**ACADEMIC CALENDER (ODD SEMESTER)**

**(Botany Honours; CBCS)**

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| Semester I (AY 2017-2024) | | Period: to | | | |
| Paper: CC 1T(Phycology and Microbiology) (Theory) | | Full Marks: 40+15 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | **Unit 1: Introduction to microbial world** : Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine). | | (7 lectures) | SkMd Ismail Al Amin |  |
| 2 | Unit 2: Viruses Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). | | (7 lectures | SkMd Ismail Al Amin |  |
| 3 | Unit 3: Bacteria Discovery, general characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction). | | (7 lectures) | SkMd Ismail Al Amin |  |
| 4 | Unit 4: Algae General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups) and Van – den Hoek et.al(1982); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry. | | (11 lectures) | Susanta Kumar Maity |  |
| 5 | Unit 5: Cyanophyta and Xanthophyta Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of Nostoc and Vaucheria. | | (8 lectures) | Susanta Kumar Maity |  |
| 6 | Unit 6: Chlorophyta and Charophyta General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Chlamydomonas, Volvox, Oedogonium, Coleochaete, Chara*. Evolutionary significance of *Prochloron*. | | (8 lectures) | Susanta Kumar Maity |  |
| 7 | Unit 7: Phaeophyta and Rhodophyta: Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Ectocarpus, Fucus* and *Polysiphonia*. | | (12 lectures) | Susanta Kumar Maity |  |

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| Semester I (AY 2017-2024) | | Period: to | | | |
| Paper: CC 1P (Phycology and Microbiology) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Microbiology 1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.  2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.  3. Gram staining.  4. Endospore staining with malachite green using the (endospores taken from soil bacteria).  5. Study of bacteria from root nodules/Curd sample. | | 20 | SkMd Ismail Al Amin |  |
| 2 | Phycology Study of vegetative and reproductive structures of Nostoc, *Chlamydomonas* (electron micrographs), Volvox, *Oedogonium,Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus* and *Polysiphonia, Procholoron* through electron micrographs, temporary preparations and permanent slides. | | 20 | Susanta Kumar Maity |  |

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| Semester I (AY 2017-2024) | | Period: to | | | |
| Paper: CC 2T (Biomolecules and Cell Biology ) (Theory) | | Full Marks: 40+15 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Biomolecules: Types and significance of chemical bonds; Structure and properties of water; pH and buffers. Carbohydrates: Nomenclature and classification; 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 quarternary; 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. | | (20 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | 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. | | (4 lectures) | Dr. Nilay Kumar Maitra |  |
| 3 | Unit 3: 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 theroy), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity. | | (6 lectures) | Dr. Nilay Kumar Maitra |  |
| 4 | Unit4: The cell: Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin ofeukaryotic cell (Endosymbiotic theory). | | (4 lectures) | Dr. Nilay Kumar Maitra |  |
| 5 | Unit 5: 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. | | (4 lectures) | Dr. NilayKumar Maitra |  |
| 6 | Unit 6: Cell organelles: Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. 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 ofproteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes | | (16 lectures) | Dr. Nilay Kumar Maitra |  |
| 7 | Unit 7: Cell division: Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases. | | (6 lectures) | Dr. Nilay Kumar Maitra |  |

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| Semester I (AY 2017-2024) | | Period: to | | | |
| Paper: CC 2P (: Biomolecules and Cell Biology) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. | | (30 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | 2. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo /Crinum. | | Dr. Nilay Kumar Maitra |  |
| 3 | 3. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf. | | Dr. Nilay Kumar Maitra |  |
| 4 | 4. Measurement of cell size by the technique of micrometry. | | Dr. Nilay Kumar Maitra |  |
| 5 | 5. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains). | | Dr. Nilay Kumar Maitra |  |
| 6 | 6. Study of cell and its organelles with the help of electron micrographs. | | Dr. Nilay Kumar Maitra |  |
| 7 | 7. Cytochemical staining of : DNA- Feulgen Actocarmin and AcetoOrcrin stain and cell wall in the epidermal peel of onion using Periodic Schiff’s (PAS) staining technique. | | Dr. Nilay Kumar Maitra |  |
| 8 | 8. Study the phenomenon of plasmolysis and deplasmolysis. | | Dr. NilayKumar Maitra |  |
| 9 | 9. Study the effect of organic solvent and temperature on membrane permeability. | | Dr. Nilay Kumar Maitra |  |
| 10 | 10. Study different stages of mitosis and meiosis. | | Dr. Nilay Kumar Maitra |  |

**ACADEMIC CALENDER (EVEN SEMESTER)**

**(Botany Honours; CBCS)**

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| Semester II (AY 2017-2024) | | Period: to | | | |
| Paper: CC 3T (Mycology and Phytopathology) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Introduction to true fungi: General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification. | | (6 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | Unit 2: Chytridiomycota and Zygomycota: Characteristic features; Ecology and significance; Thallus organisation; Reproduction; Life cycle with reference to Synchytrium, Rhizopus . | | (5 lecture) | Dr. Nilay Kumar Maitra |  |
| 3 | Unit 3: Ascomycota: General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and parasexuality; Life cycle and classification with reference to Saccharomyces, Aspergillus, Penicillium, Alternaria, Neurospora and Peziza. | | (10 lectures) | Dr. Nilay Kumar Maitra |  |
| 4 | Unit 4: Basidiomycota :General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat Puccinia (Physiological Specialization), loose and covered smut (symptoms only), Agaricus; Bioluminescence, Fairy Rings and Mushroom Cultivation with special reference to Oyster Mashroom. | | (8 lectures) | Dr. Nilay Kumar Maitra |  |
| 5 | Unit 5: Allied Fungi: General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies. | | (3 lectures) | Dr. Nilay Kumar Maitra |  |
| 6 | Unit 6: Oomycota: General characteristics; Ecology; Life cycle and classification with reference to Phytophthora, Albugo. | | (4 lectures) | Dr. Nilay Kumar Maitra |  |
| 7 | Unit 7: Symbiotic associations Lichen: – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance. | | (4 lectures) | Dr. Nilay Kumar Maitra |  |
| 8 | 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. | | (10 Lectures) | Dr. Nilay Kumar Maitra |  |
| 9 | Unit 9: Phytopathology: Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. | | (10 lectures) | Dr. Nilay Kumar Maitra |  |
| 10 | Bacterial diseases :– Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers. | | (10 lectures) | SkMdIsmail Al Amin |  |

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| Semester II (AY 2017-2024) | | Period: to | | | |
| Paper: CC 3P(Mycology and Phytopathology)(Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps&basidiocarps). | | (30 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | 2. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides. | | Dr. Nilay Kumar Maitra |  |
| 3 | 3. Aspergillus and Penicillium: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs. | | Dr. Nilay Kumar Maitra |  |
| 4 | 4. Peziza: Ascobulus sectioning through ascocarp. | | Dr. Nilay Kumar Maitra |  |
| 5 | 5. Alternaria: Specimens/photographs and temporary mounts. | | Dr. Nilay Kumar Maitra |  |
| 6 | 6. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts. | | Dr. Nilay Kumar Maitra |  |
| 7 | 7. Agaricus: Specimens of button stage and full grown mushroom; sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms to be shown. | | Dr. Nilay Kumar Maitra |  |
| 8 | 8. Study of phaneroplasmodium from actual specimens and /or photograph. Study of Stemonitis sporangia. | | Dr. Nilay Kumar Maitra |  |
| 9 | 9. Albugo: Study of symptoms of plants infected with Albugo; asexual phase study through section/ temporary mounts and sexual structures through permanent slides. | | Dr. Nilay Kumar Maitra |  |
| 10 | 10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs) | | Dr. Nilay Kumar Maitra |  |
| 11 | 11. Phytopathology : Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat and White rust of crucifers. | | (10 lectures) | SkMd Ismail Al Amin |  |

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| Semester II (AY 2017-2024) | | Period: to | | | |
| Paper: CC 4T (Archegoniate) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Introduction: Unifying features of archegoniates; Transition to land habit; Alternation of generations. | | (4 lectures) | SkMd Ismail Al Amin |  |
| 2 | Unit 2: Bryophytes: General characteristics; Adaptations to land habit; Classification; Range of thallus organization. | | (6 lectures) | SkMd Ismail Al Amin |  |
| 3 | Unit 3: Type Studies:- Bryophytes Classification (up to family), morphology, anatomy and reproduction of Riccia, Marchantia, Pellia, Porella, Anthoceros, Sphagnum and Funaria; Pogonatum,Reproduction and evolutionary trends in Riccia, Marchantia, PlagichasmaAnthoceros and Funaria (developmental stages not included). Ecological and economic importance of bryophytes with special reference to Sphagnum. | | (12 lectures) | SkMd Ismail Al Amin |  |
| 4 | Unit 4: Pteridophytes: General characteristics; Classification; Early land plants (Cooksonia and Rhynia). | | (6 lectures) | Susanta Kumar Maity |  |
| 5 | Unit 5: Type Studies-: Pteridophytes Classification (up to family), morphology, anatomy and reproduction of Psilotum, Selaginella, Equisetum and Pteris (Developmental details not to be included).Apogamy, and apospory, heterosporyandseed habit, telome theory, stelar evolution; Ecological and economic importance. | | (14 lectures) | Susanta Kumar Maity |  |
| 6 | Unit 6: Gymnosperms: General characteristics, classification (up to family), morphology, anatomy and reproduction of Cycas, Pinus and Gnetum (Developmental details not to be included); Ecological and economic importance. | | (18 lectures) | Susanta Kumar Maity |  |

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| Semester II (AY 2017-2024) | | Period: to | | | |
| Paper: CC 4P (Archegoniate) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Riccia – Morphology of thallus. | | (15 lectures) |  |  |
| 2 | 2. Marchantia- Morphology of thallus, whole mount of rhizoids & Scales, vertical sectionof thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides). | | SkMd Ismail Al Amin |  |
| 3 | 3. Anthoceros- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide). | | SkMd Ismail Al Amin |  |
| 4 | 4. Pellia, Porella- Permanent slides. | | SkMd Ismail Al Amin |  |
| 5 | 5. Sphagnum- Morphology of plant, whole mounts of leaf (permanent slide only). | | SkMd Ismail Al Amin |  |
| 6 | 6. Funaria- Pogonatum/ Polytrichum Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema. | | SkMd Ismail Al Amin |  |
| 7 | 7. Psilotum- Study of specimen, transverse section of synangium (permanent slide). | | (15 lectures) | Susanta Kumar Maity |  |
| 8 | 8. 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). | | Susanta Kumar Maity |  |
| 9 | 9. Equisetum- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide). | | Susanta Kumar Maity |  |
| 10 | 10. Pteris- Morphology, transverse section of rachis, vertical section of sporophyll, wholemount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide). | | Susanta Kumar Maity |  |
| 11 | 11. Cycas- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide). | | Susanta Kumar Maity |  |
| 12 | 12. Pinus- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section &radial longitudinal sections stem (permanent slide). | | Susanta Kumar Maity |  |
| 13 | 13. Gnetum- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide) | | Susanta Kumar Maity |  |
| 14 | 14. Botanical excursion | | Susanta Kumar Maity |  |

**ACADEMIC CALENDER (ODD SEMESTER)**

**(Botany Honours; CBCS)**

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: CC5T (Anatomy of Angiosperms) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Introduction and scope of Plant Anatomy: Applications in systematics, forensics and pharmacognosy. | | (4 Lectures) | Susanta Kumar Maity |  |
| 2 | Unit 2: Structure and Development of Plant Body Internal organization of plant body: The three tissue systems, types of cells and tissues. Development of plant body: polarity, cytodifferentiation and organogenesis during embryogenic development, Root-stem transition, Nodal anatomy – Basic concept. | | (6 Lectures) | Susanta Kumar Maity |  |
| 3 | Unit 3: Tissues Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers. | | (12Lectures) | Susanta Kumar Maity |  |
| 4 | Unit 4: Apical meristems: Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem. Origin, development, arrangement and diversity in size and shape of leaves; Structure of dicot and monocot leaf, Kranz anatomy. Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root. | | (15 Lectures) | Susanta Kumar Maity |  |
| 5 | Unit 5: Vascular Cambium and Wood Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Anomalous secondary growth in Bignonia, Boerhaavia, Aristolochia and Dracaena. Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm, rhytidome and lenticels. | | (15 Lectures) | Susanta Kumar Maity |  |
| 6 | Unit 6: Adaptive and Protective Systems Epidermal tissue system, cuticle, epicuticular waxes, trichomes(uni-and multicellular, glandular and nonglandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes. Mechanical tissue – distribution and significance. | | (8 Lectures) | SusantaKumar Maity |  |

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: CC5P (Anatomy of Angiosperms) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Study of anatomical details through permanent slides/temporary stain mounts/ macerations/museum specimens with the help of suitable examples.  2. Apical meristem of root, shoot and vascular cambium  3. Distribution and types of parenchyma, collenchyma and sclerenchyma.  4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.  5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.  6. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.  7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular  8. Root: monocot, dicot, secondary growth.  9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.  10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).  11. Adaptive Anatomy: xerophytes, hydrophytes.  12. Secretory tissues: cavities, lithocysts and laticifers. | | (20 Lectures) | Susanta Kumar Maity |  |

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: CC6T ( Economic Botany ) (Theory) | | Full Marks: 40 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Origin of Cultivated Plants: Concept of Centres of Origin, their importance with reference to Vavilov’s work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.  Unit 2: Cereals: Wheat and Rice (origin, morphology, cultivation, management processing & uses); Brief account of millets.  Unit 3: Legumes: Origin, morphology cultivation, management and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.  Unit 4: Sources of sugars and starches: (Morphology cultivation, management and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.  Unit 5: Spices: Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper  Unit 6: Beverages: Tea, Coffee (morphology, processing & uses)  Unit 7: Sources of oils and fats :General description, classification, extraction, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.  Unit 8: Natural Rubber: Para-rubber: tapping, processing and uses.  Unit 9: Drug-yielding plants :Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Papaver and Cannabis; Tobacco (Morphology, processing, uses and health hazards).  Unit 10: Timber plants: General account with special reference to teak and pine.  Unit 11: Fibers: Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses). | | (60 lectures) | Dr. Nilay Kumar Maitra |  |

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: CC6P (Economic Botany) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).  2. Legumes: Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).  3. Sources of sugars and starches: Sugarcane ( habit sketch; cane juice- micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).  4. Spices: Black pepper, Fennel and Clove (habit and sections).  5. Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).  6. Sources of oils and fats: Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds.  7. Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photographs).  8. Rubber: specimen, photograph/model of tapping, samples of rubber products.  9. Drug-yielding plants: Specimens of Digitalis, Papaver and Cannabis.  10. Tobacco: specimen and products of Tobacco.  11. Woods: Tectona, Pinus: Specimen, Section of young stem.  12. Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber). | | (24 lectures) | Dr. Nilay Kumar Maitra |  |

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: CC7T (Genetics) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Mendelian genetics and its extension Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance. | | (16 lectures) | SkMd Ismail Al Amin |  |
| 2 | Unit 2: 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. | | (6 lectures) | SkMd Ismail Al Amin |  |
| 3 | Unit 3: Linkage, crossing over and chromosome mapping Linkage and crossing over-Cytological and molecular basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage. | | (12 lectures) | SkMd Ismail Al Amin |  |
| 4 | Unit 4: Variation in chromosome number and structure Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy | | (8 lectures) | SkMd Ismail Al Amin |  |
| 5 | Unit 5: 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. | | (6 lectures) | SkMd Ismail Al Amin |  |
| 6 | Unit 6: Fine structure of gene Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus. | | (6 lectures) | SkMd Ismail Al Amin |  |
| 7 | Unit 6. Population and Evolutionary Genetics Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation. | | (6 lectures) | SkMd Ismail Al Amin |  |

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: CC7P (Genetics) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Demonstration on pretreatment, fixation, staining and squash and smear preparation. | | (40 lectures) | SkMd Ismail Al Amin |  |
| 2 | 2. Study of Mitosis from Onion / Garlic / Lentil root. | | SkMd Ismail Al Amin |  |
| 3 | 3. Study of Meiosis with pollen mother cell (PMC) of Onion / Solanum / Datura by smear preparation. | | SkMd Ismail Al Amin |  |
| 4 | 4. Mendel’s laws through seed ratios. Laboratory exercises in probability and chi-square. | | SkMd Ismail Al Amin |  |
| 5 | 5. Chromosome mapping using point test cross data. | | SkMd Ismail Al Amin |  |
| 6 | 6. Pedigree analysis for dominant and recessive autosomal and sex linked traits | | SkMd Ismail Al Amin |  |
| 7 | 7. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4). | | SkMd Ismail Al Amin |  |
| 8 | 8. Blood Typing: groups & Rh factor. | | SkMd Ismail Al Amin |  |
| 9 | 9. Study of aneuploidy: Down’s, Klinefelter’s and Turner’s syndromes. | | SkMd Ismail Al Amin |  |
| 10 | 10. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge. | | SkMd Ismail Al Amin |  |
| 11 | 11. 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 | | SkMd Ismail Al Amin |  |

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| Semester III (AY 2017-2024) | | Period: to | | | |
| Paper: SEC1T (Biofertilizers) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. | | (4 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | Unit 2: Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms.Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication. | | (8 lectures) | Dr. Nilay Kumar Maitra |  |
| 3 | Unit 3: Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. | | (4 lectures) | Dr. Nilay Kumar Maitra |  |
| 4 | Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. | | (8 lectures) | Dr. Nilay Kumar Maitra |  |
| 5 | Unit 5: Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application. | | (6 lectures) | Dr. Nilay Kumar Maitra |  |

**ACADEMIC CALENDER(EVEN SEMESTER)**

**(Botany Honours; CBCS)**

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: CC8T (Molecular Biology) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 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. | | (60 lectures) | SkMd Ismail Al Amin |  |
| 2 | Unit -2. The Structures of DNA and RNA / Genetic Material DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA-Prokaryotes, Viruses, Eukaryotes.RNA Structure-Organelle DNA -- mitochondria and chloroplast DNA.TheNucleosomeChromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. | |
| 3 | Unit- 2:The replication of DNA Chemistry of DNA synthesis (Kornberg’s discovery); General principles – bidirectional, semiconservative 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. | |
| 4 | Unit- 3: Central dogma and genetic code Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features) | |
| 5 | Unit 4: Transcription Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in E.coli. Eukaryotes:transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing. | | (60 lectures) | Susanta Kumar Maity |  |
| 6 | Unit 5: 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. | |
| 7 | Unit 6: Translation Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNAsynthetases; 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. | |

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: CC8P (Molecular Biology) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Preparation of LB medium and raising E.Coli. | | (30 lectures) | SkMd Ismail Al Amin &  Susanta Kumar Maity |  |
| 2. Isolation of genomic DNA from *E.Coli*. | |
| 3. DNA isolation from cauliflower head. | |
| 4. DNA estimation by diphenylamine reagent/UV Spectrophotometry. | |
| 5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication). | |
| 6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs | |
| 7. Photographs establishing nucleic acid as genetic material (Messelson and Stahl’s, Avery et al, Griffith’s, Hershey & Chase’s and Fraenkel & Conrat’s experiments) | |
| 8. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing. | |

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: CC9T (Plant Ecology and Phytogeography) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Introduction Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis. | | (60 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | Unit 2: Soil Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development. | | Dr. Nilay Kumar Maitra |  |
| 3 | Unit 3: Water Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table. | | Dr. Nilay Kumar Maitra |  |
| 4 | Unit 4: Light, temperature, wind and fire Variations; adaptations of plants to their variation. | | Dr. Nilay Kumar Maitra |  |
| 5 | Unit 5: Ecosystems Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids. | | Dr. Nilay Kumar Maitra |  |
| 6 | Unit 6: Population ecology Characteristics and Dynamics .Ecological Speciation | | Dr. Nilay Kumar Maitra |  |
| 7 | Unit 7: Plant communities Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts. | | Dr. Nilay Kumar Maitra |  |
| 8 | Unit 8: Biotic interactions Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop. | | Dr. Nilay Kumar Maitra |  |
| 9 | Unit 9: Functional aspects of ecosystem Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus. | | Dr. Nilay Kumar Maitra |  |
| 10 | Unit 10: Phytogeography Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation. | | Dr. Nilay Kumar Maitra |  |

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: CC9P (Plant Ecology and Phytogeography) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. | | (36 lectures) | Dr. Nilay Kumar Maitra |  |
| 2 | 2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper) | | Dr. Nilay Kumar Maitra |  |
| 3 | 3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from | | Dr. Nilay Kumar Maitra |  |
| 4 | 4. two soil samples by rapid field tests. | | Dr. Nilay Kumar Maitra |  |
| 5 | 5. Determination of organic matter of different soil samples by Walkley& Black rapid titration | | Dr. Nilay Kumar Maitra |  |
| 6 | 6. method | | Dr. Nilay Kumar Maitra |  |
| 7 | 7. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats. | | Dr. Nilay Kumar Maitra |  |
| 8 | 8. Determination of dissolved oxygen of water samples from polluted and unpolluted sources. | | Dr. Nilay Kumar Maitra |  |
| 9 | 9. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each). (b). Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche) Epiphytes, Predation (Insectivorous plants). | | Dr. Nilay Kumar Maitra |  |
| 10 | 10. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed). | | Dr. Nilay Kumar Maitra |  |
| 11 | 11. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer’s frequency distribution law. | | Dr. Nilay Kumar Maitra |  |
| 12 | 12. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus. 13. Field visit to familiarise students with ecology of different sites. | | Dr. Nilay Kumar Maitra |  |

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: CC10T (Plant Systematics) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Significance of Plant systematics Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys:Single access and Multi-access. | | (60 lectures) | Susanta Kumar Maity |  |
| 2 | Unit 2: Taxonomic hierarchy Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). | | Susanta Kumar Maity |  |
| 3 | 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. | | Susanta Kumar Maity |  |
| 4 | Unit 4: Systems of classification Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification. | | Susanta Kumar Maity |  |
| 5 | Unit 5: Biometrics, numerical taxonomy and cladistics Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences). | | Susanta Kumar Maity |  |
| 6 | 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; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). | | Susanta Kumar Maity |  |

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: CC10P (Plant Systematics) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker’s system of classification):  1. Ranunculaceae - Ranunculus, Delphinium.  2. Brassicaceae - Brassica, Alyssum / Iberis.  3. Malvaceae – Sida Sp. Urenalobota.  4. Myrtaceae - Eucalyptus, Callistemon  5. Umbelliferae - Coriandrum /Anethum / Foeniculum.  6. Asteraceae - Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax.  7. Solanaceae - Solanum nigrum/Withania, Nicotina, Plumbaginefolia.  8. Lamiaceae - Salvia/Ocimum.  9. Euphorbiaceae - Euphorbia hirta/E.milii, Jatropha.  10. Fasaceae – TephrosiaSp.,Crotalaria Sp.,  11. Caesalpineaeceae – Cassia Sp.,  12. Asclepiadaeceae- PesgulariaGygnema,  13. Apocynaceae – Hollorhen, Catharanthus.  14. Rubiaceae – Oldenladeae, Spermoeoceae,  15. Liliaceae - Asphodelus/Lilium/Allium.  16. Poaceae - Triticum/Hordeum/Avena. | | (36  lectures) | Susanta Kumar Maity |  |
| 2 | 2. Field visit (local) – Subject to grant of funds from the university. | |  | Susanta Kumar Maity |  |
| 3 | 3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book). | |  | Susanta Kumar Maity |  |

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| Semester IV (AY 2017-2024) | | Period: to | | | |
| Paper: SEC2T (**Mushroom CultureTechnology**) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | **Unit 1:** Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.Types of edible mushrooms available in India - *Volvariellavolvacea, Pleurotuscitrinopileatus, Agaricusbisporus*. | | (40 lectures) | Dr.Nilay Kumar Maitra |  |
| 2 | **Unit 2:** Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production. | | Dr.Nilay Kumar Maitra |  |
| 3 | **Unit 3:** Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. | | Dr.Nilay Kumar Maitra |  |
| 4 | **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. | | Dr.Nilay Kumar Maitra |  |

**ACADEMIC CALENDER**

**(Botany Honours; CBCS)**

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: CC11T (**Reproductive Biology of Angiosperms**) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | **Unit 1: Introduction :**History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope. | | (60 lectures) | Susanta Kumar Maity |  |
| 2 | **Unit 2: Reproductive development :**Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects. | | Susanta Kumar Maity |  |
| 3 | **Unit 3: Anther and pollen biology**  Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia. | | Susanta Kumar Maity |  |
| 4 | **Unit 4: Ovule**  Structure; Types; Special structures–endothelium, obturator, aril, caruncle and hypostase; Female Gametophyte – megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum*type); Organization and ultrastructure of mature embryo sac. | | Susanta Kumar Maity |  |
| 5 | **Unit 5: Pollination and fertilization**  Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization. | | Susanta Kumar Maity |  |
| 6 | **Unit 6: Self incompatibility**  Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and *in vitro* pollination; Modification of stigma surface, parasexual hybridization; Cybrids, *in vitro* fertilization. | | Susanta Kumar Maity |  |
| 7 | **Unit 7: Embryo, Endosperm and Seed**  Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in *Paeonia*. Seed structure, importance and dispersal mechanisms | | Susanta Kumar Maity |  |
| 8 | **Units 7: Polyembryony and apomixis**  Introduction; Classification; Causes and applications. | | Susanta Kumar Maity |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: CC11P (**Reproductive Biology of Angiosperms**) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation. | | (40 lectures) | Susanta Kumar Maity |  |
| 2 | 2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads, 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. | | Susanta Kumar Maity |  |
| 3 | 3. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs). | | Susanta Kumar Maity |  |
| 4 | 4. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus. | | Susanta Kumar Maity |  |
| 5 | 5. Intra-ovarian pollination; Test tube pollination through photographs. | | Susanta Kumar Maity |  |
| 6 | 6. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria. | | Susanta Kumar Maity |  |
| 7 | 7. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs | | Susanta Kumar Maity |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: CC12T (**Plant Physiology**) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | **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. | | (60 lectures) | Dr.Nilay Kumar Maitra |  |
| 2 | **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. | | Dr.Nilay Kumar Maitra |  |
| 3 | **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. | | Dr.Nilay Kumar Maitra |  |
| 4 | **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. | | Dr.Nilay Kumar Maitra |  |
| 5 | **Unit 5: Plant growth regulators**  Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene, Brassinosteroids and Jasmonic acid. | | Dr.Nilay Kumar Maitra |  |
| 6 | **Unit 6: Physiology of flowering**  Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy. | | Dr.Nilay Kumar Maitra |  |
| 7 | **Unit 7: Phytochrome , crytochromes and phototropins**  Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action. | | Dr.Nilay Kumar Maitra |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: CC12P (**Plant Physiology**) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Determination of osmotic potential of plant cell sap by plasmolytic method. | | (40 lectures) | Dr.Nilay Kumar Maitra |  |
| 2 | Determination of water potential of given tissue (potato tuber) by weight method. | | Dr.Nilay Kumar Maitra |  |
| 3 | Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf. | | Dr.Nilay Kumar Maitra |  |
| 4 | Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte. | | Dr.Nilay Kumar Maitra |  |
| 5 | To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces). | | Dr.Nilay Kumar Maitra |  |
| 6 | To study the phenomenon of seed germination (effect of light). | | Dr.Nilay Kumar Maitra |  |
| 7 | To study the effect of different concentrations of IAA on *Avena*coleoptile elongation (IAA Bioassay). | | Dr.Nilay Kumar Maitra |  |
| 8 | To study the induction of amylase activity in germinating barley grains. | | Dr.Nilay Kumar Maitra |  |
|  | **Demonstration experiments** | |  |  |
|  | 1. To demonstrate suction due to transpiration. | | Dr.Nilay Kumar Maitra |  |
|  | 2. Fruit ripening/Rooting from cuttings (Demonstration). | | Dr.Nilay Kumar Maitra |  |
|  | 3. Bolting experiment/*Avena*coleptile bioassay (demonstration). | | Dr.Nilay Kumar Maitra |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: DSE1 (**Biostatistics**) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | **Unit 1: Biostatistics**  Definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics. | | (60 lectures) | Dr.Nilay Kumar Maitra |  |
| 2 | **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. | | Dr.Nilay Kumar Maitra |  |
| 3 | **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; Co- efficient of variations. | | Dr.Nilay Kumar Maitra |  |
| 4 | **Unit 4: Correlation**  Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression | | Dr.Nilay Kumar Maitra |  |
| 5 | **Unit 5: Statistical inference**  Hypothesis - simple hypothesis - student 't' test - chi square test. | | Dr.Nilay Kumar Maitra |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: DSE 1P (**Biostatistics**) (Practical) | | Full Marks: 20 Credit:02 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Calculation of mean, standard deviation and standard error | | (40 lectures) | Dr.Nilay Kumar Maitra |  |
| 2 | Calculation of correlation coefficient values and finding out the probability | | Dr.Nilay Kumar Maitra |  |
| 3 | Calculation of ‘F’ value and finding out the probability value for the F value. | | Dr.Nilay Kumar Maitra |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: DSE2 (**Plant Breeding**) (Theory) | | Full Marks: 40 Credit:04 | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | **Unit 1: Plant Breeding**  Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. | | (8 lectures) | SkMd Ismail Al Amin |  |
| 2 | **Unit 2: Methods of crop improvement**  Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations. | | (8 lectures) | Susanta Kumar Maity |  |
| 3 | **Unit 3: Quantitative inheritance**  Concept, mechanism, examples of inheritance of Kernel colour in wheat, Skin colour in human beings.Monogenic vs polygenic Inheritance. | | (8 lectures) | SkMd Ismail Al Amin |  |
| 4 | **Unit 4: Inbreeding depression and heterosis**  History, genetic basis of inbreeding depression and heterosis; Applications. | | (8 lectures) | Susanta Kumar Maity |  |
| 5 | **Unit 5: Crop improvement and breeding**  Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement. | | (8 lectures) | SkMd Ismail Al Amin |  |

**ACADEMIC CALENDER (EVEN SEMESTER)**

**(Botany Honours; CBCS)**

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: CC13T ( Plant Metabolism) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Concept of metabolism Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric ,covalent modulation and Isozymes).  Unit 2: Carbon assimilation Historical background, 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, C4 pathways; Crassulacean acid metabolism; Factors affecting CO2 reduction.  Unit 3: Carbohydrate metabolism Synthesis and catabolism of sucrose and starch.  Unit 4: 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.  Unit 5: ATP-Synthesis Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker’s experiment, Jagendorf’s experiment; role of uncouplers.  Unit 6: Lipid metabolism Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation  Unit 7: Nitrogen metabolism Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.  Unit 8: Mechanisms of signal transduction Receptor-ligand interactions; Second messenger concept, Calcium calmodulin, MAP kinase cascade | | (60 lectures) | Dr.Nilay Kumar Maitra |  |

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: CC13P Plant Metabolism (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Chemical separation of photosynthetic pigments.  2. Experimental demonstration of Hill’s reaction.  3. To study the effect of light intensity on the rate of photosynthesis.  4. Effect of carbon dioxide on the rate of photosynthesis.  5. To compare the rate of respiration in different parts of a plant.  6. To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources.  7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids 1. during germination.  8. Demonstration of fluorescence by isolated chlorophyll pigments.  9. Demonstration of absorption spectrum of photosynthetic pigments | | (35 lectures) | Dr.Nilay Kumar Maitra |  |

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: CC14T (Plant Biotechnology ) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit -1: Plant Tissue Culture 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).  Unit- 2: Recombinant DNA technology Restriction Endonucleases (History, Types I-IV, biological role and application);  Unit - 5: Applications of Biotechnology Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Gentically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns. | | (30 lectures) | Susanta Kumar Maity |  |
| 2 | Unit- 2: Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).  Unit- 3:Gene Cloning Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCRmediated 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  Unit- 4: 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). | | (30 lectures) | SkMd Ismail Al Amin |  |

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| Semester V (AY 2017-2024) | | Period: to | | | |
| Paper: CC14P ( ) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. (a) Preparation of MS medium. (b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.  2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.  3. Isolation of protoplasts. | | (16  lectures) | Susanta Kumar Maity |  |
| 2 | 4. Construction of restriction map of circular and linear DNA from the data provided.  5. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene  6. transfer by electroporation, microinjection, microprojectile bombardment.  7. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.  8. Isolation of plasmid DNA.  9. Restriction digestion and gel electrophoresis of plasmid DNA. | | (16 lectures) | SkMd Ismail Al Amin |  |

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: DSE3 (Industrial and Environmental Microbiology) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Unit 1: Scope of microbes in industry and environment  Unit 2: Bioreactors/Fermenters and fermentation processes Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactorslaboratory, pilotscale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.  Unit 3: Microbial production of industrial products Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)  Unit 4: Microbial enzymes of industrial interest and enzyme immobilization Microorganisms for industrial applications\_and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).  Unit 5: Microbes and quality of environment. Distribution of microbes in air; Isolation of microorganisms from soil, air and water.  Unit 6: 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, check coliform and fecal coliform in water samples.  Unit 7: Microbes in agriculture and remediation of contaminated soils. Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots. | | (50 lectures) | SkMd Ismail Al Amin  &  Susanta Kumar Maity |  |

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: DSE3 (Industrial and Environmental Microbiology) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Principles and functioning of instruments in microbiology laboratory  2. Hands on sterilization techniques and preparation of culture media. | | (30 lectures) | SkMd Ismail Al Amin  &  Susanta Kumar Maity |  |

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: DSE4 (Analytical Techniques in Plant Sciences ) (Theory) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 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.  Unit- 2: Cell fractionation Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2gradient, analytical centrifugation, ultracentrifugation, marker enzymes.  Unit- 3: Radioisotopes Use in biological research, auto-radiography, pulse chase experiment.  Unit- 4: Spectrophotometry Principle and its application in biological research.  Unit- 5: Chromatography Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ionexchange chromatography; Molecular sieve chromatography; Affinity chromatography.  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  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. | | (50 lectures) | SkMd Ismail Al Amin  &  Susanta Kumar Maity |  |

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| Semester VI (AY 2017-2024) | | Period: to | | | |
| Paper: DSE4 (Analytical Techniques in Plant Sciences) (Practical) | | Full Marks: Credit: | | | |
| Sl. No. | **TOPICS** | | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.  2. Demonstration of ELISA.  3. To separate nitrogenous bases by paper chromatography.  4. To separate sugars by thin layer chromatography.  5. Isolation of chloroplasts by differential centrifugation.  6. To separate chloroplast pigments by column chromatography.  7. To estimate protein concentration through Lowry’s methods. 8. To separate proteins using PAGE.  9. To separation DNA (marker) using AGE.  10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).  11. Preparation of permanent slides (double staining) | | (30 lectures) | SkMd Ismail Al Amin  &  Susanta Kumar Maity |  |