

No question should be given from the highlighted portions of the syllabus as recommended by the external and internal members of UG BOS in Botany.

Phycology and Microbiology (BBOTCCHC101)

Syllabus:

Unit 1: Introduction to microbial world Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine). (7 lectures)

Unit 2: Viruses Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T4-phage), lytic and lysogenic cycle; RNA virus (TMV). (7 lectures)

Unit 3: Bacteria Discovery, general characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; vegetative and Reproductive structure - asexual and recombination (conjugation, transformation and transduction). (7 lectures)

Unit 4: Algae General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry. (11 lectures)

Unit 5: Cyanophyta and Xanthophyta Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of *Nostoc* and *Vaucheria*. (8 lectures)

Unit 6: Chlorophyta and Charophyta General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Chlamydomonas*, *Volvox*, *Oedogonium*, *Chara*. Evolutionary significance of

Prochloron. (8 lectures)

Unit 7: Phaeophyta and Rhodophyta Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of Ectocarpus, **Fucus** and Polysiphonia. (12 lectures)

Practical

Microbiology

1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.
2. Types of Bacteria to be observed from **temporary/permanent slides**/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
3. **Gram staining**.
4. Study of bacteria from curd **and root nodule**.

***** Highlighted portions could be less emphasized for this academic session**

Biomolecules and Cell Biology(BBOTCCHC102)

Syllabus:

Unit 1: Biomolecules (20 lectures) 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 quarternary; **Protein denaturation and biological roles of proteins**. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; **Structure of tRNA**.

Unit 2: Bioenergetics (4 lectures) Laws of thermodynamics, concept of free energy,

endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule.

Unit 3: Enzymes (6 lectures) 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.

Unit 4: The cell (4 lectures) Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).

Unit 5: Cell wall and plasma membrane (4 lectures) 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. Extracellular matrix

Unit 6: Cell organelles (16 lectures) 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 (6 lectures) Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases

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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/Crinum*.
3. Measurement of cell size by the technique of micrometry.
4. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).
5. Study of cell and its organelles with the help of electron micrographs.
6. Preliminary idea of Cytochemical staining of : DNA - Aceto orcein and cell wall in

the epidermal peel of onion.

7. Study the phenomenon of plasmolysis and deplasmolysis.

8. Study different stages of mitosis and meiosis using photographs/animation.

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Biodiversity (Microbes, Algae, Fungi and Archegoniate) [BBOTCCRC101]

Syllabus:

Unit 1: Microbes (10 Lectures) Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2: Algae (12 Lectures) General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life cycles of the following: **Nostoc, Chlamydomonas**, Oedogonium, **Vaucheria, Fucus**, Polysiphonia. Economic importance of algae.

Unit 3: Fungi (12 Lectures) Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of Rhizopus (Zygomycota) **Penicillium, Alternaria** (Ascomycota), Puccinia, Agaricus (Basidiomycota); Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Unit 4: Introduction to Archegoniate (2 Lectures) Unifying features of archegoniate, **Transition to land habit, Alternation of generations.**

Unit 5: Bryophytes (10 Lectures) General characteristics, adaptations to land habit, Classification, **Range of thallus organization**. Classification (up to class), morphology, anatomy and reproduction of Marchantia and Funaria. (Developmental details not to be included). **Ecology and economic importance of bryophytes with special mention of Sphagnum.**

Unit 6: Pteridophytes (8 Lectures) General characteristics, classification, Early land

plants (Cooksonia and Rhynia). Classification (up to family), morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

Unit 7: Gymnosperms (6 Lectures) General characteristics, classification.

Classification (up to order), morphology, anatomy and reproduction of Cycas and Pinus. (Developmental details not to be included). Ecological and economic importance.

Practical

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Idea of Gram staining
4. Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Oedogonium, Vaucheria, Fucus* and Polysiphonia through photographs temporary preparations and permanent slides. (* Fucus - Specimen and permanent slides)
5. Rhizopus and Penicillium: Asexual through photographs stage from temporary mounts and sexual structures through permanent slides.
6. Alternaria: Specimens/photographs and tease mounts.
7. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of Agaricus.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) photographs only.
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
11. Marchantia- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae Photographs only v.s. antheridiophore, archegoniophore, l.s. sporophyte- (Photographs only)
12. Funaria- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores

photographs only showing antheridial and archegonial heads, l.s. capsule and protonema. (Photographs only)

13. Selaginella- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll Photographs only l.s. strobilus (Photographs only)

14. Equisetum- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).

15. Pteris- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).

16. Cycas- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).

17. Pinus- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, , l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores Photographs only. l.s. female cone, t.l.s. & r.l.s. stem (Photographs only).

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Plant Ecology and Taxonomy(BBOTGEHC6)

Syllabus:

Unit 1: Introduction (2 lectures)

Unit 2: Ecological factors (10 lectures) Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: **Variation Optimal and limiting factors; Shelford law of tolerance.**

Adaptation of hydrophytes and xerophytes

Unit 3: Plant communities (6 lectures) Characters; Ecotone and edge effect;

Succession; Processes and types

Unit 4: Ecosystem (8 lectures) Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity;

Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

Unit 5: Phytogeography (4 lectures) Principle biogeographical zones; Endemism

Unit 6 Introduction to plant taxonomy (2 lectures) Identification, Classification, Nomenclature.

Unit 7 Identification (4 lectures) Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

Unit 8 Taxonomic evidences from palynology, cytology, phytochemistry and molecular data. (6 lectures)

Unit 9 Taxonomic hierarchy (2 lectures) Ranks, categories and taxonomic groups

Unit 10 Botanical nomenclature (6 lectures) Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Unit 11 Classification (6 lectures) Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Unit 12 Biometrics, numerical taxonomy and cladistics (4 lectures) Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

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, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test (idea only).
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (one each) [idea only]. (b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method (Idea only)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law (idea only).

7. 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): Brassicaceae - Malvaceae - *Sida*, *Abutilon*; Asteraceae - *Sonchus/Launaea*, *Vernonia/Ageratum*, *Eclipta/Tridax*; Solanaceae - *Solanum nigrum*, *Nicotiana*; Lamiaceae - *Leucas*, *Ocimum*;
Liliaceae - *Lilium* / *Allium*.

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

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