropins- Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action. |  | MD | September - November |
|  |  |  | **PRACTICAL BOTDSC6010P** |  |  |  |
|  |  |  | **Plant Physiology** |  |  |  |
|  |  | 1 | Determination of osmotic potential of plant cell sap by plasmolytic method. |  | MD+IC | July – August |
|  |  | 2 | Determination of water potential of given tissue (potato tuber) by weight method. |  | MD+IC | July – August |
|  |  | 3 | Study of the effect of wind and light on the rate of transpiration in any leaf (Basella, Hibiscus) |  | MD+IC | July – August |
|  |  | 4 | Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte (Basella), xerophytes (Ficus) and hydrophytes (Eichornia). |  | MD+IC | July – August |
|  |  | 5 | To determine the proportion of area covered by stomatal pore with respect to the total leaf area for mesophyte and xerophyte (both surfaces),hydrophytes. |  | MD+IC | July - August |
|  |  | 6 | To study the phenomenon of epigeal and hypogeal seed germination with respect to light. |  | MD+IC | September - November |
|  |  | 7 | To study the effect of different concentrations of IAA on Avena coleoptile elongation (IAA bioassay). |  | MD+IC | September - November |
|  |  | 8 | To study the induction of amylase activity in germinating wheat/barley grains 0  All experiments are to be performed in replicates and results to be expressed with standard error. |  | MD+IC | September - November |
|  |  |  | **Demonstration experiments.** |  |  |  |
|  |  | 1 | To demonstrate suction due to transpiration. |  | MD+IC | July - August |
|  |  | 2 | Fruit ripening/rooting from cuttings (demonstration). |  | MD+IC | September - November |
|  |  | 3 | Bolting experiment/Avena coleptile bioassay (demonstration). |  | MD+IC | September - November |
|  |  |  | **BOTDSC5011T Plant Breeding and Biostatistics** |  |  | September - November |
|  |  |  | **Plant Breeding** | 15 |  | September - November |
|  |  | Unit:1 | Introduction: - Aim and Objective of plant breeding. |  | MK | July – August |
|  |  | Unit:2 | Methods of plant breeding:- Methods of Hybridisation - Mass selection, Pureline selection; Bulk method and Pedigree method: Marker assisted selection (MARS) Male sterility and its use; 2 Back cross and Test cross; Heterosis; Mentainance of germplasm. |  | MK | July – August |
|  |  |  | **Biostatistics** | 35 |  |  |
|  |  | Unit:1 | Definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistic |  | RC | July – August |
|  |  | Unit:2 | Collection of data primary and secondary -Types and methods of data collection procedures - merits and demerits. Classification -tabulation and presentation of data - sampling methods. |  | RC | July – August |
|  |  | Unit:3 | Measures of central tendency - Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Coefficient of variations, concept of ‘p’ value and its limitations. |  | RC | July - August |
|  |  | Unit:4 | Correlation -Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression. |  | RC | September - November |
|  |  | Unit:5 | Statistical inference -Hypothesis - simple hypothesis - student’t’ test - chi square test. Calculation of F-value |  | RC | September - November |
|  |  |  | **PRACTICAL**  **BOTDSC5011P Plant Breeding and Biostatistics** |  |  | September - November |
|  |  | 1 | Calculation of mean, standard deviation and standard error. |  | RC | July – August |
|  |  | 2 | Calculation of correlation coefficient values and finding out the probability. |  | RC | July - August |
|  |  | 3 | Calculation of ‘F’ value |  | RC | September - November |
|  |  | 4 | Calculation of student’s T –test |  | RC | September - November |
| V | Minor |  | **BOTCOR505T Cell and Molecular Biology** | 50 |  |  |
|  |  | Unit:1 | **Techniques in Biology -** Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis. |  | TM | July – August |
|  |  | Unit:2 | **Cell as a unit of Life-** The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components. |  | MD | July – August |
|  |  | Unit:3 | **Cell Organelles -** Mitochondria:Structure, marker enzymes, composition; Semiautonomous nature;Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA. Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplastDNA. ER, Golgi body & Lysosomes: Structures and roles. Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants and biogenesis. Nucleus: Nuclear Envelopestructure of nuclear pore complex; chromatin; molecularorganization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief). |  | MD | July – August |
|  |  | Unit:4 | **Cell Membrane and Cell Wall-** The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of themembranes; Selective permeability of the membranes; Cell wall. |  | MD | July - August |
|  |  | Unit:5 | **Cell Cycle-** Overview of Cell cycle, Mitosis and Meiosis; Molecular controls. |  | MK | September - November |
|  |  | Unit:6 | **Genetic material**-DNA: Miescher to Watson and Crickhistoric perspective, Griffith’s and Avery’ stransformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material.DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi–conservative, semi discontinuous RNA priming, Ǿ (theta) mode of replication, replication of linear, ds-DNA, replicating the 5 ́ end of linear chromosome including replication enzymes. |  | MK | September - November |
|  |  | Unit:7 | **Transcription (Prokaryotes and Eukaryotes)**- Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types;Translation (Prokaryotes and eukaryotes), genetic code |  | MK | September - November |
|  |  | Unit:8 | **Regulation of gene expression-** Prokaryotes:Lac operon and Tryptophan operon ; and in Eukaryotes. |  | MK | September - November |
|  |  |  | **PRACTICAL BOTCOR505P Cell and Molecular Biology** |  |  |  |
|  |  | 1 | To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs. |  | MD | July – August |
|  |  | 2 | Study of the photomicrographs of cell organelles. |  | MD | July – August |
|  |  | 3 | To study the structure of plant cell through temporary mounts. |  | MD | September - November |
|  |  | 4 | Study of mitosis and meiosis (temporary mounts and permanent slides). |  | MD | September - November |
|  |  | 5 | Study of plasmolysis and deplasmolysis on Rhoeo leaf. |  | MK | July - August |
|  |  | 6 | Measure the cell size (either length or breadth/diameter) by micrometry. |  | MK | July - August |
|  |  | 7 | Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs. |  | MK | July - August |
|  |  | 8 | Study DNA packaging by micrographs. |  | MK | September - November |
|  |  | 9 | Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome. |  | MK | September - November |

**Semester- Even**

| **Semester (CBCS/NEP)** | **(Major/Minor)** | **Syllabus Module/Unit** | **Topic** | **No. of lectures (Hours)** | **Teachers** | **Tentative Distribution** |
| --- | --- | --- | --- | --- | --- | --- |
| ll | Major |  | **Course Code: BOTDSC202T Mycology Phytopathology** |  |  |  |
|  |  | Unit:1 | Introduction to true fungi General characteristics; affinities with plants and animals; idea of Fungi as a separate kingdom of life; thallus organization; cell wall composition; nutrition; sexual (with reference to sporocarp) and asexual (spore forming bodies in deuteromycetes) reproduction; classification (Hawksworth et al 1995). Concepts of Molecular identification, Barcoding and Tree of Life. |  | TM | February- April |
|  |  | Unit:2 | Chytridiomycota and Zygomycota Characteristic features; ecology and significance; thallus organisation; reproduction; life cycle with reference to Synchytrium, Rhizopus. |  | TM | February- April |
|  |  | Unit:3 | Ascomycota General characteristics (asexual and sexual fruiting bodies); ecology; life cycle, heterokaryosis and parasexuality; life cycle with reference to Saccharomyces, Penicillium, Neurospora, Ascobolus. |  | TM | May - June |
|  |  | Unit:4 | Basidiomycota General characteristics; ecology; black stem rust of wheat, life cycle with reference to spore forms; concept of macrocylic, microcyclic, demicyclic, heteroecious, autoecious rusts. Puccinia (physiological specialization), Loose and covered smut (symptoms only). Agaricus; bioluminescence, fairy rings and mushroom cultivation (general account). |  | TM | May - June |
|  |  | Unit:5 | Allied Fungi General characteristics; status of slime molds; occurrence; types of plasmodia; types of fruiting bodies. |  | RSD | February- April |
|  |  | Unit:6 | Oomycota General characteristics; ecology; life cycle and classification, concept as a separate kingdom of life with reference to Phytophthora, Saprolegnia. |  | RSD | February- April |
|  |  | Unit:7 | Symbiotic associations Lichen – Occurrence; general characteristics; growth forms and range of thallus organization; nature of associations of algal and fungal partners; reproduction; ecological and economic significance; Mycorrhiza - ectomycorrhiza, endomycorrhiza and their significance. |  | RSD | May - June |
|  |  | Unit:8 | Applied Mycology 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. |  | RSD | May - June |
|  |  |  | **Phytopathology** |  |  |  |
|  |  | Unit:9 | Definitions and Concepts of plant disease: Parasite, Pathogen and Vector, Inoculum and Inoculum density, Infection, Susceptibility and Virulence, Etiology; symptoms - types; necrotroph, biotroph & hemibiotroph; disease, disease types, disease triangle, disease cycle (monocyclic & polycyclic); sporadic, endemic, epidemic and pandemic diseases with examples that had significant impact in human history; Koch’s Postulates. |  | **MD** | February- April |
|  |  | Unit:10 | Host - Parasite Interaction: recognition concept and infection. Disease development - role of enzymes, toxins, growth regulators. Defense strategies - structural and biochemical mechanisms (Constitutive and Induced). Roles of Phytoalexins, Phytoanticipins & PR proteins, elicitors, HR response. Genetics of Plant - Pathogen interaction - Flor’s gene for gene hypothesis, Concept of R gene, Avr gene and Effectors. Resistance – systemic acquired and induced systemic resistance. |  | **IC** | February- April |
|  |  | Unit:11 | Disease Management: Chemical, Biological, Cultural & Integrated management methods; quarantine; disease diagnosis, disease clinics. |  | **IC** | February- April |
|  |  | Unit:12 | Prevention and control of plant disease and role of quarantine. Casual organism, disease cycle and management of bacterial diseases – Citrus canker, Ralstonia wilt of Tomato; Viral diseases – Tobacco Mosaic virus; Fungal and Oomycete diseases – Early and Late blight of potato, Black stem rust of wheat, Blast of Rice, Downy Mildews (Pseudoperonospora cubensis) and Powdery Mildew of Cucurbits (Podosphaera xanthii). |  | **RA** | May - June |
|  |  | Unit:13 | Plant disease epidemiology- basic concepts, elements of disease, disease forecasting (preliminary ideas); Plant pathologist’s contribution to crops and society. |  | TM | May - June |
|  |  |  | **Practical** |  |  |  |
|  |  |  | **Course Code: BOTDSC202P Mycology +Phytopathology** |  |  |  |
|  |  |  | **Fungi** | 25 |  |  |
|  |  | 1 | Introduction to the world of fungi (unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps) through temporary slide preparation and permanent slides. |  | TM | February- April |
|  |  | 2 | Micrometry (measurement of reproductive unit). Counting the cells per unit volume with the help of haemocytometer.(Yeast or spore). |  | TM | February- April |
|  |  | 3 | Rhizopus - study of asexual stage from temporary mounts and sexual structures through temporary slide preparation and permanent slides. |  | TM | February- April |
|  |  | 4 | Penicillium - study of asexual stage from temporary mounts and sexual stage through permanent slides. |  | TM | February- April |
|  |  | 5 | Ascobolus - sectioning through ascocarp. |  | TM | May - June |
|  |  | 6 | Agaricus - Sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms (to be shown from photographs). |  | TM | May - June |
|  |  | 7 | Lichens - study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. |  | TM | May - June |
|  |  | 8 | Mycorrhizae - ectomycorrhiza and endomycorrhiza (Photographs). |  | TM | May - June |
|  |  | 9 | **Phytopathology** | 25 |  |  |
|  |  | 10 | Puccinia - Herbarium specimens of Black Stem Rust of Wheat / Rust of Justicia sections; mounts of spores on wheat/Justicia. Permanent slides for identification of various stages. |  | MK | February- April |
|  |  | 11 | Herbarium specimens of Bacterial diseases- Citrus canker; Viral diseases - TMV, Vein clearing symptom from any available specimen; Fungal diseases - Early and Late blight of potato, Black stem rust of wheat and Blast of Rice, Powdery and downy mildew from any available specimen. |  | MK | February- April |
|  |  | 12 | Isolation of pathogen from diseased leaf, inoculation of fruit, demonstration of media preparation, pure culture isolation. |  | MK | May - June |
|  |  |  | **TISSUE CULTURE TECHNIQUE AND MICROPROPAGATION**  **BOTHSEC202M** |  |  |  |
|  |  | Unit:1 | Introduction to plant tissue culture: Definition, brief history, principle and significance of tissue culture; cellular totipotency – cytodifferentation: factors affecting vasculartissue differentiation, cell cycle and TE differentiation; organogenic differentation: induction, factors affecting shoot bud differentiation |  | MK | May - June |
|  |  | Unit:2 | Laboratory organization and Instrumentation: Design and layout for wash area, media preparation, sterilization and storage room, transfer area for aseptic manipulations, culture rooms, and observation/data collection areas. labwares, good laboratory practices, good safety. Working principle, maintenance and management of following instruments: Laminar air flow, autoclave, distillation unit, pH meter, orbital shaker, microscope, deep freezer, growth chamber Sterilization: Importance, |  | MK | May - June |
|  |  | Unit:3 | Tissue culture media: Introduction, Types of Media and its importance; Preparation of stocks, pH and Buffers and their significance in media. Media Constituents (Vitamins, Unidentified supplements, carbohydrate for energy source, Nitrogen source and organic supplements, complex substances, hormones, Activate charcoal). |  | **RA** | February- April |
|  |  | Unit:4 | Plant hormones: Role of Plant hormones (auxins, cytokinins, abscissic acid, ethyleneand Gibberellins) in plant development. |  | RA | February- April |
|  |  | Unit:5 | Aseptic techniques: Methods of sterilization of equipments, culture media and explants:-Washing and preparation of glassware’s, packing and sterilization, media sterilization,surface sterilization, aseptic workstation, precautions to maintain aseptic conditions. |  | RA | May - June |
|  |  | Unit:6 | Micropropagation: Meristem culture for the production of virus free plants. Nucellus culture for clonal propagation and large scale multiplication, strategies of micropropagation. Stages of micropropagation via axillary shoot proliferation in monocots and dicots and methods of micropropagation through organogenesis. Micropropagation - direct and indirect somatic embryogenesis. Low cost methods for micropropagation. |  | RA | May - June |
| II | Minor |  | **Plant Ecology and Taxonomy**  **BOT MIN202T/ BOTCOR202T** | 50 |  |  |
|  |  | Unit:1 | Introduction |  |  | February- April |
|  |  | Unit:2 | Ecological factors – Soil - Origin, composition, soil profile; water- states of water in the environment; Light and temperature - variation optimal and limiting factors; Adaptation of hydrophytes and xerophytes. |  | RSD | February- April |
|  |  | Unit:3 | Plant communities - characters; Ecotone and edge effect; succession; processes and types. |  | RSD | February- April |
|  |  | Unit:4 | Ecosystem - structure; energy flow trophic organisation; food chains and food webs, Ecological pyramids; production and productivity; biogeochemical cycling; cycling of carbon, nitrogen. |  | RSD | February- April |
|  |  | Unit:5 | Phytogeography- principle biogeographical zones; Endemism. |  | TM | February- April |
|  |  | Unit:6 | Introduction to plant taxonomy- identification, classification, nomenclature. |  | TM | February- April |
|  |  | Unit:7 | Identification - functions of herbarium, important herbaria and botanical gardens of the world and India; |  | TM | May - June |
|  |  | Unit:8 | Taxonomic hierarchy - ranks, categories and taxonomic groups. |  | MK | May - June |
|  |  | Unit:9 | Botanical nomenclature - principles and rules (ICN); ranks and names; binominal system, typification, author citation, effective and valid publication. |  | MK | May - June |
|  |  | Unit:10 | Classification - types of classification - artificial, natural and phylogenetic. Classification of Bentham and Hooker (up to series), general idea of Cronquist’s classification (1981). |  | MK | May - June |
|  |  | Unit:11 | Numerical taxonomy and cladistics (4 Lectures) – characters, variations, cluster analysis, phenograms, cladograms (definitions and differences). |  | MK | May - June |
|  |  |  | **Practical** |  |  |  |
|  |  | 1. | Study of instruments used to measure microclimatic variables - Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. |  | TM | February- April |
|  |  | 2. | . Determination of pH and analysis of two soil samples for carbonates, chlorides, nitrates, organic matter and by rapid field test. |  | TM | February- April |
|  |  | 3.A | Study of morphological adaptations of hydrophytes (Nymphaea petiole) and xerophytes (Nerium leaf) (four each). |  | RSD | February- April |
|  |  | 3.B | Study of biotic interactions of Stem parasite (Cuscuta), Epiphytes (Orchid root) |  | RSD | February- April |
|  |  | 4. | Determination of minimal quadrat size for the study of herbaceous vegetation in the HEI campus/ suitable site by species area curve method. (Species to be listed). |  | TM | February- April |
|  |  | 5. | Quantitative analysis of herbaceous vegetation in the HEI campus /suitable site for frequency and comparison with Raunkiaer’s frequency distribution law. |  | TM | May - June |
|  |  | 6. | Study of vegetative and floral characters of the following families (Description, V.S. of flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham and Hooker’s system of classification): Brassicaceae – Nastertium indicum; Asteraceae – Eclipta and Tridax; Solanaceae – Nicotiana plumbaginifolia, Solanum nigrum, Lamiaceae - Leonurus sibiricus, Leucas aspera and Ocimum sanctum; Liliaceae - Allium. |  | TM | May - June |
|  |  | 7. | One Local Excurssion and Mounting of a properly dried and pressed specimen of any ten wild plant with herbarium label (to be submitted with the record book). |  |  | May - June |
|  |  |  |  |  |  |  |
| IV | Major |  |  |  |  |  |
|  |  |  | **Course Code: BOTDSC404T**  **Archegoniatae II [Gymnosperms, Paleobotany, Palynology]** |  |  |  |
|  |  |  | **Gymnosperms** | 20 |  |  |
|  |  | Unit:1 | General characteristics; classification of Bhatnagar and Maitra 2013 (up to family), morphology, anatomy and reproduction of Cycas, Pinus, Ginkgo and Gnetum (developmental details not to be included); ecological and economic importance; evolutionary significance of gymnosperm with special reference to progymnospermopsida, Lyginopteridales, Cordaitales, Glossopteridales and Bennetitales; distribution of extant taxa; conservation strategy of gymnosperm. |  | RSD | February- April |
|  |  |  | **Paleobotany** | 15 |  |  |
|  |  | Unit:1 | Fossils - Definition, Types and mode of preservation; conditions for fossilization; Palaeobotany - a brief idea about its application. |  | TM | February- April |
|  |  | Unit:2 | Geological time scale and major events of plant life through geological ages. |  | TM | February- April |
|  |  | Unit:3 | Indian Gondwana system, 3-fold division with major megafossil assemblages. |  | TM | May - June |
|  |  | Unit:4 | Plate-tectonic movement (brief concept), continental drift theory. |  | TM | May - June |
|  |  | Unit:5 | Principles of fossil dating (a brief idea); - radioactive dating (Uranium, Lead, Potassium-Argon, Radio - Carbon and fission track dating. |  | TM | May - June |
|  |  |  | **Palynology** | 15 |  |  |
|  |  | Unit:1 | Basic concept; spore & pollen; polarity, symmetry, shape and size, aperture types, pollen wall – chemical nature, stratification & ornamentation;   1. NPC classification; 2. Application of Palynology 3. Basic concepts of Aeropalynology, Melissopalynology, Palaeopalynology and Forensic palynology (brief idea and application). |  | RSD | February- April |
|  |  |  | **Practical** |  |  |  |
|  |  |  | **Gymnosperms** |  |  |  |
|  |  | 1 | Cycas - Morphology and TS of leaflet, morphology of microsporophyll and megasporophyll (temporary slides) whole mount of spore (temporary slides); TS of coralloid root, LS of ovule (all permanent slide). of spores (temporary slides), |  | RSD | February- April |
|  |  | 2 | Pinus - Morphology of long and dwarf shoots, male and female cones, transverse section of needle (temporary slide), LS of male cone and female cone (permanent slide); microspores (permanent slides), |  | RSD | February- April |
|  |  | 3 | Gnetum - Morphology (shoot, male & female cones), VS of ovule (permanent slide). |  | RSD | February- April |
|  |  | 4 | One long Botanical excursion to an appropriate location and time schedule to be suitably adjusted. Palaeobotany |  | TM | May - June |
|  |  | 5 | Study from permanent slides – T.S. of stem of Rhynia, Calamites, Lyginopteris, |  | TM | May - June |
|  |  | 6 | Study of some megafossils – Ptilophyllum and Glossopteris leaves, Vertebraria root system. |  | TM | May - June |
|  |  |  | **Palynology** |  |  |  |
|  |  | 1 | Study of dispersal unit of spore and pollen (slide/photograph) - monad – Sena (Cassia), tetrad-(Pteridophyte), polyad- (Mimosaceae),Pollinia (Asclepiadaceae, Orchidaceae) |  | RSD | February- April |
|  |  | 2 | Spore, pollen morphological study of some Pteridophytes, Gymnosperms and Angiosperms, fresh and dry specimens. |  | RSD | February- April |
|  |  | 3 | Pollen viability – by sucrose and Ba(OH)2 solution and calculation of percentage of germination. |  | RSD | May - June |
|  |  |  |  |  |  |  |
|  |  |  | **BOTDSC405T**  **Economic Botany, Ethnobotany& Pharmacognosy** |  |  |  |
|  |  |  | **Economic Botany** | 25 |  |  |
|  |  | Unit:1 | Origin of Cultivated Plants  Concept of centres of origin, their importance with reference to Vavilov’s work; examples of major plant introductions; |  | TM | February- April |
|  |  | Unit:2 | Cereals  Rice- origin, morphology, cultivation & uses; brief account on millets. |  | TM | February- April |
|  |  | Unit:3 | Legumes  Origin, morphology and uses of Chick pea; importance to man and ecosystem. |  | TM | February- April |
|  |  | Unit:4 | Sources of sugars and starches  Morphology of sugarcane; products and by-products of sugarcane industry. |  | TM | February- April |
|  |  | Unit:5 | Spices  Economic importance with special reference to saffron, clove and black pepper |  | TM | February- April |
|  |  | Unit:6 | Beverages  Tea and coffee - morphology, processing & uses. |  | TM | May - June |
|  |  | Unit:7 | Sources of oils and fats  General description, classification, their uses and health implications of sesame, mustard and coconut (botanical name, family & uses). Essential oils – Santalum and Citronella general account. |  | TM | May - June |
|  |  | Unit:8 | Natural Rubber  Para-rubber, tapping, processing and uses. |  | TM | May - June |
|  |  | Unit:9 | Drug yielding plants  Therapeutic and habit-forming drugs with special reference to Cinchona, and Cannabis; Tobacco - health hazards. |  | TM | May - June |
|  |  | Unit:10 | Timber plants  General account with special reference to Teak (Tectona grandis), Sal (Shorea robusta). |  | TM | May - June |
|  |  | Unit:11 | Fibres  Classification of fibres based on the origin; Cotton, Jute, and Alied fibres;Uses of cotton and Jute. |  | TM | May - June |
|  |  |  | **Ethnobotany** | 15 |  |  |
|  |  | Unit:1 | Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science; Some important Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses. |  | MD | February- April |
|  |  | Unit:2 | Role of ethnobotany in modern Medicine Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and uses) a) Azadiractha indica b) Ocimum sanctum c) Vitex negundo. d) Gloriosa superba e) Tribulus terrestris f) Pongamia pinnata g) Cassia auriculata h) Indigofera tinctoria. Validation of ethnobotanical sources in modern medicine. |  | MD | February- April |
|  |  | Unit:3 | Ethnobotany and legal aspects: Biopiracy, Intellectual Property Rights and Traditional Knowledge. |  | MD | May - June |
|  |  |  | **Pharmacognosy** | 10 |  |  |
|  |  | Unit:1 | General account: Pharmacognosy and its importance in modern medicine; Crude drugs; Pharmacological and chemical classification of drugs; Drug evaluations- (Definitions with examples of the following) - organoleptic, microscopic, chemical & physical; Bioassay of drug –Adulterance, definitions and examples |  | MD | February- April |
|  |  | Unit:2 | Secondary metabolites of plants: - Definitions and difference in between, Primary and Secondary Metabolites; Utilization of major types of metabolites as drug - phenolics & quinones, terpenoids, flavonoids and alkaloids. |  | MD | February- April |
|  |  | Unit:3 | Active constituents: - Source plants, parts used, chemical nature & uses of the following - Glycosidic anthraquinone (Barbaloin); Tannic acid derivative (Catechin); Resins (Gingerol, Curcuminoids); Steroids (Diosgenin, Digitoxin); Alkaloids (Quinine, Strychnine, Reserpine, Vinblastine). |  | MD | May - June |
|  |  |  | **Practical** |  |  |  |
|  |  |  | **Economic Botany** |  |  |  |
|  |  | 1 | Cereals - Rice habit sketch with morphology- micro-chemical tests – iodine sp |  | TM | February- April |
|  |  | 2 | Legumes – chickpea habit scetch and morphology - micro-chemical tests (Millon test-). |  | TM | February- April |
|  |  | 3 | Sources of oils and fats - coconut kernel and Mustard seeds - tests for fats (Sudan IV test). |  | TM | February- April |
|  |  | 4 | Spices - black pepper and Clove - Demonstration, habit sketch and comments. |  | TM | May - June |
|  |  | 5 | Essential oil-yielding plants - habit sketch of Santalum and Citronella (specimens /photographs). |  | TM | May - June |
|  |  | 6 | Drug-yielding plants - Tobacco and Cannabis. |  | TM | May - June |
|  |  | 7 | Woods – Tectona and Shorea - section of young stem specimen (permanent slides/photogtaphs). |  | TM | May - June |
|  |  |  | **Pharmacognosy** |  |  |  |
|  |  | 1 | Chemical tests for - (a) Tannin (from Camellia sinensis & Terminalia chebula - any two confirmatory tests), and (b) Alkaloids (Quinine from any drug - single test - by I2 Soln. in KI added to the sample in acidic medium). |  | MD | February- April |
|  |  | 2 | Microscopic study of powder (of parts used in drug) - Zingiber officinale and Holarrhena antidysenterica. |  | MD | February- April |
|  |  | 3 | Histo-chemical tests of - (a) Curcumin (Curcuma longa), (b) Starch in non- lignified vessel (Zingiber officinale) and Alkaloids (in the stem of Catharanthus roseus and bark of Holarrhena antidysenterica). |  | MD | May - June |
|  |  |  | **BOTDSC406T**  **Plant Anatomy & Embryology** |  |  |  |
|  |  |  | **Plant Anatomy** | 40 |  |  |
|  |  | Unit:1 | Introduction and scope of Plant Anatomy, Applications in systematics, forensics and pharmacognosy. |  | IC | February- April |
|  |  | Unit:2 | Structure and Development of Plant Body, Internal organization of plant body; the three tissue systems, types of cells and tissues. |  | MD | February- April |
|  |  | Unit:3 | Tissues -Classification of tissues; simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; pits and plasmodesmata; ergastic substances; hydathodes, cavities, lithocysts and laticifers. |  | MD | February- April |
|  |  | Unit:4 | Apical meristems-Evolution of the concept of organization of the root and shoot apex. Apical cell theory, Histogen theory,Tunica Corpus theory, Korper-Kappe theory, types of vascular bundles; structure of dicot and monocot stem; structure of dicot and monocot leaf, Kranz anatomy; root cap; structure of dicot and monocot root. |  | IC | May - June |
|  |  | Unit:5 | Vascular Cambium and Wood - Structure, function and seasonal activity of cambium; secondary growth in root and stem anomalous secondary growth- types with examples, sapwood and heartwood; ring and diffuse porous wood; early and late wood, tyloses; development and composition of periderm, rhytidome and lenticels. |  | MD | May - June |
|  |  | Unit:6 | Adaptive and Protective Systems - Epidermal tissue system, cuticle, trichomes (uni and multicellular, glandular and nonglandular, two examples of each), stomata (classification); adcrustation and incrustation; anatomical adaptations of xerophytes and hydrophytes. |  | IC | May - June |
|  |  |  | **Embryology** | 10 |  |  |
|  |  | Unit:1 | Sporogenesis & Gametogenesis –Microsporogenesis & Microgametogenesis; Megasporogenesis & Megagametogenesis; Fertilization Embryo types based on development. Development of endosperm and role of polycomb genes; apomixis and its application. Polyembryony |  | RSD | February- April |
|  |  |  | **Practical** |  |  |  |
|  |  | 1 | Study of anatomical details of the following through permanent slides/temporary stain mounts/ macerations/museum specimens with the help of suitable representatives.  a. Apical meristem of root, shoot and vascular cambium.  b. Distribution and types of parenchyma, collenchyma and sclerenchyma.  c. Xylem: Tracheary elements- tracheids, vessel elements; thickenings; perforation plates; Xylem fibres (permanent slides).  d. Wood: ring porous; diffuse porous; tyloses; heart and sapwood (permanent slides).  e. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres. (permanent slides).  f. Epidermal system: cell types, stomata types; trichomes: non glandular and glandular (permanent slides)  g. Periderm; lenticels; C4 leaves (Kranz anatomy); Secretory tissues: cavities, lithocysts and laticifers. |  | IC | February- April |
|  |  | 2 | Workout and preparation of permanent slides by following double staining method.  a. Root anatomy (monocot – Orchid), dicot (Sunflower/ gram); secondary growth.anomalous secondary growth in root of Tinospora  b. Stem anatomy (monocot- maize), (dicot – Cucurbita) - primary and secondary growth.Anomaous growth in stem of Bignonia, Boerhavia and Dracaena  c. Leaf: isobilateral (Tube rose), dorsiventral (Mango),  d. Adaptive anatomy: xerophytes (Nerium leaf), hydrophytes (Nymphaea petiole). |  | IC | February- April |
|  |  | 3 | Anther: Tapetum (amoeboid and glandular); spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation. |  | TM | February- April |
|  |  | 4 | Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, monads, dyads, polyads, pollinia (slides/photographs,fresh material), ultrastructure of pollen wall(micrograph); Pollen viability: Tetrazolium test germination: Calculation of percentage germination in different media using hanging drop method |  | TM | May - June |
|  |  | 5 | Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs). |  | TM | May - June |
|  |  | 6 | Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus. |  | TM | May - June |
|  |  | 7 | Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria. |  | TM | May - June |
|  |  | 8 | Embryogenesis: Study of dicot embryo through permanent slides/photoghraphs; Study of embryos at various developmental stages through permanent slide/ photographs; Study of suspensor through electron micrographs. |  | TM |  |
|  |  |  | **BOTDSC407T**  **Morphology & Plant systematics** | 50 |  |  |
|  |  |  | **Morphology** |  |  |  |
|  |  | Unit:1 | Inflorescence – Types with examples, concept of advanced and primitive types. |  | IC | February- April |
|  |  | Unit:2 | Flower – Types with examples, aestivation, floral parts ( calyx, corolla, androecium, gynaecium)– various types of cohesion and adhesion with examples; carpel-types, advance and primitive ones and placentations (types)- Advanced and primitive. |  | IC | February- April |
|  |  | Unit:3 | Fruits and Seeds –types with examples, Dipersal of seeds |  | IC | May - June |
|  |  |  | **Plant systematics** |  |  |  |
|  |  | Unit:1 | Significance of Plant systematics- Introduction to systematics; plant identification, classification, nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Functions of herbarium and botanical gardens; importance of herbaria and botanical gardens of the world and India; virtual herbarium; e-flora; documentation: flora, monographs and manuals, journals; keys: single access and multi-access. |  | MK+RA | February- April |
|  |  | Unit:2 | Taxonomic hierarchy -Concept of taxa (family, genus, species); categories and taxonomic hierarchy; species concept (taxonomic, biological, evolutionary). |  | MK+RA | February- April |
|  |  | Unit:3 | Botanical nomenclature-Principles and rules (ICN); ranks and names; typification, author citation, valid publication, rejection of names, principle of priority and its limitations; names of hybrids. |  | MK+RA | February- April |
|  |  | Unit:4 | Systems of classification- Major contributions of Theophrastus, Linnaeus, Hutchinson, Takhtajan and Cronquist; classification systems of Bentham and Hooker (up to series) and Engler and Prantl (up to series); brief reference of angiosperm phylogeny Group (APG III) classification. |  | MK+RA | May - June |
|  |  | Unit:5 | Biometrics, numerical taxonomy and cladistics- Characters; Characterstates, variations; OTUs and OEUs, character weighing and coding; cluster analysis; phenograms,Cladograms (definitions and differences). |  | MK+RA | May - June |
|  |  | Unit:6 | Phylogeny of Angiosperms- Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades). Origin and evolution of Angiosperms (Brief Idea). |  | MK+RA | May - June |
|  |  |  | **PRACTICAL** |  |  |  |
|  |  | 1 | Study of the vegetative and floral characters of the following families (fifteen species among them at least one from each family) description, VS of flower, section of ovary, floral diagram/s, floral formula and systematic position according to Bentham & Hooker’s system of classification:  Asteraceae (Compositae) - Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax/Synedrella  Solanaceae - Solanum spp./Withania/Physalis  Brassicaceae (Cruciferae) –Nasturtium sp./ Brassica Lamiaceae (Labiatae) Salvia/Ocimum/Leucus/Leonurus/Anisomeles/Hyptis Euphorbiaceae - Euphorbia spp., Jatropha/Acalypha/Croton Malvaceae –Sida spp./Urena/Malachra capitata/Hibiscus vitifolius Polygonaceae – Polygonum spp/Rumex  Acanthaceae –Justicia/Rungia/Ecbolium/Hygrophila Scrophulariaceae – Lindenbergia/Mazus/Vandellia (Lindernia)/ Rubiaceae – Oldenlandia/ Dentella/ Spermacocce |  | MK | February- April |
|  |  | 2 | Botanical excursion – at least three in number (with provision of fund from college)  a. Visit to Botanic Garden (Acharya Jagadish Chandra Bose Indian Botanic Garden, BSI).  b. Field visit (Local).  c. At two different ecological zones. |  | MK+RA | May - June |
| IV | Minor |  | **BOTCOR404**  **Plant Physiology and Metabolism** | 50 |  |  |
|  |  | Unit:1 | Plant-water relations-Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation. |  | TM | February- April |
|  |  | Unit:2 | Mineral nutrition-Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential, elements; Transport of ions across cell membrane, active and passive transport,carriers, channels and pumps. |  | IC | February- April |
|  |  | Unit:3 | Translocation in phloem- Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading andunloading. |  | MD | February- April |
|  |  | Unit:4 | Photosynthesis - Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reactioncenter,antenna molecules;Electron transport and mechanism of ATP synthesis; C 3 , C4 andCAM pathways of carbon fixation; Photorespiration. |  | IC | February- April |
|  |  | Unit:5 | Respiration- Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway. |  | IC | May - June |
|  |  | Unit:6 | Enzymes - Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition. |  | MD | May - June |
|  |  | Unit:7 | Nitrogen metabolism- Biological nitrogen fixation; Nitrate and ammonia assimilation. |  | MD | May - June |
|  |  | Unit:8 | Plant growth regulators-Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. |  | TM | May - June |
|  |  | Unit:9 | Plant response to light and temperature-Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization |  | TM | May - June |
|  |  |  | **PRACTICAL BOTCOR404P** |  |  |  |
|  |  | 1 | Determination of osmotic potential of plant cell sap by weighing method. |  | IC | February- April |
|  |  | 2 | To study the effect of two environmental factors (light and wind) on transpiration by excised twig ( Basella/ Hibiscus). |  | IC | February- April |
|  |  | 3 | Calculation of stomatal index and stomatal frequency of a mesophyte (Basella) |  | IC | February- April |
|  |  | 4 | Demonstrate the activity of urease and study the effect of pH and enzyme concentration. |  | TM | February- April |
|  |  | 5 | To study the effect of bicarbonate concentration on O2 evolution inphotosynthesis. |  | TM | May - June |
|  |  | 6 | Comparison of the rate of respiration in any two parts of a plant. |  | TM | May - June |
|  |  |  | **Demonstration experiments** |  |  |  |
|  |  | 1 | Effect of auxins on rooting. |  | TM | February- April |
|  |  | 2 | Suction due to transpiration. |  | IC | February- April |
|  |  | 3 | R.Q. |  | IC | May - June |
|  |  | 4 | Demonstration of plasmolysis |  | TM | May - June |
| VI | Major |  | **DSC-12 BOTDSC5012T Molecular Biology** | 50 |  |  |
|  |  | Unit:1 | **Nucleic acids**: Carriers of genetic information, DNA as the carrier of genetic information (Griffith’s, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat’s experiment). |  | IC | February- April |
|  |  | Unit:2 | **Genetic Material**- Types of genetic material, denaturation and renaturation, cot curves; organization of DNA- prokaryotes, viruses, eukaryotes. mitochondrial DNA and chloroplast DNA, Chromatin structure with special reference to euchromatin and heterochromatin- constitutive and facultative heterochromatin. |  | IC | February- April |
|  |  | Unit:3 | **The replication DNA both Prokaryotic and Eukaryotic** Chemistry of DNA synthesis (Kornberg’s discovery); general principles – bidirectional, semi conservative and semi discontinuous replication, RNA priming; various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA, replication of the 5’end of linear chromosome; Enzymes involved in DNA replication. |  | IC | May - June |
|  |  | Unit:4 | **Central dogma and genetic code**-Key experiments establishing-the central dogma (adaptor hypothesis and discovery of mRNA template), Genetic code: salient features and deciphering (triplete binding assay). |  | IC | May - June |
|  |  | Unit:5 | **Transcription**-Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation (Operon concept), inducible and repressible operon. Prokaryotes: regulation of lactose metabolism and tryptophan synthesis in E.coli. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing. |  | RA | February- April |
|  |  | Unit:6 | **Processing and modification of RNA**-Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5’ cap, 3’ polyA tail); Ribozymes; RNA editing and mRNA transport. |  | RA | February- April |
|  |  | Unit:7 | **Translation** - Ribosome structure and assembly, mRNA; charging of tRNA, aminoacyl tRNA synthetases; various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; fidelity of translation; inhibitors of protein synthesis; post-translational modifications of proteins. |  | RA | May - June |
|  |  |  | **PRACTICAL**  **DSC-12 BOTDSC6012P Molecular Biology** |  |  | May - June |
|  |  | 1 | DNA isolation from cauliflower head/ Onion leaf and Agarose gel electrophoresis. |  | RA | February- April |
|  |  | 2 | DNA estimation by Diphenylamine reagent/UV Spectrophotometry. |  | RA | February- April |
|  |  | 3 | RNA estimation by Orcinol method. |  | RA | May - June |
|  |  | 4 | Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication). |  | RA | May - June |
|  |  | 5 | Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs. |  | IC | February- April |
|  |  | 6 | Photographs establishing nucleic acid as genetic material (Messelson and Stahl’s, Avery et al, Griffith’s, Hershey & Chase’s and Fraenkel & Conrat’s experiments) |  | IC | February- April |
|  |  | 7 | Study of the following through photographs: assembly of Spliceosome machinery; splicing mechanism in group I & group II introns; ribozyme and alternative splicing. |  | IC | May - June |
|  |  |  | **DSC-13 BOTDSC6013T Plant Biochemistry & Metabolism** | 50 |  |  |
|  |  | Unit:1 | **Concept of metabolism**- Introduction, anabolic and catabolic pathways, regulation of metabolism, Types and significance of chemical bonds; structure and properties of water; pH and buffers. 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 enzyme inhibition-types, Lineweaver-Burk Plot, factors affecting enzyme activity. |  | MD | February- April |
|  |  | Unit:2 | **Bioenergenetics-**Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP structure, its role as a energy currency molecule |  | MD | February- April |
|  |  | Unit:3 | **Carbohydrates:** Nomenclature, structures and classification; monosaccharides disaccharides; oligosaccharides polysaccharides and sugar derivatives, isomerism Carbon assimilation-Photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO2 reduction, photorespiration,C2 , C4 pathways; Crassulacean acid metabolism; factors affecting CO2 reduction. |  | IC | February- April |
|  |  | Unit:4 | **Carbohydrate metabolism** -Synthesis and catabolism of sucrose and starch. |  | MD | February- April |
|  |  | Unit:5 | **Carbon Oxidation**- Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide resistant respiration, factors affecting respiration. |  | IC | May - June |
|  |  | Unit:6 | **ATP-Synthesis** - Mechanism of ATP synthesis, substrate level Unit:phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase; role of uncouplers. |  | MD | February- April |
|  |  | Unit:7 | **Lipids:** Definition and major classes of storage and structural lipids; fatty acids structure and functions; essential fatty acids; triacylglycerols structure, functions and properties; phosphoglycerides. Lipid metabolism -Synthesis and breakdown of triglycerides, β oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation. |  | MD | May - June |
|  |  | Unit:8 | **Proteins:** Structure of amino acids; levels of protein structure primary, secondary, tertiary and quarternary; protein denaturation and biological roles of proteins. Nitrogen metabolism-Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; ammonia assimilation and transamination. |  | MD | May - June |
|  |  | Unit:9 | **Mechanisms of signal transduction** - Receptor-ligand interactions; G protein; second messenger concept, calcium calmodulin, MAP kinase cascade. |  | MD | May - June |
|  |  |  | **PRACTICAL DSC-13 BOTDSC6013P** |  |  |  |
|  |  | 1 | Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins |  | MD | February- April |
|  |  | 2 | Chemical separation of photosynthetic pigments. |  | IC | February- April |
|  |  |  | Demonstration of absorption spectrum of photosynthetic pigments (spectrophotometer). |  | IC | February- April |
|  |  | 3 | To study the effect of light intensity on the rate of photosynthesis. |  | IC | May - June |
|  |  | 4 | Effect of carbon dioxide on the rate of photosynthesis (volume measurement) |  | MD | May - June |
|  |  | 5 | To compare the rate of respiration in different parts of a plant. |  | MD | May - June |
|  |  | 6 | To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources. |  | Collaboration (IC) | May - June |
|  |  | 7 | To study the activity of lipases in germinating oilseeds. |  | Collaboration (IC | May - June |
|  |  |  | **DSC-14 BOTDSC6014T Biotechnology & Plant Tissue Culture** | 35 |  |  |
|  |  |  | **Biotechnology** |  |  |  |
|  |  | Unit:1 | **Recombinant DNA technology**- Restriction Endonucleases (Types I-IV, biological role and application); Restriction mapping (linear and circular); cloning vectors: prokaryotic (pBR322, Ti plasmid, BAC); lambda phage, cosmid; eukaryotic vectors (YAC). |  | MK | February- April |
|  |  | Unit:2 | **Gene Cloning-** Recombinant DNA, bacterial transformation and selection of recombinant clones, PCR-mediated gene cloning; gene construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR. |  | RSD | February- April |
|  |  | Unit:3 | **Methods of gene transfer**- Agrobacterium-mediated direct gene transfer by electroporation, microinjection,Microprojectile bombardment; selection of transgenics– selectable marker and reporter genes (luciferase, GUS, GFP). |  | MK | February- April |
|  |  | Unit:4 | **Applications of Biotechnology**- Pest resistant (Bt-cotton); herbicide resistant plants (round up ready soybean); transgenic crops with improved quality traits (Golden rice); improved horticultural varieties (Moondust carnations); role of transgenics in bioremediation (Superbug); edible vaccines; industrial enzymes (aspergillase, protease, lipase); genetically engineered products–human growth hormone; humulin; biosafety concerns. |  | TM | May - June |
|  |  |  | **Plant Tissue Culture-** |  |  |  |
|  |  | Unit:5 | Historical perspective; composition of media; nutrient and hormone requirements (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), hardening of the tissue culture raised plants for field plantation. |  | RSD | May - June |
|  |  |  | **PRACTICAL**  **DSC-14 BOTDSC6014P Biotechnology & Plant Tissue Culture** |  |  | May - June |
|  |  | 1.a | Preparation of MS medium. |  | MK | February- April |
|  |  | 1.b | Process of in vitro sterilization and inoculation methods by using different explants (leaf, nodal bud and seeds of tobacco, Datura, Brassica) |  | MK | February- April |
|  |  | 2 | Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs. |  | TM | February- April |
|  |  | 3 | Construction of restriction map of circular and linear DNA from the data provided. |  | RSD | February- April |
|  |  | 4 | Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment. |  | RSD | May - June |
|  |  | 5 | Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs. |  | TM | May - June |
|  |  | 6 | Isolation of genomic DNA and its gel electrophoresis. |  | MK | May - June |
|  |  |  | **DSC-15 BOTDSC6015T Analytical techniques** | 50 |  |  |
|  |  | Unit:1 | **Imaging and related techniques**- Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching. |  | TM | February- April |
|  |  | Unit:2 | **Cell fractionation**- Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2 gradient, analytical centrifugation, ultracentrifugation, marker enzymes. |  | TM | February- April |
|  |  | Unit:3 | **Radioisotopes** -Use in biological research, auto-radiography, pulse chase experiment. |  | TM | May - June |
|  |  | Unit:4 | **Spectrophotometry**- Principle and its application in biological research |  | TM | May - June |
|  |  | Unit:5 | **Chromatography**- Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography. |  | RSD | February- April |
|  |  | Unit:6 | **Characterization of proteins and nucleic acids** - Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS PAGE |  | RSD | February- April |
|  |  |  | **PRACTICAL BOTDSC6015P Analytical technique** |  |  |  |
|  |  | 1 | Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs. |  | RSD | May - June |
|  |  | 2 | To separate amino acids by paper chromatography. |  | MK | February- April |
|  |  | 3 | To separate sugars by thin layer chromatography. |  | MK |  |
|  |  | 4 | To estimate protein concentration through Lowry’s methods/ Bradford methods |  | RSD | May - June |
|  |  |  | To separate proteins using PAGE. |  | TM | May - June |
|  |  | 5 | To separate DNA (marker) using AGE. |  | TM | May - June |
|  |  | 6 | Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH). |  | TM | May - June |
| VI | Minor |  | **BOTCOR606T Analytical Techniques in Plant Sciences** | 50 |  |  |
|  |  | Unit:1 | **Imaging and related techniques** - Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching. |  | IC | February- April |
|  |  | Unit:2 | **Cell fractionation**- Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2 gradient, analytical centrifugation, ultracentrifugation, marker enzymes. |  | TM | February- April |
|  |  | Unit:3 | **Radioisotopes** - Use in biological research, auto-radiography, pulse-chase experiment. |  | TM | February- April |
|  |  | Unit:4 | **Spectrophotometry**-Principle and its application in biological research. |  | MK | February- April |
|  |  | Unit:5 | **Chromatography**-Principle;Paperchromatography;Column chromatography, TLC, GLC, HPLC, Ion exchange chromatography; Molecular sieve chromatography; Affinity chromatography. |  | MK | May - June |
|  |  | Unit:6 | **Characterization of proteins and nucleic acids** - Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS PAGE |  | MK | May - June |
|  |  | Unit:7 | **Biostatistics-** Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi square test for goodness of fit. |  | MD | May - June |
|  |  |  | **PRACTICALS**  **BOTCOR606P Analytical Techniques in Plant Sciences** |  |  |  |
|  |  | 1 | Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs. |  | TM | February- April |
|  |  | 2 | To separate nitrogenous bases by paper chromatography. |  | IC | February- April |
|  |  | 3 | Isolation of chloroplasts by differential centrifugation. |  | IC | February- April |
|  |  | 4 | To estimate protein concentration through Lowry’s methods. |  | RSD | February- April |
|  |  | 5 | To separate proteins using PAGE. |  | RSD | May - June |
|  |  | 6 | To separate DNA (marker) using AGE. |  | TM | May - June |
|  |  | 7 | Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH). |  | TM | May - June |
|  |  | 8 | Demonstration of permanent slides (double staining) (any slide). |  | TM | May - June |

| **Semester** | **(Major/Minor)** | **Tentative timeline of Continuous Internal Assessment -1** | **Tentative timeline of Continuous Internal Assessment -2** | **Tentative timeline of Continuous Internal Assessment3(Central)** | **Tentative timeline of Remedial and /Tutorial** | **Tentative timeline of University Examination** |
| --- | --- | --- | --- | --- | --- | --- |
| **I** |  | 1st week of September,2025 | 1st week of November,2025 | 1st week of December,2025 | As notified by the College | From 1st week of January,2026 |
| **III** |  | 1st week of September,2025 | 1st week of November,2025 | 1st week of December,2025 | As notified by the College | From 1st week of January,2026 |
| **V** |  | 1st week of September,2025 | 1st week of November,2025 | 1st week of December,2025 | As notified by the College | From 1st week of January,2026 |
| **II** |  | 1st week of March,2026 | 1st week of April,2026 | 1st week of May,2026 | As notified by the College | From 3rd /last week of May,2026 |
| **IV** |  | 1st week of March,2026 | 1st week of April,2026 | 1st week of May,2026 | As notified by the College | From 3rd /last week of May,2026 |
| **VI** |  | 1st week of March,2026 | 1st week of April,2026 | 1st week of May,2026 | As notified by the College | From 3rd /last week of May,2026 |