

**Department of Botany
Sarat Centenary College**

Academic Plan : 2023-2024

Distribution of syllabus into Modules and Units of B.Sc. Honours Course CBCS

Semester-1

Orientation Programme – 1st week of July - General outline on the emergence of Botany as an academic discipline and its Scope & Importance along with brief introduction programme

Ist Module (July to September)

Core Course I: Microbiology and Phycology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 1: Introduction to microbial world

Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in medicine and as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry

Unit 2: Viruses

Discovery, physiochemical and biological characteristics; classification, general structure with special reference to TMV, T2-Phage, viroids and prions; lytic and lysogenic cycle.

Unit 3: Bacteria

Discovery, general characteristics; Principles in Bacterial Taxonomy, Bergey's Man. of Syst. Bact.; 2nd Ed. - 2001-05; Types-Archaea, Eubacteria, wall-less forms; Cell structure; Bacterial Chromosome & extra-chromosomal genetic elements; Nutritional types; Vegetative Reproduction and genetic recombination, Endospore.

Practical

Microbiology

1. Aseptic method - a) Sterilization technique by Autoclaving, Hot air oven and surface sterilization. b) Preparation of standard bacteriological medium - c) Preparation of slant and plates. d) Subculturing of pure bacteriological culture. e) Pure culture technique: dilution streak method. 2. Simple staining; Differential staining: Gram staining. 3. Microscopic examination of bacteria from natural habitats: curd and root nodules of leguminous plants.

Core Course II: Archegoniate

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 1: Introduction Unifying features of archegoniates; Transition and adaptation to land habit;

Alternation of generations.

Unit 2: Bryophytes General characteristics & Classification; Adaptations to land habit; Range of thallus structure

Unit 3: Type Studies- Bryophytes

Morphology, anatomy, reproduction and evolutionary trends in *Riccia*, *Marchantia*, *Pellia*, *Anthoceros*, *Sphagnum* and *Funaria*. Ecological and economic importance of bryophytes (a brief account).

Unit 4: Pteridophytes

General characteristics; Classification, early land plants (*Cooksonia* and *Rhynia*).

Practical

1. *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 (from permanent slides). 2. *Anthoceros*- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudocelaters, columella) (temporary slide), vertical section of thallus (from permanent slide). 3. *Pellia* - Study from Permanent slides. 4. *Funaria*- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule. 5. *Lycopodium*- Morphology, whole mount of leaf, transverse section of stem (temporary slide), longitudinal section of strobilus (from permanent slide). 6. *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 (from permanent slide).

2nd Module (October to December)

Core Course I: Microbiology and Phycology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 4: Algae

General characteristics; 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, general concept of endosymbiosis, classification of Lee' 2008; Significant contributions of important phycologists (F.E. Fritsch & M.O.P. Iyengar); Role of algae in the environment, agriculture, biotechnology and industry.

Unit 5: Cyanophyta and Xanthophyta

Ecology and occurrence; Cell structure; Reproduction, Genetic recombination (in Cyanophyta); Morphology and life-cycle of *Vaucheria*.

Unit 6: Chlorophyta and Charophyta

General characteristics; Occurrence; Cell structure. Life-cycles of *Volvox*, *Zygnema*, *Oedogonium*, *Coleochaete* and *Chara*.

Unit 7: Phaeophyta and Rhodophyta

Characteristics; Occurrence; Cell structure; Reproduction, life-cycles of *Fucus* and *Polysiphonia*.

Practical

Phycology

1. Study and Camera Lucida drawings of vegetative and reproductive structures of *Nostoc*, *Scytonema*, *Zygnema*, *Oedogonium*, *Cham* and *Vaucheria* temporary preparations and identification from permanent slides.
2. Identification of all the genera included in the theoretical syllabus from Permanent slides

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

Core Course II: Archegoniate

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 5: Type Studies- Pteridophytes

Morphology, anatomy and reproduction of *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris* and *Marsilea* (Developmental details not to be included). Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance

Unit 6: Gymnosperms

General characteristics, classification, morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum* Ecological and economic importance.

Practical

7. *Equisetum*- Morphology, transverse section of intemode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores, transverse section of rhizome (from permanent slide).
8. *Pteris*- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (from permanent slide).
9. *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).

10. **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 (Permanent slide), tangential longitudinal section & radial longitudinal sections stem (permanent slide).

11. **Gnetum**- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

Semesterr-II

Ist Module (January to March)

Core Course III: Mycology and Phytopathology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 1: Introduction to true fungi

General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification

Unit 2: Chytridiomycota and Zygomycota

Characteristic features; Thallus organisation; Life cycle with reference to *Synchytrium* and *Rhizopus*.

Unit 3: Ascomycota

General characteristics, sexual reproduction and development of ascus and ascospores, types of ascocarp; Phenomenon of Heterokaryosis and parasexuality in asexual members; Life cycle of *Saccharomyces*, *Talaromyces*, *Neurospora* and *Ascobolus*.

Unit 4: Basidiomycota

General characteristics; Phenomenon of dikaryotization, development of basidia and basidiospores and basidiocarp, Life cycle of *Puccinia* (Physiological Specialization) and *Agaricus*, Bioluminescence, Mushroom Cultivation.

Unit 5: Allied Fungi

General characteristics; Status of Slime molds, Occurrence; Types of plasmodia. **Unit 6: Oomycota** General characteristics; Life cycle of *Phytophthora* and *Albugo*.

Practical

1. Study of the following genera and their identification: *Rhizopus*, *Talaromyces*, *Alternaria*, *Ascobolus*, *Agaricus* and *Polypoms*. 2. Identification of all the macroscopic and microscopic genera included in the theoretical syllabus.

Core Course IV: Morphology & Anatomy of Angiosperms

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 1: Introduction and scope of Plant Anatomy

Applications in systematics, forensics and pharmacognosy.

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

Unit 3: Tissues

Classification of tissues; Simple and complex tissues (no phylogeny); cyto-differentiation of tracheary elements and sieve elements; Cell wall and its secondary growth; Pits and plasmodesmata; Ergastic substances. Hydathodes, cavities, lithocysts and laticifers.

Unit 4: Apical meristems

Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Coipus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structural differences of dicot and monocot stem, root & leaf, Kranz anatomy. Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Endodermis, exodermis and origin of lateral root.

Practical

1. Study of anatomical details through permanent slides/temporary stain mounts/ macerations/museum specimens with the help of suitable examples.
2. Study of the secondary structures of stem of the following genera: *Bignonia*, *Dracaena (Cordyline)*, *Boerhaavia* and *Strychnos*.
3. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres. (from permanent slides)
4. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres, (from permanent slides)
5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular, lenticels.

2nd Module (April to June)

Core Course III: Mycology and Phytopathology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 7: Symbiotic associations

Lichen - Occurrence; General characteristics; Range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza with special reference to VAM and their significance.

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,

Unit 9: Phytopathology

Terms and concepts; General symptoms; Geographical distribution of diseases; Symptomology; Koch's Postulate; Host-Pathogen relationships; Disease cycle and environmental relation; types of diseases, host defense mechanism; prevention and control of plant diseases (biological & chemical), and role of quarantine. Bacterial diseases-Citrus canker and bacterial blight of rice. Viral diseases-Tobacco Mosaic virus. Fungal diseases & Control - Late blight of potato. Ergot of rye; Black stem rust of wheat, loose and covered smut of wheat, White rust of crucifers.

Practical

Plant Pathology

1. Identification of diseases prescribed in the theoretical syllabus.
2. Study of the following diseases: White rust, Rust of wheat/*Justicia*, loose smut of wheat.
3. Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early & Late blight of potato, Black stem rust of wheat and White rust of crucifers.
4. Mycorrhizae-Ecto and Endo mycorrhizae (photographs only)

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course IV: Morphology & Anatomy of Angiosperms

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 5: Vascular Cambium and Wood

Structure, function and seasonal activity of cambium; Secondary growth in root and stem with special reference to *Bignonia*, *Dracaena (Cordyline)*, *Boerhaavia* and *Strychnos*. Types of rays and axial parenchyma; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm; General account of Rhytidome and lenticels

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).

Unit 7: Leaves and Inflorescence

Leaves-types, phyllotaxy and modifications; Inflorescence-Types and evolution

Unit 8: Flower, Fruit and Seed

Types of flower; Aestivation, placentation - types and evolution. Floral formula & floral diagram; Adhesion-Cohesion of floral parts, micro and mega gameto- and sporogenesis; embryo sac, Fruits -types, dispersal. Seed dispersal.

Practical

5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular, lenticels. 6. Root: monocot, dicot, secondary growth (from permanent slides). 7. Stem: monocot, dicot - primary and secondary growth; periderm (from permanent slides); 8. Leaf: Different variations; C4 leaves (Kranz anatomy). 9. Cystolith, lithocysts and aphides.

10. Types of inflorescence, placentation and fruits.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Semesterr-III

Ist Module (July to September)

Core Course 5 : Plant Ecology and Phytogeography

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 1: Introduction

Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.

Unit 2: Soil

Importance; Origin; Formation; Composition; Physical; Chemical and Biological components.

Unit 3: Water

Importance: States of water in the environment; Atmospheric moisture; Precipitation types; Hydrological Cycle;

Unit 4: Light, temperature, wind and fire

Climatic variables; adaptations of plants to their variation.

Unit 4: Ecosystem

Structure; Process; Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.

Practical

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. 2. Determination of pH of various soil and water samples (pH meter, universal indicator and pH paper) 3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests. 4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.

Core Course 6 : Plant Systematics

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

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, Revision, Monographs, Journals; Keys:Single access and Multi- access.

Unit 2: Taxonomic hierarchy

Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).

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.

Practical

1. Study of vegetative and floral characters from the locally available plants 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):

Dicotyledons: Malvaceae, Fabaceae, Euphorbiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Scrophulariaceae, Lamiaceae, Verbenaceae, Acanthaceae, Rubiaceae, Asteraceae.

Core Course 7 : Economic Botany

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

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, processing & uses); Brief account of millets.

Unit 3: Legumes

Origin, morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.

Unit 4: Sources of sugars and starches

Morphology 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)

Practical

1. Cereals: 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- tests). **4. Spices:** Black pepper, Fennel and Clove (Macromorphology). **5. Beverages:** Tea (plant specimen, tea leaves), Coffee (plant specimen, beans). **6. Sources of oils and fats:** Coconut-T.S. nut (photograph), Mustard-plant specimen, seeds; tests for fats in crushed seeds.

SEC-1

Agricultural Botany

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher : Dr. K. M. Hasib

Unit: 1 Plant physiology

- Plant water relation, stomatal regulation, mineral nutrition, N₂ cycle.
- C₃ fixation mechanism in C₂, C₃, C₄ and CAM plants. Transport of water and photosynthate.
- Plant development Phytohormones : IAA, GA, Cytokinin, ABA, Ethylene; their role and regulation in plant system
- Physiology of flowering and seed development

Unit: 2 Organic farming

- Microbes used as bio fertilizer
- Cyanobacteria isolation and mass multiplication
- Mycorrhizal association in Agriculture

2nd Module (October to December)

Core Course 5 : Plant Ecology and Phytogeography

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 6: Population ecology

Characteristics and Dynamics .Ecological Speciation

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.

Unit 8: Functional aspects of ecosystem

Principles and models of energy flow; Production and productivity; EcologicalBiogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.

Unit 9: Phytogeography

Principles; Continental drift; Theory of tolerance; Endemism; Characteristicfeatures of major terrestrial biomes; Phytogeographical division of India Phytogeographical classification of India (D. Chatterjee- 1962)]; Vegetation Characteristics of Eastern Himalaya and Sunderbans.

Practical

5. Determination of dissolved oxygen of water samples from polluted and unpolluted sources. 6. Ecological adaptations of some species: *Ipomoea aquatica* stem, Phyllode of *Acaccia auriculiformis*, *Nerium* leaf and *Vanda* root 7. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).8. Field visit to familiarize students with ecology of different sites.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Core Course 6 : Plant Systematics

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 4: Systems of classification

Major contributions of Theophrastus, Bauhin, Toumefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker [1862-83 (upto series)] and Takhtajan (1997); Brief idea of APG System.

Unit 5: Biometrics, numerical taxonomy and cladistics

Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms

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; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

Practical

Monocotyledons: Liliaceae, Poaceae. 2. Field visit - 3. Demonstration of mounting of a properly dried and pressed specimens of any wild plant with herbarium label

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Core Course 7 : Economic Botany

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

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).

Practical

7. **Essential oil-yielding plants:** Habit sketch of *Rosa* and *Eucalyptus*- specimens/photographs. 8. **Rubber:** specimen, photograph/model of tapping, samples of rubber products. 9. **Drug-yielding plants:** Organoleptic study of specimens of *Andrographis* and *Catharanthus*. 10. **Woods:** *Tectona*, *Pinns*'. Specimen, Section of young stem. 11. **Fiber-yielding plants:** Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber) **N.B.** - Students are required to submit a **PROJECT COPY** containing photographs of all above mentioned "Economically Important" plants with few identifying characters, economic use and local names.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

SEC-1

Agricultural Botany

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher : Dr. K. M. Hasib

Unit:3 Plant breeding, Tissue culture and Biotechnology

a) Mass selection and pure line selection, heterosis breeding b) Marker assisted breeding for agronomic crops c) Micro propagation techniques, different organ culture d) *Agrobacterium* mediated transformation, vector mediated transformation, Biolistics e) GMO, transgenic plant, patent. f) Molecular markers used in Agriculture

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Semester IV

Ist Module (January to March)

Core Course 8: Palaeobotany & Palynology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit-1. Introduction, importance of Palaeobotany.

Unit-2. Definition of fossil, process of fossilization, types of fossils on the basis of their preservation; concept of Form Genus.

Unit-3. Introductory idea of correlation and stratigraphy; stratigraphic deductions based on plant fossils.

Unit-4. Age of the earth, Geologic Time Scale, major events of plant life through geologic time.

Practical

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

Core Course 9 : Biomolecules and Cell Biology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

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; Triacyl glycerols structure, functions and properties; Phosphoglycerides.

Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Biological roles of proteins in plants.

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.

Unit 2: Bioenergetics

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.

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 theory), Michaelis - Menten equation, enzyme inhibition and factors affecting enzyme activity.

Practical

1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. 2. Study of plant cell structure with the help of epidermal peel mount of Onion/*Rhoeo* 3. Demonstration of the of protoplasmic streaming in *Hydrilla* leaf. 4. Measurement of cell size by the technique of micrometry.

Core Course 10 : Molecular Biology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 1: Nucleic acids: Carriers of genetic information

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

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

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. The Nucleosome Chromatin structure-Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.

Unit 3: The replication of DNA

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.

Unit 4: Central dogma and genetic code lectures)

Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)

Practical

1. Preparation of LB medium and raising *E. coli*. 2. Study of genomic DNA from *E. coli* through photographs 3. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).

SEC-2: Biofertilizers

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher : Dr. Quazi Taheruzzaman

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* uro/*Zae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

2nd Module (April to June)

Core Course 8: Palaeobotany & Palynology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit-5. Microsporogenesis; Spore/pollen morphology with reference to polarity, size, shape, symmetry, aperture and sculpture.

Unit-6. Organization of orthotropous ovule, types of ovules; megasporogenesis.

Unit-7. Pollination: Types and contrivances.

Practical

2. Pollen morphological studies of *Impatiens* and *Hibiscus* pollens from prepared slides.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course 9 : Biomolecules and Cell Biology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit4: The cell

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

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

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 of proteins and lipids; Golgi Apparatus - organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

Unit 7: Cell division

Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.

Practical

5. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiffs (PAS) staining technique. 6. Study the phenomenon of plasmolysis and deplasmolysis. 7. Study the effect of organic solvent and temperature on membrane permeability. 8. Study different stages of mitosis and meiosis of *Allium cepa*.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course 10 : Molecular Biology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

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.

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.

Unit 6: Translation lectures)

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.

Practical

4. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs. 5. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments) 6. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

SEC-2: Biofertilizers

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher : Dr. Quazi Taheruzzaman

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 bio-degradable municipal, agricultural and Industrial wastes - biocompost making methods, types and method of vermicomposting field Application.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Semester V

Ist Module (July to September)

Core Course 11 : Plant Physiology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 1: Plant-water relations

Water Potential and its components, water absorption by roots, 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.

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.

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.

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.

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method. 2. Determination of water potential of given tissue (potato tuber) by weight method. 3. Study of the effect of Humidity and light on the rate of transpiration in excised twig/leaf. 4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.

Core Course 12 : Plant Metabolism

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 1: Concept of metabolism

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes). 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, Cr pathways; Crassulacean acid metabolism; Factors affecting CO₂ reduction.

Unit 2: Carbon assimilation

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.

Practical

1. Chemical separation of photosynthetic pigments. 2. To study the effect of light intensity on the rate of photosynthesis. 3. Effect of carbon dioxide on the rate of photosynthesis. 4. To compare the rate of respiration in different parts of a plant.

Discipline Specific Elective

DSE 1: Reproductive Biology of Angiosperms

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 1: Introduction

History and scope.

Unit 2: Reproductive development

Induction of flowering. Flower development: genetic and molecular aspects.

Unit 3: Anther and pollen biology

Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, NPC system; Palynology and scope (a brief account); Pollen viability, storage and Germination.

Unit 4: Ovule

Structure; Types; Female gametophyte- megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type); Organization and ultrastructure of mature embryo sac.

Practical

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. 2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs), Pollen viability: Tetrazolium test. germination: Calculation of percentage germination in different media using hanging drop method.

3. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/photographs).

DSE- 2 : Biostatistics

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 1: Biostatistics

Definition limitations and uses of statistics. statistical methods - basic principles. Variables - measurements, functions,

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.

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.

Practical

1. Calculation of mean, standard deviation and standard error - Protocol
2. Calculation of correlation coefficient values and finding out the probability

2nd Module (October to December)

Core Course 11 : Plant Physiology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 5: Plant growth regulators

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene, Brassinosteroids (Outline) and Jasmonic acid (Outline).

Unit 6: Physiology of flowering

Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.

Unit 7: Phytochrome , cryptochromes and phototropins

Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

Practical

5. To study the phenomenon of seed dormancy (TTZ).
6. Demonstration on the effect of different concentrations of IAA on *Plant* (Locally Available) coleoptile elongation (IAA Bioassay).
7. To study the induction of amylase activity in germinating grains.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

Core Course 12 : Plant Metabolism

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

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. Receptor-ligand interactions; Second messenger concept, Calcium calmodulin, MAP kinase cascade.

Practical

5. To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources. 6. To study the activity of lipases in germinating oil-seeds and demonstrate mobilization of lipids during germination.
7. Demonstration of absorption spectrum of photosynthetic pigments

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

DSE 1: Reproductive Biology of Angiosperms

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 5: Self incompatibility

Basic concepts; Methods to overcome self- incompatibility: mixed pollination, bud pollination, Intra-ovarian and *in vitro* pollination; Modification of stigma surface, Cybrids, *in vitro* fertilization.

Unit 6: 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; Seed structure and importance.

Units 7: Polyembryony and apomixis

Causes and applications.

Practical

4. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus. 5. Embryogenesis: Study of development of dicot embryo through permanent photographs; dissection of developing seeds for embryos at various developmental stages; electron micrographs

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

DSE- 2 : Biostatistics

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 4: Correlation

Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression

Unit 5: Statistical inference

Hypothesis - simple hypothesis - student 't' test - chi square test.

Practical

3. Calculation of 'F' value and finding out the probability value for the F value.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Semester VI

Ist Module (January to March)

Core Course 13 : Genetics & Plant Breeding

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

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.

Unit 2: Extrachromosomal Inheritance

Chloroplast mutation: Variegation in Four o'clock plant

Unit 3: 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.

Unit 4: Variation in chromosome number and structure

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

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: C1B method. Role of Transposons in mutation. DNA repair mechanisms.

Unit 6: Fine structure of gene

Classical vs molecular concepts of gene;

Practical

1. Meiosis through temporary squash *preparation, Allium cepa*.
2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
3. Chromosome mapping using point test cross data.
4. Pedigree analysis for dominant and recessive autosomal and sex linked traits.

Core Course 14: Plant Biotechnology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

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); 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, 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

Practical

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- Protocol

DSE-3 : Plant Evolution and Biodiversity

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 1: Earliest forms of plant life: the earliest environment; formation of first cell; first prokaryotes; evolution of eukaryotes.

Unit 2: Evolutionary trends: green algae to land plants; non-vascular to vascular plants; gymnosperm to angiosperms; evolution of plants using C4 and CAM photosynthetic pathway.

Unit 3: Phylogeny of plants: the archetypes of plants; evolution in major groups of plants. Phylogeny of flowering plants: Basal flowering plants and Eumagnoliids; Monocots; Eudicots; Core eudicots

Practical

1. Study of vegetative and reproductive structure of aquatic plants (*Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Polysiphonici*). 2. Study of vegetative and reproductive structure of plants of moist shady habitats (*Marchantia*, *Funaria*, *Pteris*). 3. Leaf anatomy of *Suaeda*, *Avicennia* and *Hertiera* (Halophytes)- Photographs

DSE-4 : Horticultural Practices and Post-Harvest Technology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 1: Introduction

Scope and importance, Branches of horticulture; Role in rural economy and employment generation; Importance in food and nutritional security; Urban horticulture and ecotourism.

Unit 2: Ornamental plants

Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental plants [rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents (opuntia, agave and spurges)] Ornamental flowering trees (Indian laburnum, gulmohar, Jacaranda, Lagerstroemia, fishtail and areca palms, semul, coral tree).

Unit 3: Fruit and vegetable crops

Production, origin and distribution; Description of plants and their economic products; Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, chillies and cucurbits).

Unit 4: Horticultural techniques

Application of manure, fertilizers, nutrients and PGRs; Weed control; Biofertilizers, biopesticides; Irrigation methods (drip irrigation, surface irrigation, furrow and border irrigation); Hydroponics; Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Scope and limitations.

Unit 5: Landscaping and garden design

Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Urban forestry; policies and practices.

Field trip and Practical

Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at IARI or other suitable locations (like Horticulture Society of India, Alipore Kolkata) and preparation of Detailed report with suitable photographs.

2nd Module (April to June)

Core Course 13 : Genetics & Plant Breeding

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 7. Population and Evolutionary Genetics

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

Unit-8 : Plant Breeding

Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.

Unit 9: 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.

Unit 10: Inbreeding depression and heterosis

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

Unit 11: Crop improvement and breeding

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

Practical

5. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
7. Testing of goodness of fit with Mendelian mono and dihybrid ratios

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course 14: Plant Biotechnology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

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).

Unit 5: Applications of Biotechnology

Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Golden rice); Improved horticultural varieties (Moon dust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products-Human Growth Hormone; Humulin; Biosafety concerns.

Practical

4. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment. 5. Study of steps of genetic engineering for production of Bt cotton, Golden rice, through photographs. 6. Isolation of plasmid DNA - Protocol

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

DSE-3 : Plant Evolution and Biodiversity Credits

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. Quazi Taheruzzaman

Unit 4: Evolutionary theories: Natural Selection, Group Selection, Neutral theory of molecular evolution.

Core eudicots.

Unit 5: Plant diversity around the world: aquatic and wetland plants; halophytes; plants of low nutrient conditions; plants of moist shady habitats (Sciophytes); epiphytes; climbers; plants of cold or hot arid habitats; island floras.

Practical

4. Morphological and anatomical study of *Hydrilla*, *Vallisneria* and arum. 5. Morphological and anatomical study of plants of arid habitat (*Nerium* and *Pinus*). 6. Field visit and report preparation.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

DSE 4 : Horticultural Practices and Post-Harvest Technology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Dr. K. M. Hasib

Unit 6: Floriculture

Cut flowers, bonsai, commerce (market demand and supply); Importance of flower shows and exhibitions.

Importance of post-harvest technology in horticultural crops; Evaluation of quality traits; Harvesting and handling of fruits, vegetables and cut flowers; Principles, methods of preservation and processing; Methods of minimizing losses during storage and transportation; Food irradiation - advantages and disadvantages; food safety.

Unit 8: Disease control and management

Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.

Unit 7: Post-harvest technology

Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.

Unit 9: Horticultural crops - conservation and management

Documentation and conservation of germplasm; Role of micropropagation and tissue culture techniques; Varieties and cultivars of various horticultural crops; IPR issues; National, international and professional societies and sources of information on horticulture.

Field trip and Practical

Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at IARI or other suitable locations (like Horticulture Society of India, Alipore Kolkata) and preparation of Detailed report with suitable photographs.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Counselling Programme – Final week of June- General outline on the admission and scope of higher education and related jobs

BOTANY