LESSON PLAN

[UNDER 1+1+1 SYSTEM]

PART - I

PAPER I (THEORETICAL)

ALGAE

No of Classes allotted - 10

DR. NANDINI CHAKRABARTI & DR. ARKAJO MAJUMDAR

1. *General account* :
1.1. Thallus organization, Structure of algal cell, 1.2. Ultrastructure of Plastids and Flagella, 1.3. Origin and evolution of sex, 1.4. Life cycle patterns.
2. *Classification* :
2.1. Criteria and basis of Fritsch's classification
2.2. Classification by Lee (2008) upto phylum with examples
2.3. Salient features of Cyanobacteria, Rhodophyta, Chlorophyta , Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta.
3. Cyanobacteria :
3.1. Ultrastructure of cell, 3.2. Heterocyst - structure and function.
4. *Bacillariophyta* :
4.1. Cell structure, 4.2. Cell division, 4.3. Auxospore formation in Centrales and Pennales.
5. *Life History* :
5.1. *Chlamydomonas, 5.2. Oedogonium*, 5.3. *Chara*, 5.4. *Ectocarpus*, 5.5. *Polysiphonia*.
6. *Applied phycology* :
6.1. Algae as food and source of phycocolloid (Agar-agar, Algin, Carrageenan), 6.2. Diatomite, 6.3. Algal toxin, 6.4. Algal Biotechnology – potential of microalgae for SCP, β-carotene, Biodiesel.

MICROBIOLOGY

No of Classes allotted - 20

DR. RUPAK KUMAR SENGUPTA

1. *Virus* :
1.1. Plant virus- types, 1.2. Transmission and translocation of Plant virus, 1.3. TMV- Physicochemical characteristics and Multiplication, 1.4. One step growth curve, 1.5. Lytic cycle (T4 phage) and Lysogenic cycle (Lambda phage), Significance of lysogeny, 1.6.Viroids and Prions.
2. *Bacteria* :
2.1. Distinguishing features of Archaea and Bacteria, 2.2. Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae, 2.3. Bacterial growth curve and generation time, 2.4.Flagella (ultrastructure) & Pilli, 2.5. Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, 2.6. Bacterial genome and plasmid, 2.7. Endospore - formation, structure and function,2.8.Genetic Recombination (a) Transformation – with special emphasis on Natural and Induced competence and DNA uptake, (b) Conjugation— F- factor, $F^+ \times F^-$, Hfr $\times F^-$, concept of F', chromosome mobilization, (c) Transduction– Generalised and specialized.
3. *Applied Microbiology* :
3.1. Industrial Production of Vinegar and Streptomycin (brief outline), 3.2. Microbial sources and uses of Enzyme (Amylase, Protease), Amino acid (Glutamic acid, Lysine), Polysaccharides (Dextran), 3.3. Use of microbes as Biofertilizer and Biopesticides, 3.4. Use of microbes in mineral processing.

FUNGI & LICHEN

No of Classes allotted - 20

DR. SITAL PRASAD CHATTOPADHYAY

1. *General Account* :

1.1. Hyphal forms, 1.2. Fungal spore forms and mode of liberation, 1.3. Sexual reproduction and degeneration of sex, 1.4. Parasexuality and sexual compatibility, 1.5. Life cycle patterns.
2. *Classification* :
2.1. Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. 2.2. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota.
3. *Life history* :
3.1. *Synchytrium,* 3.2. *Rhizopus*, 3.3. *Ascobolus*, 3.4. *Agaricus*.
4. *Mycorrhiza* :
4.1. Types with salient features, 4.2. Role in Agriculture & Forestry.
5. *Applied mycology* :
5.1. Fungi as food, 5.2. Cheese and Ethanol- Industrial production (brief outline), 5.3. Fungal sources and uses of Enzyme (Cellulase), Amino acid (Tryptophan), Vitamin (Riboflavin), Antibiotic (Griseofulvin), Pharmaceuticals (Cyclosporin-A). 5.4. Aflatoxin
6. *Lichen* :
6.1. Types, 6.2. Reproduction, 6.3. Economic and ecological importance

PLANT PATHOLOGY

No of Classes allotted - 20

SUTAPA GUHA

1. *Terms and Definitions* :
1.1. Disease concept, 1.2. Symptoms, 1.3. Etiology & causal complex, 1.4. Primary and secondary inocula, 1.5. Infection, 1.6. Pathogenecity and pathogenesis, 1.7. Necrotroph and Biotroph, 1.8. Koch's Postulates, 1.9. Endemic, Epidemic, Pandemic and Sporadic disease, 1.10. Disease triangle, 1.11. Disease cycle (monocyclic, polycyclic and polyetic).
2. *Host – Parasite Interaction* :
2.1. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), 2.2. Pathotoxin (Definition,criteria and example), 2.3. Defense mechanism with special reference to Phytoalexin, 2.4.Resistance- Systemic acquired and Induced systemic.
3. *Plant Disease Management* :
3.1. Quarantine, 3.2. Chemical, 3.3. Biological, 3.4. Integrated.
4. *Symptoms , Causal organism ,, Disease cycle and Control measures of* :
4.1. Late blight of Potato, 4.2. Brown spot of rice, 4.3. Black stem rust of wheat, 4.4. Stem rot of jute.

PAPER IIA (THEORETICAL)

BRYOPHYTA

No of Classes allotted - 16

DR. SUJITA DATTA GHOSH

1. *General Account* :
1.1. General characteristics and adaptations to land habit, 1.2. Classification (Strotler and Crandle Strotler, 2009) upto class with diagnostic characters and examples.
2. *Life History:* Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in:
2.1. *Marchantia*, 2.2. *Anthoceros,* 2.3. *Funaria.*
3. *Phylogeny* :
3.1. Origin of Alternation of Generations (Homologous and Antithetic theory), 3.2. Evolution of Sporophytes (Progressive and Regressive concept), 3.3. Origin of Bryophytes.
4. *Importance :*
Role of bryophytes in: 4.1. Plant succession, 4.2. Pollution Monitoring, 4.3. Economic importance of bryophytes with special reference to *Sphagnum.*

PALAEOBOTANY & PALYNOLOGY

No of Classes allotted - 16

DR. ARGHYA KUMAR HAIT

1. *Plant Fossil* :

1.1. Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, 1.2. Different modes of preservation (Schopf, 1975), 1.3. Conditions favouring fossilization, 1.4. Nomenclature and Reconstruction, 1.5.Principle of fossil dating (a brief idea), 1.6.Importance of fossil study.
2. *Geological time scale* with dominant plant groups through ages.
3. *Indian Gondwana System* - Three fold division with major megafossil assemblages.
4. *Palynology* :
4.1. Spore and Pollen, 4.2. Pollen aperture types, 4.3. NPC classification (Erdtman). 4.4. Pollen wall- Sporopollenin, Stratification and Ornamentation (sculpturing).
5. *Applied Palynology*:-
Basic concepts of: 5.1.Palaeopalynology, 5.2.Aeropalynology, 5.3.Forensic palynology, 5.4.Melissopalynology.

EMBRYOLOGY

No of Classes allotted - 08

DR. SITAL PRASAD CHATTOPADHYAY

1. *Pre-fertilisation changes* :
1.1. Microsporogenesis and Microgametogenesis, 1.2. Megasporogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic).
2. *Fertilisation:*
2.1. Pollen germination, 2.2. Pollen tube— growth, entry into ovule and discharge, 2.3. Double fertilization.
3. *Post-fertilization changes :*
3.1. Embryogenesis in *Capsella,* 3.2. Development of Endosperm (3 types).
4. *Apomixis & Polyembryony:*
4.1. Apomixis- Apospory and Apogamy, 4.2.Polyembryony- different types.

PAPER IIB (PRACTICAL)

ALGAE

DR. RUPAK KUMAR SENGUPTA & DR. ARKALO MAJUMDAR

1.Work out of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): *Oedogonium*, *Chara, Ectocarpus.*
2. Study of (a) Permanent slides : *Gloeoitrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia,* Centric and Pennate diatom*;* (b) Macroscopic specimens : *Laminaria, Sargassum.*

FUNGI AND LICHEN

DR. SUJITA DATTA GHOSH & SUTAPA GUPTA

1. Work out of the following fungi with reproductive structures (including microscopic measurement of Reproductive structures): *Rhizopus* (asexual), *Ascobolus , Agaricus* .
2. Study from permanent slides: Zygospore of *Rhizopus*, Conidia of *Fusarium*,Conidiophore of *Penicillium.*
3. Morphological study of Fungi (fruit body of *Polyporus, Cyathus*), Lichens (fruticose and foliose).

BRYOPHYTES

DR. SUJITA DATTA GHOSH & SUTAPA GUPTA

1.Morphological study of the plant body: Genera as mentioned in theoretical syllabus and *Riccia, Porella*.
2. Study from permenant slides : *Riccia* (V.S. of thallus with sporophyte), *Marchantia* (L.S.through gemma cup, antheridiophore , archegoniophore), *Anthoceros* (L.S. of sporophyte) , *Funaria* (L.S. of capsule) .

MICROBIOLOGY

DR. RUPAK KUMAR SENGUPTA

1. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petriplates.
2. Sub-culturing of bacterial culture.
3. Gram staining from bacterial culture.
4. Microscopic examination of bacteria from natural habitat (curd) by simple staining.

PLANT PATHOLOGY

DR. SUJITA DATTA GHOSH & SUTAPA GUHA

1. Preparation of fungal media (PDA).
2. Sterilization process.
3. Isolation of pathogen from diseased leaf.
4. Inoculation of fruit and subculturing.
5. Identification : Pathological specimens of Brown spot of rice, Bacterial blight of rice ,Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of *Puccinia graminis.*

PART – II

PAPER III (THEORETICAL)

ANATOMY

No of Classes allotted - 20

DR. NANDINI CHAKRABARTI & DR. ARKAJO MAJUMDAR

1. *Cell wall:*
1.1. Ultrastructure & Chemical constituents, 1.2. Plasmodesmata- ultrastructure, 1.3. Concept of Apoplast and Symplast, 1.4. Growth and Thickening of cell wall.
2. *Stomata* :
2.1. Types (Metcalfe and Chalk, Stebbins and Khush), 2.2. Ontogeny.
3. *Ontogeny of* 3.1. Trachea and 3.2. Sieve-tube.
4. *Stele* :
4.1 Leaf-trace and leaf-gap, 4.2. Stelar types & evolution
5. *Primary structure of stem and root*- Monocot and Dicot
6. *Secondary growth:*
6.1. Normal (intra- & extra-stelar), 6.2. Anomalous (stem of Bignonia, Boerhavia, *Tecoma, Dracaena* and root of *Tinospora*).
7. Mechanical tissues and the Pinciples governing their distribution in plants.
8. Developmental Anatomy :
Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), 7.2. Plastochrone.
9. *Ecological Anatomy*:
Adaptive anatomical features of 9.1. Hydrophytes, 9.2. Xerophytes.

PTERIDOPHYTES

No of Classes allotted - 20

DR. ARGHYA KUMAR HAIT

1. *General Account* :
1.1. Colonisation and rise of early land plants, 1.2. Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples.
2. *Life History* :
Sporophyte structure, Reproduction and Structure of gametophyte in 2.1. *Psilotum*, 2.2. *Selaginella*, 2.3. *Equisetum*, 2.4. *Pteris*.
3. *Fossil Pteridophytes* : Structural features, Geological distribution and Evolutionary significance of 3.1. *Rhynia*, 3.2. *Lepidodendron* (Reconstructed) 3.3. *Calamites* (Reconstructed).
4. *Telome concept* and its significance in the origin of different groups of Pteridophytes.
5. *Heterospory and Origin of Seed habit.*
6. *Economic importance* as food, medicine and Agriculture.

GYMNOSPERMS

No of Classes allotted - 20

DR. SUJITA DATTA GHOSH & SUTAPA GUPTA

1. *Classification* of vascular plants by Gifford & Foster (1989) upto division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples.
2. *Progymnosperms* :
2.1. Diagnostic characters of the group, 2.2.Vegetative and reproductive features of Archeopteris, 2.3. Phylogenetic importance.
3. *Life History* :
Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte and Embryogeny in : 3.1. *Cycas* , 3.2. *Pinus* and 3.3. *Gnetum.*
4. *Fossil gymnosperms* :
Structural features and Geological distribution of reconstructed genera: 4.1. *Lyginopteris*, 4. 2 . *Williamsonia*, 4.3.*Cordaites.*
5. *Economic Importance* with reference to Wood, Resins, Essential oils, and Drugs.

ECOLOGY

No of Classes allotted - 10

DR. ARGHYA KUMAR HAIT

1. *Preliminary idea on* :
1.1. Habitat and Niche, 1.2. Ecotone and edge–effect, 1.3. Microclimate, 1.4. Ecads, ecotype and ecoclines, 1.5. Carrying capacity.
2. *Community ecology* :
2.1. Community- Characteristics and diversity, 2.2. Ecological succession –Primary and secondary, Seral stages (with
reference to Hydrosere), autogenic and allogenic succession.
3. 3.1. Plant indicators (metallophytes); 3.2. Phytoremediation.
4. *Conservation of Biodiversity*: 4.1. Level of Biodiversity: genetic, species & ecosystem diversity, 4.2. Biodiversity
hot spots- criteria, Indian hotspots, 4.3. *In- situ and ex-situ* conservation, 4.4. Seed-banks, 4.5. Cryopreservation, 4.6. Geographic Information System and Remote Sensing (brief idea).

PLANT GEOGRAPHY

No of Classes allotted - 10

DR. ARGHYA KUMAR HAIT

1. *Phytogeographical regions* :
1.1. Phytogeographical regions of India (Chatterjee 1960); 5.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sunderban.
2. *Endemism* :
1.2. Endemic types and Factors; 6.2. Age & Area hypothesis and Epibiotic theory; 6.3. Endemism in Indian flora.

EVOLUTION

No of Classes allotted - 10

DR. ARGHYA KUMAR HAIT

1. 1.1 Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis
2. Brief idea on: Stabilizing, directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation
3. 3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, 3.2. Phylogenetic tree.

PAPER IVA (THEORETICAL)

MORPHOLOGY OF ANGIOSPERMS

No of Classes allotted - 08

SANDHYA DATTA

1. *Inflorescence* types with examples.
2. *Flower*
3. *Fruits and seeds* - types with examples.

TAXONOMY OF ANGIOSPERMS

DR. SITAL PRASAD CHATTOPADHYAY & SANDHYA DATTA

1. *Introduction* :
1.1. Components of Systematic: Nomenclature, Identification, Classification; 1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy.
2. *Nomenclature* :
Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN- Principles.
3. *Systems of classification :*
Broad outline of Bentham & Hooker (1862-1883), Cronquist (1988), Takhatajan (1991) - system of classification with merits and demerits
3.1. *Systematics in Practice*: Herbaria and Botanical Gardens – their role in teaching and research; important Herbaria and Botanical Gardens of India and world (3 each); 4.2. Dichotomous keys – indented and bracketed.
4. *Phenetics and Cladistics* :
Brief idea on Phenetics, Numerical taxonomy- methods and significance; Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.
5. *Data sources in Taxonomy:*
Supportive evidences from: 5.1. Phytochemistry, 5.2. Cytology, 5.3. Palynology and 5.4. Molecular biology data (Protein and Nucleic acid homology).
7.Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the following families:
7.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae.
7.2. Dicotyledons : Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae, Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae)

PAPER IVB (PRACTICAL)

PTERIDOPHYTES

DR. ARGHYA KUMAR HAIT

1.Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and *Lycopodium, Ophioglossum, Marsilea* and *Pteris.*
2. Workout of the reproductive structures: *Selaginella, Equisetum, Pteris*.
3. Study from permanent slides : *Psilotum* (T.S. of synangium), *Lycopodium* (L.S. of strobilus),*Ophioglossum* (L.S. of spike), *Dryopteris* (gametophyte), *Marsilea* (L.S. of sporocarp)

ANGIOSPERMS

DR. SITAL PRASAD CHATTOPADHYAY & SANDHYA DATTA

1. Study of types of inflorescence, flower and fruit (from specimens).
2.Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants from the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae.
3. Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided).

ANATOMY
DR. NANDINI CHAKRABARTI & DR. ARKAJO MAJUMDAR
1.Microscopic studies on: Types of stomata, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) starch grains, aleurone grains, laticiferous ducts, oil glands. 2. Study of anomalous secondary structure in stem of *Bignonia, Boerhaavia, Tecoma, Dracaena* and root of *Tinospora* 3. Study of adaptive anatomical features: Hydrophytes (*Nymphaea* – petiole) and Xerophytes (*Nerium* – leaf).
GYMNOSPERMS
DR. ARGHYA KUMAR HAIT
1.Morphological study: *Cycas* (microsporophyll and megasporophyll), *Pinus* (female and male cone), *Gnetum* (female and male cone). 2. Study from permanent slides: *Cycas* (L.S. of ovule), *Pinus* (L.S. of male and female cone), *Ginkgo* (L.S.of female strobilus), *Gnetum* (L.S. of male cone and ovule).
PALAEOBOTANY AND PALYNOLOGY
DR. ARGHYA KUMAR HAIT
1.Morphological study: *Ptilophyllum* and *Glossopteris* leaf fossils. 2. Study from permanent slides: T.S. of stem of *Rhynia,Lepidodendron, Calamites, Lyginopteris, Cordaites.* 3. Study of Pollen types (colpate,porate and colporate) from permanent slides. Slides may be prepared from specimens: Colpate (*Leonurus sibiricus/ Brassica* sp.), Porate (*Hibiscus rosa-sinensis*), Colporate (*Cassia sophera/C. tora*).

PART – III

PAPER V (THEORETICAL)

PLANT PHYSIOLOGY **No of Classes Allotted -** 40 Periods
DR. NANDINI CHAKRABARTI & DR. ARKAJO MAJUMDAR
1. *Plant-water relations*: 1.1 Concept of water potential, components of water potential in plant system, 1.2. Soil-plant-Atmosphere continuum concept, Cavitation in xylem and embolism, 1.3. Stomatal physiology-mechanism of opening and closing, Role of carbon di-oxide, potassium ion, abscisic acid and blue light in stomatal movement, Antitranspirants. 2. *Organic Translocation* : 2.1 Phloem sap, P-protein, 2.2. Phloem loading and unloading, 2.3. Mass-flow (pressure flow) hypothesis and its critical evaluation. 3. *Photosynthesis* : 3.1 Chemical structure of chlorophyll a and b, absorption and action spectra, biological significance of carotenoid pigments, 3.2. Red drop and Emerson effect, Components of photosystems (light harvesting complex), Photochemical reaction centres, Cyclic and noncyclic electron transport, Water splitting mechanism, 3.3. Calvin cycle – Biochemical reactions & stoichiometry, 3.4. HSK Pathway– three variants of the pathway, 3.5. Photosynthetic efficiency of C_3 and C_4 plants and crop productivity, 3.6. Photorespiration – mechanism and significance, 3.7. Crassulacean Acid metabolism– mechanism and ecological significance. 4. *Respiration* : 4.1 EMP pathway, regulation and its anabolic role, 4.2. Conversion of Pyruvic acid to Acetyl CoA, 4.3. TCA-cycle and its amphibolic role ,4.4. Oxidative pentose phosphate pathway and its significance, 4.5. ß-oxidation of fatty acids and significance, 4.6. Mitochondrial electron transport system, uncouplers, 4.7. Oxidation of cytosolic $NADH+H^+$ 4.8. Stoichiometry of glucose oxidation (aerobic). 5. *Nitrogen Metabolism* : 5.1 Assimilation of nitrate by plants, 5.2. Biochemistry of dinitrogen fixation in *Rhizobium*, 5.3. General principle of amino acid biosynthesis (including GS and GOGAT enzyme system). 6. *Plant Growth Regulators* : 6.1. Physiological roles of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene, 6.2. Chemical nature –IAA, GA_3, Kinetin, 6.3. Biosynthesis and bioassay of IAA, 6.4. Mode of action of IAA, 6.5. Brassinosteroids and

Polyamines as PGRs (brief idea).
7. *Photomorphogenesis* :
7.1 Concept of photomorphogenesis, 7.2. Photoperiodism and plant types, 7.3. Perception of photoperiodic stimulus, 7.4. Critical day length, concept of light monitoring, 7.5. Phytochrome – chemical nature, interconversion, function in flowering, 7.6. Role of GA in flowering, 7.7. Vernalisation – role of low temperature in flowering, 7.8. Concept of biological clock and biorhythm .
8. *Seed dormancy:* 8.1. Types, Causes and Methods of breaking seed dormancy, 8.2. Biochemistry of seed germination.
9. Physiology of Senescence and Ageing.
10. *Physiology and molecular biology of stress*: Plant responses to: 10.1. Water stress, 10.2. Temperature stress, 10.3. Salt stress.

BIOCHEMISTRY **No of Classes Allotted -** 28 Periods

DR. NANDINI CHAKRABARTI & DR. ARKAJO MAJUMDAR

1. *Biochemical Foundations* :
1.1. Covalent and non-covalent bonds; hydrogen bond; Van der Waal's forces; 1.2. Structure and properties of water; 1.3. pH and buffer (inorganic and organic); 1.4. Handerson-Hasselbalch equation; 1.5. Isoelectric point.
2. *Molecules of life :*
2.1. Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP), 2.2. Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; 2.3. Carbohydrates - structure of mono-, di and polysaccharide; stereoisomers, enantiomers and epimers; 2.4. Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated.
3. *Energy flow and enzymology* :
3.1. Bioenergetics-Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, 3.2. Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes, 3.3. Mechanism of enzyme action; enzyme inhibition; 3.4. Enzyme kinetics (Michaelis-Menten equation) and simple problems.
4. *Cell membrane and Biosignalling* :
4.1. Membrane chemistry, 4.2. Membrane transport (uniport, symport, antiport), mechanism of ion uptake 4.3. Signal Transduction pathway and second messenger concept - G-protein and Ca
5. *Phosphorylation:* ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation- Mechanism and differences.

PHYTOCHEMISTRY AND PHARMACOGNOSY **No of Classes Allotted -** 12 Periods

DR. SITAL PRASAD CHATTOPADHYAY

1. *General account* :
1.1 Pharmacognosy and its importance in modern medicine, 1.2 Crude drugs, 1.3 Classification of drugs- chemical and pharmacological, 1.4 Drug evaluation– organoleptic, microscopic, chemical, physical and biological, 1.5. Major pharmacological groups of plant drugs and their uses
2. *Secondary metabolites* :
2.1 Definition of secondary metabolites and difference with primary metabolites , 2.2 Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only), 2.3 Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.
3. *Pharmacologically active constituents :*
Source plants (one example) parts used and uses of: 3.1 Steroids (Solasodin, Diosgenin, Digitoxin), 3.2 Tannin (Catechin), 3.3 Resins (Gingerol, Curcuminoids), 3.4 Alkaloids (Quinine, Atropine. Pilocarpine, Strychnine, Reserpine, Vinblastine), 3.5. Phenols (Sennocide and Capsaicin).

PAPER VI (THEORETICAL)

CELL BIOLOGY **No Of Classes Allotted -** 16 Periods

DR. SUJITA DATTA GHOSH, DR. ARGHYA KUMAR HAIT & SAYELA GUHA

1. *Origin and Evolution of Cells :*
1.1. Concept of RNA world, Ribozymes, First cell, 1.2. Origin of eukaryotic cell (endosymbiotic theory), 1.3. Small RNA- ribpswitch, RNA interference, si RNA, mi RNA- brief idea, 1.4.Organellar DNA (cp- and mt-DNA).
2. *Nucleus and Chromosome :*
2.1. Nuclear envelope, Nuclear lamina and Nuclear pore complex, 2.2. Nucleolus-ultrastructure and ribosome biogenesis, 2.3. Chromatin ultrastructure and DNA packaging in eukaryotic chromosome, 2.4. Centromere: types,structure and function.
3. *Cell cycle and its regulation :*
3.1. Kinetochore and spindle apparatus-structural organization and functions, 3.2.Microtubules- structure, organization and function, 3.3. Mechanism of cell cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea).

PLANT BREEDING & BIOMETRY **No of Classes Allotted -** 12 Periods

DR. SUJITA DATTA GHOSH & SAYELA GUHA

1. *Plant Breeding:*
1.1 Maintenance of germplasm, 1.2. Mass selections and Pure line selection, 1.3. Back cross method, 1.4. Heterosis and hybrid seed production, 1.5. Male sterility and its use in plant breeding, 1.6. Molecular Breeding (use of DNA markers in plant breeding), 1.7. Inbreeding and inbreeding depression, effect of outcrossing- a very brief idea.
2. *Biometry:*
2.1 Data, Sample, Population, Random sampling, Frequency distribution- definition only, 2.2. Central tendency–Arithmetic Mean, Mode and Median, 2.3.Measurement of dispersion – Standard Deviation, Standard error of Mean,Coefficient of variation, 2.4. Test of significance: chi- square test for goodness of fit, 2.5 Probability- multiplicative and additive rules of probability: application and importance, 2.6. Measurement of gene frequency: Hardy-Weinberg equilibrium- conditions applied for its implications (simple problems to calculate genotypic and allelic frequencies).

PLANTBIOTECHNOLOGY **No of Classes Allotted -** 12 Periods

DR. RUPAK KUMAR SENGUPTA

1. *Plant tissue culture –Introduction:*
1.1. Basic concept and milestones, 1.2. Cellular totipotency, 1.3. Tissue culture media, 1.4. Aseptic manipulation, 1.5. Cyto-differentiation and dedifferentiation.
2. *Callus culture* :
2.1. Callus induction, maintenance and application, 2.2. Suspension culture- introductory idea
3. *Plant regeneration* :
3.1. Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, 3.3. Significance of organogenesis and somatic embryogenesis, 3.4. Artificial seed
4. *Haploid Culture* :
4.1. Anther and Pollen culture methods, 4.2. Significance.
5. *Protoplast Culture* :
5.1. Protoplast isolation and culture, 5.2. Protoplast fusion (somatic hybridization), 5.3. Significance.
6. *Plant Genetic Engineering* :
6.1. Brief concept of different gene transfer methods, special emphasis on *Agrobacterium* mediated gene transfer, Role of Reporter gene, 6.2. Achievements in crop biotechnology, environment and industry (suitable example)- pest resistant plants (BT cotton), herbicide resistance, disease and stress tolerance, transgenic crop with improved quality (flavr tomato, golden rice), role of transgenic in population degradation (super-bug), leaching of minerals, production of industrial enzymes, oil, edible vaccine. leaching of minerals, production of industrial enzymes, oil, edible vaccine.

GENETICS & MOLECULAR BIOLOGY **No Of Classes Allotted -** 40 Periods

DR. SUJITA DATTA GHOSH & SAYELA GUHA

1. *Linkage, Crossing over and Gene Mapping :*

1.1. Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, 1.2. Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and 1.3.Molecular mechanism of crossing over (Holliday model), 1.4. Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, 1.5 Co-efficient of coincidence and interference, Mapping function, 1.6 Problems on gene mapping, 1.7 Molecular mapping – ISH, FISH (brief idea).
2. *Epistasis and Polygenic inheritance* in plants.
3. *Aneuploidy and Polyploidy*: Types, examples, meiotic behaviour and importance of: 3.1. Aneuploidy, 3.2. Polyploidy,
3.2. Speciation and evolution through polyploidy.
4.*Chromosomal aberration*: Types and meiotic behaviour of: 4.1. Deletion, 4.2. Duplication, 4.3. Translocation, and 4.4. Inversion.
5. *Mutation :*
5.1. Point mutation-Transition, Transversion and Frame shift mutation, 5.2. Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 5.3. DNA repair (brief idea).
6. *Structural organisation of Gene* :
6.1. One Gene–one polypeptide concept, 6.2. Split gene, 6.3. Overlapping gene, 6.4. Repetitive DNA-tandem and interspersed, 6.5. Transposon (*Ac-Ds* system), 6.6. Homoeotic gene in plants (ABCE Quartet model of flowering).
7. *DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes):*
7.1. Central Dogma, 7.2. Semiconservative DNAreplication – *mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins, 7.3. Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the endchromosome telomere, telomerase concept, 7.4. Fidelity of DNA replication- prokaryote: nucleotide selection, proof reading, mismatch repair; eukaryote: through selection of error prone DNA polymerase, 7.5.Transcription, 7.6 RNA processing, 7.7. Aminoacylation of tRNA, 7.8. Translation.*
8. *Gene Regulation* :
8.1. Concept of *Lac*-operon, 8.2. Positive and negative control.
9. *Genetic Code* :
9.1. Properties-evidences & exceptions, 9.2. Decipherence of codon (Binding technique).
10. *Recombinant DNA Technology:* 10.1. Restriction endonuclease, - types and roles, 10.2. Vector (plasmid pBR 322) 10.3. Marker gene, 10.4. Steps of cloning technique, 10.5. PCR and its application, 10.6. Genomic DNA and cDNA library.
11. Development and causes of Cancer (in general and brief), tumor suppressor gene and oncogene

PAPER VII (PRACTICAL)

DR. NANDINI CHAKRABARTI & DR. ARKAJO MAJUMDAR

PLANT PHYSIOLOGY

1. Determination of loss of water per stoma per hour.
2. Relationship between transpiration and evaporation.
3.Effect of HCO_3^- concentration on oxygen evolution during photosynthesis in an aquatic plant and to find out the optimum and toxic concentration(either by volume measurement or bubble counting) .
4. Separation of plastidial pigments.
5. Measurement of oxygen uptake by respiring tissue (per g/hr.)
6. Determination of the RQ of germinating seeds.
7. Measurement of osmotic pressure of storage tissue by weighing method.
8. Measurement of osmotic pressure of *Rhoeo* leaf by plasmolytic method.
9. Effect of temperature on absorption of water by storage tissue and determination of Q_{10}.
10. Rate of imbibition of water by starchy, proteinaceous and fatty seeds and effect of seed coat.

PLANT BIOCHEMISTRY

Qualitative:

1. Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples.
2. Detection of carbohydrate and protein from plant samples.
3. Detection of the nature of carbohydrate – glucose, fructose, sucrose and starch from laboratory samples.
4. Detection of Ca, Mg, Fe, S and P from plant ash sample.

Quantitative:

1. Preparation of solutions and buffers
2. Estimation of amino-nitrogen by formol titration method (glycine).
3. Estimation of glucose by Benedict's quantitative reagent.
4. Estimation of titratable acidity from lemon and from laboratory sample.
5. Estimation of catalase activity in plant samples.
6. Estimation of urease activity in plant samples.
7. Colorimetric estimation of protein by Folin phenol reagent.

PHARMACOGNOSY

DR. SITAL PRASAD CHATTOPADHYAY

1. Chemical tests for (a) Tannin (*Camellia sinensis / Terminalia chebula*), (b) Alkaloid (*Catharanthus roseus)* .
2. Powder microscopy – *Zingiber* and *Holarrhena.*
3. Structural identification of different types of pharmaceutically useful starch grains – ginger, arrowroot, maize, wheat and rice,
4. Test for non-lignified vessel (*Zingiber*),

PAPER VIII (PRACTICAL)

CELL BIOLOGY AND GENETICS

DR. SUJITA DATTA GHOSH & SAYELA GUHA

1. *Introduction to chromosome preparation:* Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides.
2. *Determination of mitotic index* and frequency of different mitotic stages in pre-fixed root tips of *Allium cepa.*
3. *Study of mitotic chromosome:* Metaphase chromosome preparation, free hand drawing under high power objective, drawing with drawing prism under oil immersion lens, determination of 2n number, comment on chromosome morphology of the following specimens from root tips: *Allium cepa , Aloe vera , Lens esculenta.*
4. *Study of meiotic chromosome:* Smear preparation of meiotic cells, identification of different stages and free hand drawing of the following specimens from flower buds: *Allium cepa* and *Setcreasea* sp.
5. *Identification from permanent slides* : Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (*Rhoeo discolor*); Mitosis – (i) normal stages, (ii) abnormal stages- early separation, late separation, multipolarity , sticky bridge, laggard, fragmentation, (ii) pollen mitosis.

BIOMETRY

DR. SUJITA DATTA GHOSH & SAYELA GUHA

1.Determination of goodness of fit in normal and modified mono-and dihybrid ratios (3:1, 1:1, 9:7, 13:3, 15:1, 9:3:3:1,1:1:1:1) by Chi-square analysis and comment on the nature of inheritance.
2.Univeriate analysis of statistical data: Statistical tables, mean, mode, median, standard deviation and standard error (using seedling population / leaflet size).