SYLLABUS -BOTANY

Section- C

1. MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY:

A. Composition structure and functions of Biomolecules (carbohydrates, lipids proteins, nucleic acids) Nucleotides Amino Acids & Vitamins stability of protein & nucleic Acid structures

B. Bioenergetics : Glycolsis; Oxidative phosphorylation coupled reaction, group transfer biological energy transducers.

C. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.

2. CELLULAR ORGANIZATION:

A. Prokaryotes and Eukaryotes, evolutions of eukaryotic cell Membrane structure and function : popular models of plasma membrane, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membrane.

B. Structural organization and function of cell wall & intracellular organelles : nucleus, Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, ribosome, vacuole.

C. Organization of genes and chromosomes: interrupted genes, gene families, structure of chromatin and chromosomes, repetitive DNA, heterochromatin, euchromatin, transposons.

D. Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle.

E. DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, DNA damage and repair mechanisms extra chromosomal replicons.

F. RNA synthesis and processing: Transcription factors, machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases,

capping elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, RNA transport.

G. Protein synthesis and processing: Central dogma of molecular Biology: Transcription & translation, translational inhibitors, post-translational modification of proteins.

H. Control of gene expression at transcription and translation level: in prokaryotes and eukaryotes, role of chromatin in regulating gene expression and gene silencing.

3. DEVELOPMENTAL BIOLOGY (EMBRYOLOGY) :

A. Microsporogenesis microgametogenesis, ovule structure & megasporogenesis, embryosac development pollination incompatability double fertilization, endosperm and embryo development seed formation and germination.

B. Morphogenesis and organogenesis in plants: Organization of root and shoot apical meristem, root and shoot development, leaf development and phyllotaxy; transition to floral meristems and floral development in Arabidopsis and Antirrhinum.

4. PLANT PHYSIOLOGY :

A. Movement of materials - Diffusion, Osmosis, Chemiosmosis.

B. Photosynthesis : Light harvesting complexes, mechanisms of electron transport, photoprotective mechanisms; CO_2 fixation-C_3, C_4 and CAM pathways.

C. Respiration and photorespiration : Citric acid cycle, plant mitochondrial electron transport and ATP synthesis, photorespiration.

D. Nitrogen metabolism: Nitrate and ammonium assimilation; aminoacid biosynthesis.

E. Plant hormones: Biosynthesis, storage, breakdown and transport; physiological effects and mechanism of action aging and senescence.

F. Sensory photobiology: structure functions and mechanism of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

G. Solute transport and photoassimilate translocation : Update transport and translocation of water, ions solutes and macromolecules from soil, through cells across membranes & through xylem and phloem, mechanism of loading and unloading of photoassimilates, transpiration.

H. Secondary metabolites, Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

I. Stress physiology Responses of plants to biotic (pathogen and insects) and a biotic (water temperature and salt) stresses, mechanism of resistance to biotic stress and tolerance to biotic stress.

5. BIOLOGY AND DIVERSITY OF VIRUSES BACTERIA FUNGI ALGAE :

A. Virology General account of viruses, characteristics, ultra structure chemical nature replication, transmission.

B. Bacteriology General account of bacteria ultrastructure, nutrition, reproduction economic importance, Cyanobacteria salient features and biological importance.

C. Mycology General characters and classification of fungi cellular organization, cell wall composition, nutrition reproduction, Heterothallism and parasexuality. General account of mostigomycotina, Zygomycotina Ascomycotina, Basidiomycotina and Deuteromycotina. Fungi in industry, medicine and as food. Mycorrhiza, Fungal deseases in plants. Host parasite relationships. mycotoxins, and afflatoxins.

D. Phycology: Habitat , thallus organization cell ultrastructures reproduction in Algae criteria for classification. General account of Protochlorophyta, chlorophyta, charophyta xanthophyta, Bacillariophyta, phaeophyta and Rhodophyta, Algal blooms, Algae as food, industrial uses of algae.

6. BIOLOGY AND DIVERSITY OF EBBYOPHTTA (BROPHYTA, PTERIDOPHYTA, GYMNOSPERM) :

A. Bryophyta : Distribution, general characters and reproduction of bryophytes, General account of marchantiales, jungermanniales anothocerotales, sphagnales, funariales and polytrichales, Ecological and economic importance of Bryophytes.

B. Pteridophyta : Morphology anatomy reproduction and life history of pteridophyta. Evolution of stele, heterospory and origin of seed habit. General account of Psilopsida Lycopsida, Sphenopsida and pteropsida.

C. Gymnosperms Evolution, Characters, Classification and economic importance of Gymnosperms.

General account of Pteridospermales, Cycadeoidales, cordaitales, cycadales ginkgoales, coniferales, ephedrales welwitschiales and Gnetales.

7. MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS :

A. Origin of angiosperms.

B. Morphology of stamen and carpel, their evolution.

C. Morphology and anatomy of plant parts. Tissue system, secondary Growth & Anomalous structures.

D. Concept of species and hierarchical taxa, Salient features of international code of Botanical Nomenclature.

Taxonomic tools :Herbaria, Flora, Botanical Gardens and keys.

E. Systems of angiosperm classification, their relative merits and demerits.

F. Ethnobotanical studies, Economic botany.

8. ECOLOGY & BIOGEOGRAPHY :

A. The Environment : Physical environment, biotic environment, biotic and abiotic interactions.

B. Habital and Niche: Concept of habital and niche, niche width and overlap; fundamental and realized niche; resource partitioning character displacement.

C. Population Ecology : Characteristics of a population: population growth curves, population regulation: life history strategies (r and k selection)

D. Species interactions : Types of interactions interspecific competitions herbivory carnivory, symbiosis.

E. Community ecology : Nature of communities, community structure and attributes, levels of species diversity and its measurement, ecotone, ecotypes, Ecads .

F. Ecological succession : Types, mechanisms, changes involved in succession, concept of climax.

G. Ecosystem: Structure and function, energy flow and mineral cycling (C.N.P), primary production and decomposition. Structure and function of some Indian ecosystems, (forest & grassland) and aquatic (freshwater, marine, estuarine) wetland.

H. Major terrestrial biomes,
Phytogeographical zones of India.

I. Applied Ecology : Environmental pollution, global environmental change, biodiversity status, monitoring and documentation major drivers of biodiversity change, biodiversity management approaches. Endemism and hotspots.

J. Conservation biology : Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (soil conservation & watershed management, Biosphere reserves)

9. EVOLUTION :

A. Emergence of evolutionary thoughts : Lamarck, Darwin, concepts of variation, adaptation, struggle, fitness and natural selection. Mendelism, spontancity of mutations, the evolutionary synthesis.

B. Origin of cells and unicellular evolution : Origin of basic biological molecules, abiotic synthesis of organic monomers and polymers, concept of oparin and Haldane. Experiments of Miller (1953).

C. Paleobotany and evolutionary history : the evolutionary time scale, years, periods, epochs, major events in the evolutionary time scale and major groups of plants, Origin of unicellular and multicellular organisms.

D. Fosssils types & formation.

10. BIOTECHNOLOGY AND GENETIC ENGINNERING :

A. Microbial fermentation and production of small and macro molecules.

B. Tissue and cell culture methods for plants.

C. Transgenic plants

D. Phytoremediation

E. Recombinant DNA technology, Isolation and purification of RNA, DNA (Genomic and plasmid) and proteins, different separation methods, analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, isoelectric focusing gels, DNA finger printing.

F. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems expression of recombinant proteins using bacterial, animal and plant vectors, isolation of specific nucleic acid sequences, generation of genomic and C-DNA libraries in plasmid, phage, cosmid, BAC and YAC vectors;

G. In vitro mutagenesis and deletion techniques, geneknockout in bacterial and eukaryotic organisms, Protein sequencing methods, detection of post translation modification of proteins; DNA sequencing methods, strategies for genome sequencing, methods for analysis of gene expression at RNA and protein level, large scale expression analysis such as micro array based techniques, isolation, separation and analysis of carbohydrate and lipid molecules, RFLP, RAPD and AFLP techniques.

H. Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flourimetry and immunefluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH, GISH.

I. BIOPHYSICAL METHODS: Analysis of biomolecules using UV, visible fluorescence circular dichroism, NMR and ESR spectroscopy, structure determining using X-Ray differaction and NMR; analysis using scattering. Different types of mass spectrometry and surface plasma resonance methods.

J. Microscopic techniques, Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, Freeze etching and freeze fracture methods for EM, image processing methods in microscopy.

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