**ACADEMIC CALENDER (**4-YEAR UNDERGRADUATE PROGRAMME**)**

**(Botany Honours;** (CCFUP), 2023 & NEP, 2020**)**

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| Semester I (2023-2024) | Period: to  |
| Paper: MJ-1: Plants and Microbial Diversity and its Evolution | Full Marks: 40+15 Credit:04 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Introduction to microbial diversity; Whittaker’s five-kingdom system and Carl Richard Woese’s three-domain system. | (3lectures) | SkMd Ismail Al Amin |  |
| 2 | Virus: General characteristics; classification (Baltimore), idea aboutviroids and prions; detailed structure T4-phage and SARS-COV2, lytic and lysogenic cycle; Economic importance of viruses. | (7 lectures | SkMd Ismail Al Amin |  |
| 3 | Bacteria: General characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Bergey’s classification, Cell structure; Nutritional types; vegetative and Reproductive structure - asexual and recombination (conjugation, transformation and transduction).Economic importance of bacteria. | (8 lectures) | SkMd Ismail Al Amin |  |
| 4 | Algae: General characteristics; Ecology and distribution; range of thallus organization; Classification (Van Den Hoek, 1995), reproduction and life cycles of Nostoc, Oedogonium, Chara, and Polysiphonia. | (8 lectures) | Susanta Kumar Maity |  |
| 5 | Fungi: General characteristics; Affinities with plants and animals; Thallus organization; Heterothallism and parasexuality. Classification Ainsworth (up to Order). Life cycles of Synchitrium, Saccharomyces, Ascobolus, Agaricus. Symbiotic associations: Lichen and Mycorrhiza. Economic importance | (8 lectures) | Dr. Nilay Kumar Maitra |  |
| 6 | Archegoniate: Unifying features of archegoniates, Bryophytes: General characteristics; Adaptations to land habit; Range of thallus organization. Idea about different orders. Outline classification (Mishler), Morphology, anatomy and reproduction of Marchantia, Porella, Anthoceros, Notothylas and Funaria; Economic importance with special reference to Sphagnum | (7 lectures) | SkMd Ismail Al Amin |  |
| 7 | Pteridophytes: General characteristics; Idea about different orders. Classification (Sporne, 1975), Early land plants (Rhynia and Asteroxylon)Morphology, anatomy and reproduction of Lycopodium, Selaginella, Equisetum and Pteris. Economic importance. | (7lectures) | Susanta Kumar Maity |  |
| 8 | Gymnosperms: General characteristics, idea about different orders, Classification (Sporne, 1965), morphology, anatomy and reproduction of Cycas, Pinus and Gnetum; Economic importance. | (7lectures) | Susanta Kumar Maity |  |
| 9 | Palaeobotany: Geological time scale and important events, Types of plant fossils - impressions, compressions, petrifaction. Stromatolites, Factors for fossilization. | (5 lectures) | Dr. Nilay Kumar Maitra |  |

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| Semester I (AY 2023-2024) | Period: to  |
| Paper: MJ-1P: Plants and Microbial Diversity and its Evolution (Practical) | Full Marks: 20 Credit:02 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Electron micrographs/Models of viruses – T-Phage and Sars-CoV2, Sketches of Lytic and Lysogenic Cycle. Study ofcurd organisms curd through Gram staining.Endospore staining.Marchantia- Morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of antheridiophore, archegoniophore, longitudinal section of sporophyte (all permanent slides). Anthoceros- Morphology of thallus, dissection of sporophyte (to show spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide). Pogonetum- 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. | 20 | SkMd Ismail Al Amin |  |
| 2 | Study of vegetative and reproductive structures of Nostoc, Oedogonium and PolysiphonSelaginella- 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).  Equisetum- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores, transverse section of rhizome (all permanent slide). 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).Cycas- Morphology (leaf),vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).Pinus- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle (temporary slide), 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). Gnetum- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (all permanent slide) | 20 | Susanta Kumar Maity |  |
|  | Study of reproductive structures of Ascobolus, and Agaricus. Study of reproductive structure of Saccharomyces and Penicillium. Lichens: Photomicrographs of different types of Lichens.Study of fossil genera - Rhynia, Cooksonia, LepidodendronandLepidocarpon through photographs. | 20 | Dr. Nilay Kumar Maitra |  |

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| Semester II (AY 2023-2024) | Period: to  |
| Paper: MJ-2: Morphology, Anatomy and Plant Taxonomy (Theory) | Full Marks: 40+15 Credit:04 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Vegetative morphology- A general account of root, stem & leaves with different types of modifications; Different types of stipules and modifications along with phyllotaxy and diversity of leaves.  Flower- different types of inflorescences; Floral morphology, aestivation with special reference to adhesion and cohesion of the floral parts, Placentaion - types; Floral formula, Floral diagram.  Fruits & seeds-types and dispersal mechanisms  Structure and Development of Plant Body: internal organization of plant body: The three tissue systems, types of cells and tissues. Root stem transition. Apical meristems, types of stomata, Types of vascular bundles; Stele and its evolution. Vascular Cambium and Wood Structure, function and seasonal activity of cambium; Secondary growth in root and stem, Types of Anomalous secondary growth with special emphasis on Boerhavia and Dracaena. Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Annual ring; composition of periderm, rhytidome and lenticels.Significance of Plant systematics; 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. Taxonomic hierarchy, Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). Botanical nomenclature, Principles and rules (ICN); Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.  Systems of classification, Overview of artificial, natural and phylogenetic classification; Classification system of Bentham and Hooker (up to series). Brief reference of Angiosperm Phylogeny Group (APG IV) classification. Taximatrics: numerical taxonomy and cladistics Characters; OTUs, Cluster analysis; Phenograms, cladograms (definitions and differences). Phylogeny of Angiosperms: Terms and concepts (homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms. Concept of Basal Angiosperms and Eudicots.  General descriptions of the given families: Magnoliaceae, Malvaceae, Acanthaceae, Verbenaceae, Scrophulariaceae, Fabaceae, Caesalpinioideae, Asteraceae, Euphorbiaceae, Lamiaceae, Poaceae, Orchidaceae. | (60 lectures) | Susanta Kumar Maity |  |

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| Semester II (AY 2023-2024) | Period: to  |
| Paper: MJ-2P: Morphology, Anatomy and Plant Taxonomy (Practical) | Full Marks: 20 Credit:02 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Study of phyllotaxy and stipules. 2. Study of Inflorescence types- Racemose, Cymose, Special types (Capitulum, Verticellaster, and Hypanthodium) 3. Study of floral morphology with special reference to adhesion and cohesion of the floral parts, placentation types. 4. Study of different fruit types. 5. 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): Malvaceae – Sidasp. / Abutilon sp. Acanthaceae – Ruellia sp./Barleria sp. Fabaceae – Tephrosiasp./Crotalaria sp. Verbenaceae – Lantana sp./Durantasp. Asteraceae - Vernoniasp./Ageratum sp., Ecliptasp./Tridaxsp. Lamiaceae –Leucassp./Ocimum sp. Euphorbiaceae – Euphorbia sp. / Jatropha sp. Poaceae –Triticumsp./Chrysopogonsp. or any local common grass Orchidaceae- Vanda sp. 6. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book – At least 25 nos.). 7. Root: monocot, dicot, secondary growth. 8. Stem: monocot, dicot - primary and secondary growth 9. Anatomy of Leaf: isobilateral, dorsiventral 10. Anomalous secondary growth (Through permanent slides). 11. Study of Stomata and its types 12. Field visit (two) at least one to study the local flora | (30 ) | Susanta Kumar Maity |  |

**ACADEMIC CALENDER (**4-YEAR UNDERGRADUATE PROGRAMME**)**

**(Botany Honours;** (CCFUP), 2023 & NEP, 2020**)**

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| Semester I (AY 2023-24) | Period: to  |
| Paper: MI – 1: Plant Science-I (Theory) | Full Marks: 40 Credit:04 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Introduction to microbial world- Whittaker’s five-kingdom system Virus: General characteristics, classification (Baltimore), Economic importance. Bacteria: General characteristics, Bergey’s Classification, Economic importance. 2 Bryophytes: General characteristics, classification (Proskauer, 1957), morphology, anatomy and reproduction of Riccia, Anthoceros and Funaria, economic importance of bryophytes.  | (25 lectures) | Sk Md Ismail Al Amin |  |
| 2 | Algae: General characteristics; habitat, classification (Van Den Hoek, 1995), lifecycle patterns of Volvox and Batrachospermum, Economic importance. Pteridophytes: General characteristics, Classification (Sporne, 1975), morphology, anatomy and reproduction of Lycopodium, Adiantum and Marsilea. Economic importance 15 3 Gymnosperms: General characteristics, Classification (Sporne, 1965), morphology, anatomy and reproduction of Cycas and Pinus. Economic importance. | (25 lecture) | Susanta Kumar Maity |  |
| 3 | Fungi: General characteristics,Classification (Ainsworth, up to Order), life cycle patterns of Rhizopus and Agaricus, economic importance. Brief account of lichen and mycorrhiza. Paleobotany: Geological time scale and important events, Types of plant fossils. | (25lectures) | Dr. Nilay Kumar Maitra |  |

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| Semester I (AY 2023-24) | Period: to  |
| Paper: MI – 1: Plant Science-I (Practical) | Full Marks: 20 Credit:02 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | 1. Electron micrographs/Models of viruses – T-Phage and Sars-CoV2. 2. Study of Curd organisms through Gram staining.. Study of morphology of thallus and reproductive structure of Riccia, Anthoceros and Funaria.  | (20 lectures) | Sk Md Ismail Al Amin |  |
| 2 | 3. Study of vegetative and reproductive structure of Volvox, and Batrachospermum. 6. Study of morphology vegetative and reproductive structure of Lycopodium, Adiantum and Marsilea.  | 20 | Susanta Kumar Maity |  |
| 3 | Study of morphology and reproductive structure of Rhizopus and Agaricus.Study of morphology and vegetative structure of Cycas and Pinus. Study of fossil types (impressions, compressions, petrifaction). | 20 | Dr. Nilay Kumar Maitra |  |

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| Semester II (AY 2023-2024) | Period: to  |
| Paper: MI-2: Plant Science II (Theory) | Full Marks: 40 Credit:04 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Plant morphology- A general account of root, stem & leaves of monocot and dicot; phyllotaxy. 2 Flower- different types of inflorescences, Aestivation, Placentation - types; Floral formula, Floral diagram. 3 Fruits and Seeds-types 2 4 Structure and Development of Plant Body: The three tissue systems, primary structure of root, stem, and leaf; types of stomata, Types of vascular bundles; Secondary growth in root and stem, Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood; Annual ring; peridermand lenticels. 5 Significance of Plant systematics; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Brief concept about Flora, Monographs; Keys:Single access and Multi-access. Taxonomic hierarchy, Concept of taxa (family, genus, species); Species concept (taxonomic, biological, evolutionary). Botanical nomenclature, Principles and rules (ICN); author citation, valid publication. 7 Systems of classification, Overview of artificial, natural and phylogenetic classification; Classification system of Bentham and Hooker (up to series). Brief account of Angiosperm Phylogeny Group classification. Concept of primitive and Advance angiosperms (basal angiosperm and eudicots). 8 General descriptions of the given families: Malvaceae, Papilionaceae, Acanthaceae, Verbenaceae, Asteraceae, Poaceae. | (40 lectures) | Susanta Kumar Maity |  |

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| Semester II (AY 2023-2024) | Period: to  |
| Paper: MI-2P: Plant Science II (Practical) | Full Marks: 20 Credit:02 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | Study of leaf types (Simple and Compounds). 2. Study of inflorescence types(recemose and cymose) 3. Study of floral diversity with special reference to adhesion and cohesion. 4. Study of fruit types: Berry: Cucumis sativus, Capsicum annuum, Solanum melongena Drupe: Mangifera indica, Borasus flaballifer Hesperidium: Citrus Nut: Arachis hypogea 5. Study of vegetative and floral characters of the following families Malvaceae – Sida sp. / Abutilon sp. Acanthaceae – Ruellia sp./Barleria sp. Papilionaceae – Tephrosia sp./Crotalaria sp. Verbenaceae – Lantana sp./Duranta sp. | (30 lectures) | Susanta Kumar Maity |  |

**ACADEMIC CALENDER**

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| Semester II (AY 2023-2024) | Period: to  |
| Paper: SKILL ENHANCEMENT COURSE (SEC) SEC 1: Biofertilizers | Full Marks: 40 Credit:04 |
| 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. 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. Unit- 3: Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. 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. 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. | (30 Lectures) | Sk Md Ismail Al Amin |  |

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| Semester II (AY 2023-2024) | Period: to  |
| Paper: SEC 2: Floriculture | Full Marks: 20 Credit:02 |
| Sl. No. | **TOPICS** | CLASSES ALLOTED | Class taken by | Remark |
| 1 | UNIT-1: Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. UNIT-2: Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators. UNIT-3: Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai. UNIT-4: Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. UNIT-5: Landscaping Places of Public Importance: Landscaping highways and Educational institutions. UNIT-6: Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Lilium, Orchids). UNIT-7: Diseases and Pests of Ornamental Plants. | (20 Lectures) | Dr. Nilay Kumar Maitra |  |