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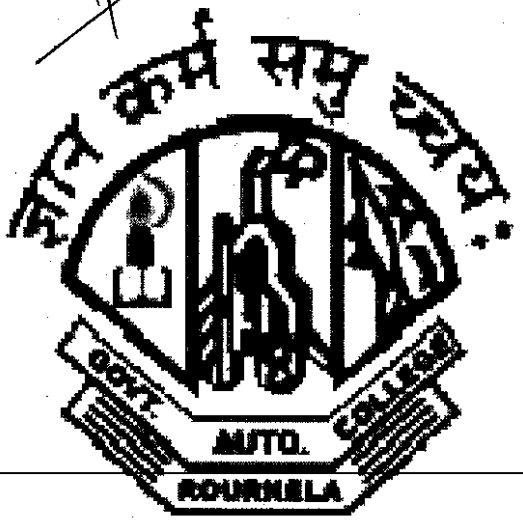

GOVERNMENT AUTONOMOUS COLLEGE, ROURKELA.

POST GRADUATE DEPARTMENT OF BOTANY PG SYLLABUS- 2017-18

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***PAPER 101*- MICROBIOLOGY**

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT –I

History and development of microbiology, General features of Bergy's manual for classification ofmicrobes, Whittakar's five kingdom concept, Carl Woese's 3 domain classification, Isolation, cultureand maintenance of microorganisms, Microbial growth, continuous culture (chemostat), Factorsinfluencing growth of microbes, Role of microbes in agriculture and industry.

UNIT -II

General features of Archaea, Structure, Nutrition and Reproduction of Eubacteria, Geneticrecombination in bacteria (Transformation, Conjugation and Transduction), General features andpathogenecity of mycoplasma, Rickttsia and Spirochaetes.

Cyanobacteria: Cell structure and reproduction. Heterocysts: Structure, development and function

UNIT-III

Virus: General characteristics and classification of viruses, nature , morphology and chemistry ofvirus, transmission of virus, virus-vector relationship, replication of BacteriophagePlant virus-TMV, structure, transmission, pathogenicity and replication

Animal viruses - HIV, structure, transmission, pathogenicity and replication Treatment and prevention by anti-virals and vaccine Viroids and Prions.

UNIT –IV

Microbial toxins: types, mode of actions and pathogenicity.

Bacterial toxins: Endo and exotoxins Fungal toxins: toxins of *Aspergillus, Penicillium, Fusarium* and *Alternaria* Algal toxins: cyanotoxins and dinotoxins Chemotherapeutic agents: antibiotics and their mode of action; bacterial drugs (Penicillin,fluoroquinolones, tetracycline and aminoglycosides)

PAPER 102 Genetics

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT-I

Mendel's experiments and laws of inheritance, gene interaction with epistasis or modified mendeliandihybrid ratios: masking gene action, supplementary gene action, duplicate gene action, complementarygene actionMultiple allele in human (ABO blood group); eye colour in Drosophila, self incompatibility in plants;Polygenic inheritance, pleiotrophyMaternal effects and cytoplasmic inheritance, mitochondrial & chloroplast genome

UNIT-II

Sex chromosomes, Chromosomal sex determination: XX-XY, XX-XO and ZZ-ZW systems,Compound sex chromosome,Meiotic behavior of chromosomes: Primary & Secondary non-disjunction, Genic balance theory of sexdetermination, Sex determination in humans and Drosophila with special reference to SRY and sex

lethal genes.Sex linkage: Sex linked genes in man, sex chromosome disorders in man, Sex influenced dominance bysex-linked gene expression.Sex determination in plants with special reference to *Melandrium*

UNIT-III

Linkage groups: Complete and incomplete linkage Crossing over: Relationship between genetic and cytological crossing over, Relationship between crossing over and chaisma formation, molecular mechanism of crossing over Detection of linkage & Linkage maps: Test cross, test for linkage on the basis of F2 generation, LOD score, gene mapping, three point test cross in

Drosophila, construction of linkage maps, identification of particular linkage groups with specific chromosome, physical distance and map distance
Interference and coincidence Mitotic Recombination, Recombination within gene

Unit-IV

Structural and numerical alterations in chromosomes: Spontaneous and induced mutations, physical and chemical mutagens, chromosomal aberrations, meiotic behavior of deletion, duplication, inversion and translocation. Euploids and aneuploids-classification, origin, induction, role of polyploidy in evolution and practical significance in crop improvement Population genetics: Hardy-Weinberg's Law, genetics of quantitative traits in population

PAPER 103: Biochemistry

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT-I

Amino acids: Classification and properties, Acid–base properties, The Peptide bond, ionization behavior of peptides, biologically active peptides. Levels of protein structure, Determination of primary structure of protein. Three dimensional structure of proteins (Secondary, tertiary and quaternary structures, structural patterns: motifs and domains),
Protein denaturation and folding Amino acid catabolism (transamination, oxidative deamination and urea cycle) Protein degradation (proteosomal pathway) and Solid phase synthesis of peptides.

UNIT - II

Carbohydrates: Classification, configuration and conformation of monosaccharides, sugar derivatives, important disaccharides. Structural and storage polysaccharides, glucosaminoglycans, proteoglycans, glycoproteins and glycolipids Carbohydrate metabolism: Glycolysis, TCA cycle, pentose-phosphate pathway. Gluconeogenesis,
glycogen metabolism, regulation of carbohydrate metabolism, Oxidative phosphorylation, electron transport and ATP synthesis

UNIT –III

Enzymes: General properties, nomenclature and classification, extraction and assay
Michaelis-Menten kinetics and its significance, Brigg's-Halden modification, determination of Vmax and Km Mechanism of enzyme action: general acid-base catalysis, covalent catalysis, metal catalysis Mechanism of action of RNAse, Lysozyme and Chymotrypsin Enzyme inhibition: competitive, non-competitive inhibition, determination of Ki, allosteric regulation, covalent modification

UNIT – IV

Lipids: Classification, storage lipids, structural lipids (glycerophospholipid and sphingolipids), signaling lipids, cofactors, terpenes, and pigments.
Coenzymes and vitamins Biosynthesis and oxidation of fatty acids, regulation of fatty acid metabolism

PAPER 104: Plant Physiology

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT-I

Water balance in plants, water absorption and transport through xylem, active and passive transportTransport of ions across membrane barrier, membrane transport processes,Membrane transport proteins: water channels, H+ - ATPase and H+- pyrophosphatase Mechanism of solute accumulation in vacuoles, solute transport: Phloem loading & unloading

UNIT-II

Photochemistry and photosynthesis: General concept of photochemistry, Photosynthetic pigments and light harvesting complexes, Photo-oxidation of water, mechanisms of electron and proton transport & ATP synthesis. Carbon assimilation: C3, C4 cycle and the CAM pathway Photorespiration and its significance, the glyoxylate cycle Biosynthesis of starch and sucrose

Unit-III

Nitrogen metabolism: Overview, biological nitrogen fixation, mechanism of nitrate uptake and reduction, nitrate and ammonium assimilation, amino acid biosynthesis.

Stress Physiology: Responses of plants to biotic and abiotic stresses, mechanism of stress resistance and tolerance, water deficit and drought stress, salinity stress, metal toxicity, freezing and heat stress, HR and SAR, oxidative stress.

UNIT-IV

Plant growth regulators: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene and abscisic acid Photoreceptors: phytochromes, cytochromes, UV-B and their role in regulation of plant morphogenesis Flowering: Phenomenon of flowering, photoperiodism and its significance, endogenous clock

PAPER 105: PRACTICALS

100Marks (3 hours)

1. General idea on instruments used in microbiology laboratory.
2. Preparation and sterilization of media (Nutrient Agar, Nutrient Broth, Czapeck-Dox), Plating,Tubing, Slanting of media.
3. Gram staining and acid-fast staining of bacteria.
4. Isolation of bacteria in pure culture.
5. Study of commonly occurring cyanobacteria.
6. Measurement of length/breadth/diameter of microbial cell/spore using ocular and stagemicrometer.
7. Study of principles of spectrophotometer and verification of Beer-Lambert's law.
8. Effect of substrate concentration on activity of any enzyme and determination of Km value. (Acid Phosphatase, peroxidase, catalase)
9. Extraction of pigment from leaves and preparation of absorption spectra for chlorophylls and carotenoids.
10. Preparation of standard curves for quantification of protein, carbohydrate and reducing sugar.
11. Quantification of soluble and total protein and total carbohydrate contents of plant samples.
12. Isolation of Chloroplast and study of protein profile of RUBISCO by SDS-PAGE.

PAPER 201: Plant Diversity

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT - I

Algae: Marine, Freshwater and Terrestrial algae, Classification, Food reserve, Pigment and Thallusorganization Life cycles, salient features and reproduction in Prochlorophyta, Chlorophyta, Bacillariophyta, Xanthophyta, Dinophyta, Phaeophyta and Rhodophyta. Algal biomass production and utilization, algal blooms and their environmental impacts Seaweed cultivation and utilization

UNIT-II

Bryophyta: Theories of origin (algal and pteridophytean), Ecology, Evolution and Classification, Structure and reproduction of Anthocerotales, Marchantiales, Jungermanniales, Sphagnales,

and Polytrichales Evolution of gametophytes and sporophytes in Bryophytes Phylogenetic relationships among Bryophytes

UNIT-III

Pteridophyta: Theories of origin (algal and bryophytean), evolution and classification, Structure and reproduction of Psilophyta, Lycophyta, Sphenophyta and Pterophyta. Structural diversity of sori, Soral evolution in ferns, diversity and germination of spores, Structure, morphology, evolution and significance of sporocarp.

UNIT-IV

Gymnosperm: origin, evolution and classification.
Vegetative and reproductive structures of Cycadales, Ginkgoales, Coniferales, and Gnetales, Structural diversity of pollen grains in Gymnosperms, Evolution of male and female gametophytes in Gymnosperms.

PAPER 202: Cell Biology

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT –I

Cell Theory, Variability, Size, Shape, Complexity and functions. General organization of Prokaryotic and Eukaryotic cells
Plasma membrane: Composition and dynamics, membrane carbohydrates and their role in cell recognition. Social context of cells: Cell junction, cell adhesion and extra-cellular matrix. Cell motility: Cilia and flagella of prokaryotes and eukaryotes.
Cytoskeleton: Microtubules, intermediate filaments and microfilaments.
Cell Wall: Structure & functions, biogenesis, growth.
Cell inclusions: pigments molecules & nutritive materials

UNIT-II

Nucleus: Structure and function of nuclear envelope, nucleolus & Chromatin organization and its packaging role of nuclear matrix in chromosome organization and function, matrix binding proteins. Lampbrush chromosome, Polytene chromosome, telocentric chromosome, Inter-phase chromatin, Euchromatin and Heterochromatin, karyotype and its significance Cell cycle: Molecular models and events. Regulators and checkpoints in cell cycle Molecular mechanisms of cell division: Mitosis (Behavior of chromosomes, formation of mitotic spindle, Sister chromatid separation), Cytokinesis (Role of mitotic spindle in determining cytoplasmic cleavage site), Meiosis: Events & mechanism

UNIT – III

Plasmodesmata: Structure, role in movement of molecules & macromolecules, comparison with gap junctions. Plant Vacuole: Tonoplast membrane, ATPases, transporters as storage organelle Chloroplast: Structure, genome organization, gene expression, RNA editing, nucleo-chloroplastic interaction. Mitochondria: Structure, genome organization, Biogenesis.

UNIT – IV

Transport across cell membrane: Major types of membrane transport, Active transport, Co-transport, Symport, Antiport, Ion channels, Osmosis. Macromolecular trafficking into and out of nucleus Protein sorting: Transport of proteins into mitochondria and lysosomes. Vesicular traffic: Coated and un-coated vesicles, Transport of secretory materials, Endocytosis.

PAPER 203: Molecular Biology

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT –I

DNA replication: Replication in prokaryotes, replication fork, initiation, elongation, termination, Replication in eukaryotes, D-loop model of DNA replication, DNA replication in single stranded DNA, rolling circle replication, DNA synthesis by reverse transcription DNA Repair: mismatch repair, base excision, nucleotide excision, direct repair, SOS repair

UNIT –II

Prokaryotic transcription: Mechanism of transcription, Principle of gene regulation, The Operon concept, lac- & trp-operon. Processing of tRNA and Rrna Eukaryotic transcription and regulation: RNA polymerases structure and assembly, Eukaryotic promoters and enhancers, General and specific transcription factors, transcriptional repressors, mechanism of transcription regulation, Transcriptional and post-transcriptional gene silencing. Modifications in RNA: 5'-cap formation, transcription termination, 3'-end processing and polyadenylation, splicing, editing, synthesis and processing of non-coding RNAs.

UNIT –III

Prokaryotic and eukaryotic translation: The translation machinery, mechanism of initiation, elongation and termination Co- and post-translational modifications of proteins

Cell Signaling: Signaling molecules and signal receptors, second messengers, G protein coupled receptors, activation of gene transcription by G protein coupled receptors.

UNIT –IV

Scope of Genetic engineering, Milestones in genetic engineering Molecular tools: Enzymes (Nucleases, Restriction endonucleases, Phosphomonoesterase, Alkaline phosphatase, Polynucleotide kinase, DNA ligase, DNA polymerases, Reverse transcriptase, terminal deoxynucleotidyl transferase, Poly A polymerase), Hosts (*E. coli*, yeast, animal cells and Plant cells) and Vectors (Plasmids, Bacteriophages, Cosmids, Phagemids and artificial chromosomes)

PAPER 204: Instrumentation & Analytical Techniques

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT –I

Principle of operation and Instrumentation of Light, Fluorescence and Electron Microscopes Ultraviolet-visible absorption spectroscopy: Principle, Instrumentation and application, Fluorescence spectrophotometry: Principle, Instrumentation and application

Radioisotope techniques: Nature of radioactivity, isotopes in biochemistry, measurement of radioactivity (carbon dating, Geiger-Muller counting and liquid scintillation counting).

UNIT –II

Principles of electrochemical techniques: Electrochemical cells and reactions, potentiometry and voltametry, the pH electrode Centrifugation techniques: Basic principles of sedimentation, Types of centrifuges, Types of rotors, Methods in preparatory ultracentrifugation (differential and density gradient centrifugation). Chromatographic techniques: Principles of chromatography (Adsorption and Partition chromatography), Planar chromatography (Paper and Thin-layer chromatography), Column chromatography (Gas chromatography, Gel exclusion/permeation chromatography, Ion exchange chromatography, Affinity chromatography, HPLC).

UNIT III

Electrophoretic techniques: General principles, support media, electrophoresis of proteins (SDS-PAGE, native gels, gradient gels, isoelectric focusing gels and two dimensional gels),

electrophoresis of nucleic acids (Agarose, pulse-field and sequencing gels). Blotting techniques (Southern, northern and western blotting)

UNIT –IV

Statistical Methods: Sampling methods, sampling distribution, measures of central tendency and dispersion, Probability distribution: normal, binominal and poisson distribution. Sample homogeneity and heterogeneity analysis by binomial and poisson distribution, Parametric and nonparametric statistics: paired and unpaired t-test and _2 test, analysis of variance: one factor and two factor ANOVA, linear and non-linear regression and correlation

PAPER 205: PRACTICALS

100 Marks (6 hours)

1. Study of micro and macro algae in the field and in the laboratory (preparation of temporary and permanent materials and identification).
2. Study of morphology and reproductive structures of algae belonging to different classes through permanent microscopic preparations and preserved specimens.
3. Study of temporary & permanent preparation for microscope observation of external and internal features of vegetative and reproductive structure of important genera of Bryophytes.
4. Study of temporary and permanent preparation of vegetative and reproductive structure of Pteridophytes.
5. Study of temporary and permanent preparation of vegetative and reproductive structure of Gymnosperms.
6. Squashing techniques for study of mitosis and meiosis in onion root tip and flower bud. Use of

camera lucida to study chromosomes & calculating the magnification.

7. To find out mitotic index of dividing cells of Allium cepa root tips.
8. Comparative karyotypic analysis of two species of a genus.
9. Measurement of Dispersion, [Standard Deviation (SD), Standard Error of Mean (SEM), Variance] of the given plant sample
10. Statistical analysis of biological samples and study of test of significance by t-test, _2 test, and Ftest
11. Isolation of plant DNA and quantification of extracted DNA by spectrophotometric method.
12. Separation of DNA by gel electrophoresis.

PAPER 301: Ecology

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT-I

Abiotic and biotic components; Primary and secondary production, methods of measuring productivity, pattern of primary production and biomass in the major ecosystem of the world Energy flow: sources and pattern; food chain and food web in terrestrial and aquatic ecosystems Biogeochemical cycles - Carbon, Nitrogen, Sulphur, Phosphorus.

UNIT-II

Community ecology: nature, structure and gradient analysis, structural analysis of plant and animal community Niche and Random Niche model of species association

Species diversity in ecological gradient, Experimental and field test of diversity-stability Hypothesis. Ecotone and edge effect Competition theory and coexistence

Succession - models of succession (monoclimax and polyclimax theories), Mechanism of succession in natural communities - facilitation, tolerance, and inhibition

Plant communities association

UNIT-III

Population ecology: Basic concept, population characters, biotic potential.
Kinetics of population growth, population growth curves, laws of population growth, regulation of population density, limiting factors of population growth, population fluctuation r & k selection, Population interactions: positive and negative interactions, interspecific relationship Population regulation: competitive exclusion, density dependent and independent regulation

UNIT-IV

Environmental pollution: Kinds and sources of pollutants, classification of pollutants,
Soil pollutants: sources, types, and effects; modification of plant productivity by soil pollution, effects on soil microflora. Water & Air pollutants: fates and effects, role of plants for pollution control, Global climate change, green house effect, ozone depletion- causes and effects.

PAPER 302: CONSERVATION BIOLOGY

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT -I

Biodiversity: Concepts and level (_, _, _), importance of biodiversity, status of biodiversity in India, assessment of biodiversity, major causes of biodiversity loss and its impact, biodiversity hot spots of India and world, IUCN categories of threat, red data book, convention of biological diversity (CBD), salient features of biodiversity Act.
Agrobiodiversity: Concept of diversity in domesticated species (land races, advanced cultivars, wild relatives of cultivated plants, wild plants), Economic value of agrobiodiversity. Causes of erosion and management for food security, Governance of agrobiodiversity

UNIT-II

Conservation: Strategies for *in situ* Conservation: Protected areas, wildlife sanctuaries, national parks, biosphere reserve, strategies for *ex situ* conservation: botanical gardens, field gene banks, seed banks, *in vitro* conservation, DNA banks, wetlands and mangroves for conservation of biodiversity, national and international strategies for conservation of plant genetic resources, sustainable development in biodiversity.

UNIT-III

Plant resource and utilization: Origin and domestication of cultivated plants, world centres of diversity of domesticated plants, plant introduction, primary, secondary centres of origin and diversity of crop plants, origin, evolution and wild relatives of food crop (rice and pigeon pea), fibre (cotton & jute) and oil-yielding crops (groundnut), sugar and biomass crop (sugarcane), fruits (mango).

UNIT-IV

Ethnobotany and forest products: basic principles and scope, uses of medicinal and aromatic plants, cultivation and trade of medicinal plants, important firewood and timber yielding plants, collection, trade and management of non-wood forest products, plants used as avenue trees for shade, and aesthetics, plants used in sericulture and biodiesel production, joint forest management and stake holders responsibility.

PAPER 303: Taxonomy & Plant Pathology

75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT-I

Nomenclature: The species concept, delimitation of taxa and attribution of ranks, salient features of ICBN, herbarium methodology, important herbaria of the world. Phenetic and phylogenetic systems of classification, relative merits and demerits of major system of classification (Benthem & Hooker, Engler-Prantl, Hutchinson, APG system)

UNIT –II

Cladistics in taxonomy: concepts and methodology, parallelism and convergence, cladistics in classification of plants Molecular taxonomy: Morphology, anatomy, palyonology, embryology, cytology and phytochemistry as taxonomic tools

UNIT- III

Plant families: Phylogeny of flowering plants.
Range of floral structures in major dicot groups: Ranales, Rosales, Asterales and Lamiales,
Range of floral structures in monocot groups: Poales, Scitaminae and Orchidales

UNIT-IV

Fungi: Classification of fungi, structure and reproduction of Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Degeneration of sexuality in fungi, nutrition in fungi, heterothallism, heterokaryosis Plant Pathology: Disease symptoms, modes of infection and dissemination, disease resistance, defense
mechanisms in plants and control of plant diseases, host-parasite relationship, fungal toxins and their mode of action

PAPER 304: Plant development and tissue culture
75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT – I

Differentiation and development: Plant cell development with its unique features.
Development of shoot and root apical meristem, leaf development and phyllotaxy, vascular tissue differentiation of root, shoot & leaf, transition to flowering, floral development & homoeotic mutants in *Arabidopsis*

Developmental Biology: Molecular and cytological analysis of fruit development (special reference to *Arabidopsis*)
Fruit ripening and its manipulation, metabolic changes associated with senescence and its regulation.

UNIT – II

Male gametophyte: Structure of anthers, microsporogenesis, pollen development, male sterility, pollen germination, pollen tube growth and guidance, pollen storage, pollen embryos. Female gametophyte: Ovule development, megasporogenesis, structure and organization of the embryo sac, pollination mechanisms and vectors.

UNIT -III

Structure of pistil, pollen - pistil interactions,
Self incompatibility in plants: cytological, biochemical and molecular aspects,
Double fertilization and endosperm development: types, development and maturation
Embryogenesis: structure and development of monocot, dicot and grass embryos

UNIT-IV

Plant tissue culture: Concept of totipotency, lab requirements and general techniques involved tissue culture, plant regeneration through nodal explants & shoot tip cultures, organogenesis,

somatic embryogenesis, callus culture, artificial seeds, protoplast isolation, culture and techniques of fusion, methods for gene transfer in plants (*Agrobacterium* - mediated & direct gene delivery).

PAPER 305: PRACTICALS
100 Marks

1. Study of living shoots apices by dissection using Hydrilla plants
2. Study of cytological zonation in the shoot apical meristem (SAM) by preparing L. S of *Coleus* shoot apex and making permanent slides with double stained procedures
3. Study of wood anatomy through temporary and permanent slides
4. Study of different types of ovules, endosperm, and embryos in permanent slide preparation
5. Study of *in vitro* pollen morphology, germination and pollen tube growth
6. Collection, description and identification of locally available wild angiospermic taxa pertaining to nomenclaturally important category
7. Description of various species of a genus and preparation of a key at generic level
8. Finding out the relationship between two ecological variable using correlation and regression analysis.
9. Determination of minimum size and number of quadrants required for reliable estimates of biomass in grassland
10. Determination of frequency, density of a species of a grassland community
11. To estimate dissolved oxygen, chloride, CO2, acidity and alkalinity content in eutrophic and oligotrophic water samples by Winkler's method
12. Preparation of a short list of ten most important sources of firewood and timber of the locality. Give their local names, scientific names and families to which they belong. Mention their characters.
13. Preparation of tissue culture media.
14. Techniques of surface sterilization and plant regeneration via organ culture.
15. Production of synthetic seeds.
16. Study of common pathogens of plant (fungi, bacteria, mycoplasma) with anatomy of infected parts.
17. Collection, identification and preservation of common plant diseased materials of the locality.
18. Temporary and permanent preparation for microscopic observation of external features, internal structures and reproductive structures of important genera belonging to fungi.
19. Study of biodiversity and important flora of Odisha and India through field trips.

PAPER 306: project paper (dissertation)
200 marks

PAPER 401: ENVIRONMENT AND POLLUTION MANAGEMENT
75Marks (3 hours) (60 marks end semester and 15 marks mid semester examination)

UNIT -I

Basic Environmental biotechnology: Scopes and issues, basic environmental problems-pollution, land degradation, deforestation, biodiversity loss and eutrophication, biotechnology for safer environment, biotechnology for resource management and biomass production, biotechnology for generation of biogas and bio fuels, biotechnology for environmental friendly processes.

UNIT-II

Soil: Classification, formation, survey and land capability, soil structure and profile, soil reaction and buffering, soil organisms-microbes, algae and invertebrates, rhizospheric activity and plant

ELECTIVE (D): PLANT BIOCHEMISTRY

PAPER 2.4.1 BIOENERGETICS, BIOMOLECULES AND BIOSIGNALLING

50 Marks (3 hours) (40 marks end semester and 10 marks mid semester examination)

UNIT -I

Bioenergetics: Thermodynamics principles in biology, concept of free energy, standard free energy, energy-rich compounds, oxidation-reduction reactions.

pH and Buffers: Ionization of water, weak acids and weak bases, concept of pH, pH scale, pKa, Henderson Hasselbalch equation & biological buffers.

UNIT-II

Carbohydrates: Classification, basic chemical structure, monosaccharides, aldoses, and ketoses, cyclic structure of monosaccharides, steroisomerism, anomers and epimers. Sugar derivatives, deoxy sugars, amino sugars, and sugar acids.

Lipids: Classification, basic chemical structure and functions, major lipid subclasses and their role in plant groups, biological role of lipids.

UNIT –III

Amino acids: Classification, structure and properties.

Proteins: Primary, secondary, tertiary and quaternary structure, The covalent structure of proteins, protein-denaturation and folding, reversible binding of protein to ligands, complementary interactions between proteins and ligands.

UNIT-IV

Biosignaling: Molecular mechanisms and general function of signal transduction, ion channels, receptor enzymes, G protein-coupled receptors and second messengers.

Signal transduction: Concept of signal transduction, signaling in microorganisms and plants. plant receptors.

PAPER 2.4.2 PHOTOSYNTHESIS & BIOMOLECULES METABOLISM

50 Marks (3 hours) (40 marks end semester and 10 marks mid semester examination)

UNIT -I

Photosynthesis: Light Absorption, photosystems-structure and regulation, light-driven electron flow, Plastoquinone cycle, thylakoid ATPase-structure and regulation, Calvin cycle, HSK pathway, CAM pathway and their regulation,

Biosynthesis of starch and sucrose, synthesis of cell wall polysaccharides

UNIT-II

Carbohydrate Catabolism: Hydrolysis of starch and sucrose, glycolysis and its regulation, tricarboxylic acid cycle and its regulation, mitochondrial electron transport chain and oxidative phosphorylation and its regulation.

UNIT-III

Lipid Metabolism: lipids as signaling compounds, Biosynthesis of fatty acids (saturated & unsaturated). Biosynthesis of triglycerols, membrane phospholipids, cholesterols, steroid hormones

Oxidation of saturated fatty acids, β-oxidation, oxidation of unsaturated fatty acids, α-oxidation

UNIT-IV

Protein biosynthesis: components/factors of protein synthesis (Amino acids, ribosome, m-RNA, t-RNA, energy resources (ATP/GTP), Protein factors)

Process/Mechanism of protein synthesis proper: Transcription, activation of amino acids, initiation, translation, elongation, termination

Chaperones and protein bindings, Inhibitors of protein synthesis, regulation in protein synthesis

PAPER 2.4.3 ENZYMOLOGY & NITROGEN METABOLISM

50 Marks (3 hours) (40 marks end semester and 10 marks mid semester examination)

UNIT-I

Amino acid synthesis: Synthesis of amino acid of α-ketoglutarate family, 3-phosphoglycerate precursor family, oxalo-acetate and pyruvate precursor family, PEP erythose-4-phosphate precursor family, Ribose-5 phosphate precursor family.

Feedback control of amino acid biosynthesis: (sequential, concerted and cumulative feedback control).

UNIT-II

Nitrogen metabolism: N_2 fixation (Biological), N_2 environment, nodule formation and nod factors, Nitrogenase enzyme, *Nif* genes, nitrate assimilation and ammonium assimilation. *Sulphur mechanism:* Sulphur uptake, assimilation and sulphur reduction

UNIT-III

Enzyme: Factors contributing to catalytic efficiency of enzymes, mechanism of action of lysozyme and Ribonuclease,

Enzyme regulation: Regulation of enzyme activity by covalent modification, binding of inhibitor and activator, enzyme phosphorylation, ubiquitin-proteasome pathway, immobilized enzymes.

UNIT -IV

Enzyme kinetics: Michaelis-Menten equation and Briggs-Haldane modification, determination of Km, Mechanism of single and bi-substrate catalysis.

Enzyme inhibition: Mechanism of competitive, non-competitive and un-competitive Inhibition, determination of inhibition constant.

PAPER 2.4.4: **PLANT METABOLISM AND INSTRUMENTATION**

50 Marks (3 hours) (40 marks end semester and 10 marks mid semester examination)

UNIT -I

Stress physiology: Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic stress tolerance, salinity stress and salinity resistance, metal toxicity, freezing and heat stress, water stress and stress responsive proteins, oxygen deficiency

UNIT –II

Plant growth regulators: Mechanism of action and physiological effect of auxin, gibberlins, cytokinins, ethylene and ABA, concept of hormonal receptors, application of growth regulators in agriculture and horticulture

Flowering: Physiology of flowering, circadian rhythms, biological clocks, endogenous clock,

UNIT-III

Membrane Channels and Pumps: The transport of molecules across a membrane, active and passive transport, ATP hydrolysis and ion pumping, ATP-binding cassette domains of membrane proteins, secondary transporters

Mineral nutrition: Essential nutrients, deficiencies and plant disorders, techniques used in nutritional studies (hydroponics growth system, nutrient film growth system, aeroponic growth system)

UNIT-IV

Instrumental Methods of Analysis: Microscopy, UV-VIS Spectrophotometry, Fluorescence Spectrophotometry, Centrifugation techniques, pH meter, Oxygen electrode, Radioisotope techniques: Separation techniques: Chromatography and Electrophoresis (SDS-PAGE, 2D gel electrophoresis), mass spectrometry

PEA, Florescence transient analysis, GCMS, Infrared gas analyzer, flow cytometry, gel documentation, infra red spectrophotometry

PAPER 2.4.5: **PROJECT BASED ON ELECTIVE PAPER**