BSc. (Hons) under CBCS Syllabus

Subject : Botany

Semester I

Core Course – I (Theory) (25 marks)

HBOT-CCT-101

Phycology

1. Introduction; thallus organization; origin and evolution of sex in algae; Life cycle patterns. 2. Outline of classification of Lee (2008) up to class and divisions respectively. 3. Cyanophyceae: Salient features, ultrastructure of cell, structure and function of heterocyst; reproduction. 4. Chlorophyceae: Salient features; life history of *Chlamydomonas, Oedogonium*. 5. Charophyceae: Salient features; life history of Chara. 6. Xanthophyceae: Salient features; life history of *Vaucheria*. 7. Bacillariophyceae: Salient features, cell structure and reproduction. 8. Phaeophyceae: Salient features; life history of *Ectocarpus.* 9. Rhodophycee: Salient features; life history of *Polysiphonia*.

Lichenology

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

Core Course – I (Practical) (15 marks)

HBOT-CCT-101

Algae/Phycology -

1. Study of the following genera: *Oscillatoria, Oedogonium, Chara, Vaucheria* and *Ectocarpus.*

2. Identification of all the genera included in the theoretical syllabus by their vegetative and reproductive structures.

Core Course – II (Theory) (25 marks)

HBOT-CCT-102

Mycology (15)

1. Introduction; Salient features - fungal tissue organization, modification of hyphae, structure of fungal cell, homothallism and heterothallism, Para sexuality, cell division.

2. Broad outline classification of Ainsworth and Bisby (1983).

3. Phycomycetes: Salient features; life histories of *Synchytrium*, *Rhizopus*.

4. Ascomycetes: Salient features; life histories of *Saccharomyces* and *Ascobolus*.

5. Basidiomycetes: Salient features with special reference to fruit body types; life histories of *Puccinia* and *Agaricus*.

6. Deuteromycetes: Salient features with special reference to conidial fruit body types.

7. Edible Mushroom – types; cultivation of Oyster and Button mushroom

8. Mycorrhizae (importance in agriculture and forestry).

Phytopathology (10) -

1. Diseases: Definition, classification, concepts of parasitism and saprophytism, Koch's postulate.

2. Structural and biochemical defence mechanism of plants.

3. Control of Plant diseases: Physical, chemical and biological methods.

4. Symptoms, disease cycles and control measures of Late blight of potato, Rust of wheat.

Internal Assessment - 10

Practical

HBOT-CCP-102 (15 marks)

Mycology -

1. Study of the following genera: *Rhizopus, Ascobolus, Agaricus* (gill) and *Polyporus*.

2. Identification of all the macroscopic and microscopic genera included in the theoretical syllabus.

3. Collection, preservation (traditional as well as modern methods) and identification of locally available macro fungi (at least 20 members).

Phytopathology -

1. Study of the following diseases: White rust of crucifer, grey blight of tea, late blight of potato, stem rot of jute.

2. Demonstration on isolation and sub culturing of pathogen.

3. Collection of Phyto pathological specimens from crop fields and preparation of digital herbarium (at least 25 different diseases).

Semester-III

Core Course – V (Theory) (Marks 25)

HBOT-CCT-305

Plant Systematics (25)

1. 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; Documentation: Flora, Monographs, Keys: Single access and Multi-access.

2. Principles and rules (ICN); Ranks and names; Typifcation, author citation, valid publication,

rejection of names, principle of priority and its limitations; Names of hybrids.

3. Classification systems of Bentham and Hooker (up to series) and Engler and Prantl (up to series);

4. Study of the following families: Solanaceae, Acanthaceae, Lamiaceae, Rubiaceae, Poaceae and Orchidaceae

Practical – Marks 15

Core Course – V (Practical) (Marks 15)

HBOT-CCP-305-(15)

Plant Systematics-

Study of morphology of locally available plants of following families including floral formula floral diagram and their identifcation up to genus by following published keys (e.g. Bengal Plants by David Prain(1903): Malvaceae, Fabaceae, Apiaceae, Apocyanaceae, Solanaceae, Schrophulariaceae, Acanthaceae, Lamiaceae, Rubiaceae, Cucurbitaceae and Commelinaceae.

Spot identification up to species mentioning families of all locally available plants included under the theoretical syllabus.

Core Course – VI (Theory) (Marks 25)

HBOT-CCT-306

Phytogeography, Economic Botany and Ethnomedicine

Phytogeography-

Continental drift; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.

Economic Botany-

1. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

2. Cereals: Wheat and Rice (origin, morphology & uses); Brief account of millets.

3. Legumes: Uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.

4. Sources of sugars and starches:

Processing of sugarcane, products and by-products of sugarcane industry.

Potato – Propagation & uses.

5. Spices:

Listing of important spices, their family and part used. Economic importance with special reference to fennel, large cardamom, clove and black pepper.

6. Beverages: Tea, Coffee (processing & uses)

7. Sources of oils and fats:

General description, classification, their uses and health implications: groundnut, coconut, soybean, mustard (Botanical name, family & uses).

Essential Oils: General account, comparison with fatty oils & their uses.

8. Natural Rubber: Para-rubber: tapping, processing and uses.

9. Drug-yielding plants:

Therapeutic and habit-forming drugs with special reference to *Cinchona, Digitalis, Papaver* and *Cannabis*; Tobacco (Processing, uses and health hazards).

10. Timber plants: General account with special reference to teak and pine.

Ethnomedicine-

1. Ethnomedicine- definition

2. Plants used by tribes of North Bengal: *Eclipta prostrata; Sesbania grandiflora;Vitex negundo; Coccinia grandis (=indica); Allostonia scholaris, Artemisia vulgaris.*

Core Course – VII (Theory) (Marks 25)

HBOT-CCT-307

Morphology and Plant Anatomy

Morphology of Angiosperms-

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

Plant Anatomy –

1. Cell wall: Structure and thickenings.

2. Tissue: Definition, organization of shoot and root apices, mechanical tissue and their distribution in plant bodies.

Tissue system – Epidermal (multiple epidermis, bulliform cells, stomatal types, trichoblasts, glandular hairs), vascular (leaf gap, branch gap, types of vascular bundles) system; Stele types.

3. Secondary growth: normal secondary growth in dicot shoot and root, concept of growth ring, ring and diffused porous wood, heart wood and sap wood, Periderm, Lenticel, commercial cork, bark, polyderm and rhytidome.

Internal Assessment- 10 Marks

Core Course – VII (Practical)

HBOT-CCP-307 (Marks 15)

Morphology –

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

Plant Anatomy –

1. Study of the anomalous structures of stems of the following genera: *Bignonia, Dracaena, Boerhaavia and Strychnos.*

2. Microscopic identification of the followings: Primary structure of Sunflower and maize stem and gram and *Canna* root, bulliform cells, stomatal types, lenticels, raphides (acicular and sphaeraphides), cystolith.

3. Maceration of wood elements of *Cucurbita* and *Pinus* stem and their microscopic examination.

Core Course – XI (Theory)
(Marks 25)
HBOT-CCT-511

Microbiology

Biology & Diversity of Virus

1. Nature and origin of virion, viroid, virusoid and prions.

2. Nomenclature and classification

3. Structure & chemistry of viruses- capsid and their arrangements, types of envelops and their composition, molecular organization of virion with special reference to TMV and HIV.

4. Management of plant viruses following classical and modern techniques.

5. Viral replication: Lytic cycle in T even phages, lysogeny in lambda phage.

Biology & Diversity of Bacteria

1. Bacterial morphology and ultra-structure.

2. Bacterial taxonomy and phylogeny, major groups of Bacteria.

3. Bacterial Growth: growth curve, factors affecting growth; Nutritional types.

5. Bacterial Genetics: Replication of genetic material in bacteria; types of recombination-conjugation, transformation and transduction.

6. Immunology: Cells and organs of immune system, types, antigen (chemical nature and types),

immunoglobulins (structure and types), brief idea about hypersensitivity and vaccine.

7. Medical Microbiology: Water, food–borne diseases: causal organisms, symptoms,

control measures.

8. Industrial microbiology: Industrial production of ethanol, penicillin.

Internal Assessment-10 Marks

Core Course – XI (Practical)
(15 Marks)
HBOT-CCP-511

Microbiology

1. Field study of symptoms of diseases of economically important plants caused by bacteria & virus, and preparation of digital herbarium.
2. Survey and digital recording of locally available traditional fermented foods and methods of preparation.
3. Preparation of bacterial media- slants, stabs and plates.
4. Isolation of soil bacteria by serial dilution agar plate method.
5. Sub-culturing of bacteria.
6. Staining of bacteria: simple, negative, differential and endospore staining.

   Study of morphology of microorganisms present in curd

Core Course – XII (Theory) (Marks 25)

HBOT-CCT-512

Cell Biology and Genetics

Cell Biology

1: Origin of eukaryotic cell (Endosymbiotic theory). 2: structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; 3: Cell organelles Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. Cytoskeleton: general over view of structure and function. Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast. Endomembrane system: Endoplasmic Reticulum – Structure, function; Smooth ER and lipid synthesis; Golgi apparatus – organization, protein glycosylation, overview of protein sorting and export from Golgi apparatus; Lysosomes 4: Cell division Phases of eukaryotic cell cycle, Regulation of cell cycle- checkpoints, role of protein kinases.

Genetics

1: Mendelian genetics and its extension Mendelism: Principles 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; Polygenic inheritance. 2: Extrachromosomal Inheritance, Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; 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; Numerical based on gene mapping; Sex Linkage. 4: Overview of Variation in chromosome number and structure Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy 5: Gene mutations Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents).

Core Course – (XII) (Marks 15)

HBOT-CCP-512

Cell Biology -

1. Study of plant cell structure with the help of epidermal peel mount of Onion/*Rhoeo*

2. Measurement of cell size by the technique of micrometry.

3. Study the phenomenon of plasmolysis and deplasmolysis.

4. Study the effect of organic solvent and temperature on membrane permeability.

5. Study different stages of mitosis, karyotype and mitotic index of *Allium cepa* by aceto-orcein squash technique.

6.Study of meiosis of *Allium cepa* and *Rhoeo* by aceto-carmine smear technique.

Genetics-

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.

2. Pedigree analysis for dominant and recessive autosomal and sex-linked traits.

3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1,

12:3:1, 9:3:4).

Discipline Specifc Elective-I

Ethnobotany

(Credits: Theory 4,Practical 2)

Theory- 25 Marks

Ethnobotany

1. Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major ethnic groups of North Bengal, and their life styles. Plants used by the tribal: a) Food plants b) intoxicants and beverages.

2. Methodology of Ethnobotanical studies

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

3. Role of ethnobotany in modern Medicine

Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo.* d) *Gloriosa superba* e) *Tribulus terrestris* f) *Indigo feratinctoria.* Role of ethnobotany in modern medicine with special example *Rauwolfia sepentina, Artemisia, Withania.*

Role of ethnic groups in conservation of plant genetic resources.

4. Ethnobotany and legal aspects

Ethnobotany as a tool to protect interests of ethnic groups. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

5. Ethnobotany in the North Bengal.

Discipline Specifc Elective-II

Plant Breeding

(Credits: Theory-4, Practical-2)

THEORY- 25 Marks

1: Plant Breeding

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

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.

3: Inbreeding depression and heterosis

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

4: Crop improvement and breeding

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

Practical-15 Marks

1. Hybridization techniques

SEMESTER – I

GE-I(Algae, Fungi and Bryophyta)

Theory –

Algae -General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae (Lee – 2008);Morphology and life-cycles of the following: *Nostoc*, *Fucus*. Economic importance of algae.

Fungi -Introduction- General characteristics, cell wall composition, nutrition, reproduction and classification (Ainsworth and Bisby-1983)

General characteristics and life cycle of *Mucor* (Zygomycota), *Penicillium* (Ascomycota), *Agaricus* (Basidiomycota) and Deuteromycetes;

Lichens: General account, reproduction and significance;

Bryophytes -

General characteristics, Classification (Proskauer, 1957), Morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Economic importance of bryophytes.

Internal assessment – (10)

Practical (15)

(Algae, Fungi and Bryophyta)

Study of following genera: *Oscillatoria, Oedogonium, Mucor, Agaricus; Marchantia, and Funaria***.**

Identifications of all the genera included in the theoretical syllabus. Wet specimen collection and preservation.

SEMESTER – III GEI

Theory –

Plant Taxonomy and Plant Anatomy- Marks (25)

Plant Taxonomy-

1. Introduction to plant taxonomy-Identification, Classification, Nomenclature.

2. Identifcation

Functions of Herbarium, important herbaria and botanical gardens of the world and India;

3. Taxonomic hierarchy

Ranks, categories and taxonomic groups

4. Botanical Nomenclature-Principles and rules (ICN); ranks and names; binominal system, typifcation, author citation, valid publication, rejection of names, principle of priority and its limitations.

5.Classifcation-Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (up to series).

Plant Anatomy-

1: Meristematic and permanent tissues

Root and shoot apical meristems; Simple and complex tissues.

2: Organs

Structure of dicot and monocot root stem and leaf.

3: Secondary Growth

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood).

Internal assessment – (10)

Practical –

Plant Taxonomy-

1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/s and systematic position according to Bentham & Hooker's system of classification):
Brassicaceae -*Brassica, Alyssum / Iberis;* Asteraceae -*Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax;* Solanaceae -*Solanum sp, Withania;* Lamiaceae -*Salvia, Ocimum*; Liliaceae -*Asphodelus / Lilium / Allium.*

2. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Plant Anatomy-

1. Study of meristems through permanent slides and photographs.

2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)

3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).

4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).

5. Leaf: Dicot and Monocot leaf (only Permanent slides).