

UNIT-1

Bacteria : Structure, nutrition, reproduction and economic importance; general account of cyanobacteria (with reference to *Nostoc*).

Algae: General characters, classification (upto classes) and economic importance; important features and life-history (excluding development) of *Volvox*, *Oedogonium* (Chlorophyceae), *Vaucheria* (Xanthophyceae), *Ectocarpus* (Phaeophyceae) and *Polysiphonia* (Rhodophyceae).

Viruses: General account of Viruses including structure of TMV and Bacteriophages.

Fungi: General characters, classification (upto classes) and economic importance; important features and life-history of *Phytophthora* (Mastigomycotina), *Mucor* (Zygomycotina), *Penicillium* (Ascomycotina), *Puccinia*, *Agaricus* (Basidiomycotina), *Colletotrichum* (Deuteromycotina); General account of Lichens.

UNIT-II

The Cell Envelopes: Structure and functions of Cell Wall and Plasma Membrane.

Ultrastructure and function of nucleus, Golgi Apparatus, Endoplasmic Reticulum, Chloroplast, Mitochondria, Lysosomes, Peroxisomes and Vacuoles.

Cell Division: Mitosis and Meiosis.

Chromosome: Morphology, organization, ultrastructure of Centromere and Telomere; Chromosomal alterations- deletions, duplications, translocations, inversions; Variations in chromosome number-aneuploidy, polyploidy; sex chromosomes and sex determination.

UNIT-III

Bryophyta- General characters, classification (upto classes), alternation of generations, structure and reproduction (excluding development) of *Marchantia* (Hepaticopsida), *Anthoceros* (Anthocerotopsida), *Funaria* (Bryopsida).

Pteridophyta- General characters, classification (upto classes), alternation of generations, structure and reproduction (excluding development) of *Rhynia* (Psilopsida), *Selaginella* (Lycopsida), *Equisetum* (Sphenopsida) and *Pteris* (Pteropsida).

UNIT-IV

Genetic Material: DNA the genetic material, DNA structure and replication, DNA-Protein interaction, the Nucleosome Model, Genetic Code, Satellite and Repetitive DNA.

Genetic Inheritance: Mendelism: Laws of segregation and Independent Assortment; Linkage Analysis; Allelic and non-allelic interactions.

Genetic Variations: Mutations- spontaneous and induced; transposable genetic elements; DNA damage and repair.

Gene Expression: Modern concept of gene; RNA; Ribosomes; transfer of genetic information- transcription and translation (Protein Synthesis); regulation of gene expression in prokaryotes and eukaryotes; 1-D, 2-D and 3-D structure of Proteins.

Extra Nuclear Inheritance: Presence and function of Mitochondrial and Plastid DNA; Plasmids.

UNIT-V

General characters and diversity of Gymnosperms (seed plants without fruits).

Pilger and Melchior's (1954) system of classification.

Geological Time Table; Evolution of Seed Habit.

Palaeobotany-Fossils and Fossilization (Processes involved, types of Fossils and Importance of

Morphology and anatomy of root, stem leaf/leaflet and reproductive parts including mode of reproduction, life-cycle and economic importance of the following:

Cycas

Pinus

Ephedra

General characters of Angiosperms including primitive angiosperms (Amentiferae, Ranales, Magnoliales).

Taxonomy and Systematics, fundamental components of taxonomy (identification, classification, description, nomenclature and phylogeny).

Role of chemotaxonomy, cytotaxonomy and taximetrics in relation to taxonomy.

Botanical Nomenclature, principles and rules, principle of priority. Type concept, taxonomic ranks.

Keys to identification of plants.

Flower and Types of Inflorescence.

Salient features of the systems of classification of angiosperms proposed by Bentham & Hooker and Engler & Prantl.

Diversity of Flowering Plants: Diagnostic features and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Euphorbiaceae, Rutaceae, Leguminosae, Apiaceae, Asclepiadaceae, Lamiaceae, Solanaceae, Asteraceae, Liliaceae and Poaceae.

UNIT-VI

Diversity in plant forms-annuals, biennials and perennials. Tissues-meristematic and permanent (simple and complex).

The Shoot system-shoot apical meristem and its histological organizations (monocot and dicot stem); Cambium-structure and functions.

Secondary growth in dicot stem; characteristics of growth rings; sap wood and heart wood, periderm; Anomalous secondary growth (*Dracaena*, *Boerhaavia* and *Achyranthes*)

Leaf-Types of leaves (simple and compound); phyllotaxy.

Epidermis-uniseriate and multiseriate, epidermal appendages and their morphological types. Anatomy of typical Monocot and Dicot leaf and cell inclusions in leaves; leaf abscission. Stomatal apparatus and their morphological types.

Root system- the root apical meristem; the histological organization (monocot and dicot root). Secondary growth in dicot root.

Structural modifications in roots- storage (*Beta*), Respiratory (*Rhizophora*), Epiphytic (*Vanda*).

Origin, distribution, botanical description, brief idea of cultivation and uses of the following:

Food plants- Cereals (Rice, Wheat and Maize).

Pulses- (Gram, Arhar and

Pea). **Vegetables-**

(Potato, Tomato and

Onion). **Fibers-** Cotton,

Jute and Flax.

Oils- Groundnut, Mustard and Coconut.

Morphology of plant part used, brief idea of cultivation and uses of the following:

Spices- Coriander, Ferula, Ginger, Turmeric, Cloves.

Medicinal Plants- *Cinchona*, *Rauwolfia*, *Atropa*, *Opium*, *Cannabis*, Neem.

Botanical description and processing of:

Beverages- Tea and Coffee.

Rubber- *Hevea*.

Sugar- Sugarcane.

General account and sources of timber; energy plantations and bio-fuels.

UNIT-VII

Flower-a modified shoot; functions of various floral parts.

Microsporangium, its wall and dehiscence mechanism.

Microsporogenesis, pollen grains and its structure (pollen wall).

Pollen-pistil interaction; self incompatibility.

Pollination (types and agencies); pollen germination (microgametogenesis).

Male gametophyte.

Structure of Megasporangium (ovule), its curvatures; Megasporogenesis and Megagametogenesis.

Female gametophyte (mono-, bi- and Tetrasporic).

Double fertilization.

Endosperm types and its biological importance.

Embryogenesis in Dicot and Monocot; polyembryony.

Structure of Dicot and Monocot seed.

Fruit types; dispersal mechanisms in fruits and seeds.

UNIT-VIII

Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration.

Mineral Nutrition: Essential macro and micro elements and their role; mineral uptake; deficiency symptoms.

Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation.

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C₄ pathway; CAM plants; photorespiration.

Respiration: ATP—the biological energy currency; aerobic and anaerobic respiration; Krebs cycle; electron transport mechanism (chemi-osmotic theory); redox -potential; oxidative phosphorylation; pentose phosphate pathway.

Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.

UNIT-IX

Introduction to Ecology: Definition; scope and importance; levels of organization.

Environment: Introduction; environmental factors- climatic (water, humidity, wind, light, temperature), edaphic (soil profile, physico-chemical properties), topographic and biotic factors (species interaction).

Adaptations of plants to water stress and salinity (morphological and anatomical features of hydrophytes, xerophytes and halophytes).

Population Ecology: Basic concept; characteristics; biotic potential, growth curves; ecotypes and ecads.

Community Ecology: Concepts; characteristics (qualitative and quantitative-analytical and synthetic); methods of analysis; ecological succession.

Ecosystem: Structure (components) and functions (trophic levels, food chains, food webs, ecological pyramids and energy flow)

Biogeochemical Cycles: carbon and nitrogen; hydrological (water) cycle.

Phyto-geography: Phyto-geographical regions of India; vegetation types of India (forests).

Environmental Pollution: Sources, types and control of air and water pollution.

Global Change: Greenhouse effect and greenhouse gases; impacts of global warming; carbon trading.

UNIT-X

Basics of Enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and co-factors; regulation of enzyme activity; mechanism of action.

Growth and development: Definitions; phases of growth and development; Plant hormones- auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of their discovery, mechanism of action; photo-morphogenesis; phytochromes and their discovery, physiological role and mechanism of action.

Lipid metabolism: Structure and functions of lipids; fatty acid biosynthesis; B-oxidation; saturated and unsaturated fatty acids; storage and mobilization of fatty acids.

Nitrogen metabolism: Biology of nitrogen fixation; importance of nitrate reductase and its regulation; ammonium assimilation.

Genetic engineering and Biotechnology: Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis; biology of Agrobacterium; vectors for gene delivery and marker genes.