

**72. BIOCHEMISTRY / BIOTECHNOLOGY / ENVIRONMENTAL SCIENCE /
FORENSICSCIENCE / GENETICS/MICROBIOLOGY (BCBTESFSGM)**

PART – A : CHEMISTRY (40 Marks)

Coordination Chemistry, spectral and magnetic properties of metal complexes, reactivity of metal complexes, stability of metal complexes, hard and soft acids and bases, Bio Inorganic Chemistry, nitrogen compounds, heterocyclic compounds, carbohydrates, amino acids and proteins, mass spectrometry, Chemical kinetics, Photo chemistry, thermodynamics, separation techniques, Spectrophotometry, Molecular Spectroscopy, drugs, formulations, pesticides, green Chemistry, Macromolecules, Material science, Catalysis.

Atomic structure and elementary quantum mechanics, Chemical bonding, General principles of inorganic qualitative analysis, theory of quantitative analysis, evaluation of analytical data, Molecular symmetry, s-block elements, p-block elements, Chemistry of d-block elements, Chemistry of f-block elements, Organo metallic compounds, theories of bonding in metals, Metal carbonyls and related compounds. Structural theory in Organic Chemistry, Acyclic hydrocarbons, Alicyclic hydrocarbons, benzene and its reactivity, polynuclear hydrocarbons, stereo Chemistry of carbon compounds, Introductory treatment to pericyclic reactions, synthetic strategies, asymmetric synthesis, Halogen compounds, hydroxyl compounds, carbonyl compounds, carboxylic acids and derivatives, active methylene compounds, exercises in inter conversions. Gaseous state, liquid state, solid state, solutions, colloids and surface Chemistry, phase rule, dilute solutions, electro chemistry.

PART – B (60 Marks)

SECTION – I: PHYSICS

Electrostatics-Gauss's Law and its applications. Dielectrics and Capacitance. Magnetostatics. Moving charge in electric and magnetic fields-Hall effect, Cyclotron and Synchrocyclotron, Biot Savart's law. Electromagnetic induction-Faraday's laws and applications, Lenz law. Varying and alternating currents-LCR circuits and related concepts, Resonant circuits. Maxwell's equations and electromagnetic waves. Semiconductor devices-diodes, transistors, oscillators. Digital principles. Atomic and Molecular physics-atomic spectra, theories; Zeeman effect; X-ray spectra; Molecular spectra, Raman effect and spectroscopic techniques. Elements of quantum theory wave nature of matter, uncertainty principle, wave mechanics; Schrodinger's wave equation and its applications. Nuclear Physics-Nucleus, its properties and models; Radioactive decay-Laws and theories; Radiation detectors, Nuclear Reactors. Crystals structures and X-ray diffraction; bonding in crystals; Magnetic properties of materials; Superconductivity - Nano-materials.

Vector analysis-Vector integration, Stokes, Gauss and Greens theorems. Mechanics of particles-Laws of motion, conservation of energy and momentum, and collisions. Dynamics of a rigid body. Mechanics of continuous media- Elastic constants of isotropic solids and their relations. Dynamics of a rigid body. Mechanics of continuous media – Elastic constants of isotropic solids and their relation, Equation of continuity. Central forces-nature; Gravitational field; Kepler's laws. Special theory of relativity. Fundamentals of Vibrations- Simple harmonic oscillators. Damped and forced Oscillations. Complex Vibrations-Fourier theorem, analysis of periodic, square, triangular and saw tooth wave functions. Coupled Oscillators. Vibrating strings-transverse wave propagation, strings clamped at both the ends, overtones and energy transport. Vibrations of bars – longitudinal wave propagation in bars. Ultrasonic- properties, methods of production and detection, and applications. Kinetic theory of gases- Law of distribution of molecular speeds, Application to Viscosity, thermal conduction and diffusion of gases. Laws of

thermodynamics, entropy and disorder. Thermodynamic potentials and Maxwell's equations, specific heats and Joule Kelvin effect. Low temperature Physics. Quantum theory of Radiation-Black body, Wein's law, Rayleigh Jeans law and Plank's law, and measurement of Radiation. Elements of Statistical Mechanics. Concept of ensembles – MB, BE and FD Statistics, Matrix Methods in paraxial optics. Aberrations and methods of their minimization. Interference and its theories; Interference by films and interferometry. Fraunhofer diffraction and Fresnel diffraction. Polarization-production and analysis. Phenomenon of double refraction. Babinet's compensator. Optical activity. Lasers, fibre optics and holography.

SECTION – II: BOTANY

Evolution of Life and Diversity of Microbes: Origin and evolution of Life with reference to microbes- an outline. **Viruses:** Structure, replication and transmission; plant diseases caused by viruses and their control. Brief account of Archaeobacteria, Chlamydia, Actinomycetes and Mycoplasma. **Bacteria:** Structure, nutrition, reproduction and economic importance. An outline of plant diseases of important crop plants caused by bacteria and their control. **Cyanobacteria:** Cell structure, thallus organization and their prospecting (uses)-Biofertilizers. Structure and life history of *Oscillatoria*, *Nostoc* and *Anabaena*.

Algae and Fungi: Algae: General account, thallus organization, structure, reproduction, classification and economic importance. Structure, reproduction, life history and systematic position of *Oedogonium*, *Coleochaete*, *Chara*, *Ectocarpus* and *Polysiphonia*. **Fungi:** General characters, classification and economic importance, Structure, reproduction and life history of *Albugo*, *Saccharomyces*, *Penicillium*, *Puccinia*, *Alternaria*, General account of plant diseases caused by Fungi and their control. **Lichens:** Structure and reproduction; ecological and economic importance.

Bryophyta and Pteridophyta: Bryophytes: General characters, classification and alternation of generations. Structure, reproduction, life history and systematic position of *Marchantia*, *Anthoceros* and *Polytrichum*. Evolution of Sporophyte in Bryophytes. **Pteridophytes:** General characters, classification, alternation of generations and evolution of sporophyte, Structure, reproduction, life history and systematic position of *Rhynia*, *Lycopodium*, *Equisetum* and *Marsilea*, Evolution of stele, heterospory and seed habit in Pteridophytes.

Gymnosperms and Palaeobotany: Gymnosperms: General characters, structure, reproduction and classification, Morphology of vegetative and reproductive parts, systemic position, life history of *Pinus* and *Gnetum*, Distribution and economic importance; endangered Gymnosperms, **Palaeobotany:** Introduction, Fossils and fossilization; Geological time scale; Importance of fossils, Bennettiales: General account.

Anatomy: Meristems: Types, histological organization of shoot and root apices and theories, **Tissues and Tissue Systems:** Simple, complex, and *special tissues*, **Leaf:** Ontogeny, diversity of internal structure; stomata and epidermal outgrowths, **Stem and root anatomy, Vascular cambium-** Formation and function. Anomalous secondary growth of stem-*Achyranthes*, *Boerhavia*, *Bignonia*, *Dracaena*; **Root – Beta.** **Wood structure:** (General account) Study of local timbers – Teak (*Tectona grandis*), Rosewood, (*Dalbergia latifolia*), Red sanders, (*Pterocarpus santalinus*) Nallamaddi (*Terminalia tomentosa* (*T. alata*), and Neem (*Azadirachta indica*).

Embryology: Introduction to Embryology, Anther structure, Microsporogenesis and development of male gametophyte, Ovule Structure and types; Megasporogenesis; types and development of female gametophyte, Pollination – Types; Pollen – pistil interaction, Fertilization, Endosperm – Development and types, Embryo – development and types; Polyembryony and Apomixis – an outline, **Palynology:** Pollen morphology, NPC system, application of Palynology.

Taxonomy: Introduction: Principles of plant systematics, Systematics vs Taxonomy, Types of classification: Artificial, Natural and Phylogenetic, Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantle. An introduction to Angiosperm Phylogeny Group (APG), Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy, Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy, Nomenclature and Taxonomic resources: An introduction to ICBN, Vienna code – a brief account. Herbarium:

OUCET-2017 Syllabus

Concept, techniques and applications, Systematic study and economic importance of plants belonging to the following families: Annonaceae, Capparaeae, Rutaceae, Fabaceae (Faboideae/Papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae, Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae and Poaceae.

Medicinal Botany: Ethnomedicine: Scope, interdisciplinary nature, distinction of Ethnomedicine from Folklore medicine. Outline of Ayurveda, Sidda, Unani and Homeopathic systems of traditional medicine, Role of AYUSH, NMPB, CIMAP and CDRI. **Plants in primary health care:** Common medicinal plants – Tippateega (*Tinospora cordifolia*), tulasi (*Ocimum sanctum*), pippallu (*Piper longum*), Karaka (*Terminalia chebula*), Kalabanda (*Aloe vera*), Turmeric (*Curcuma longa*), **Traditional medicine vs Modern medicine:** Study of select plant examples used in traditional medicine as resource (active principles, structure, usage and pharmacological action) of modern medicine: Aswagandha (*Withania somnifera*), Sarpagandha (*Rauwolfia serpentina*), Nela usiri (*Phyllanthus amarus*), Amla (*Phyllanthus emblica*) and Brahmi (*Bacopa monnieri*), **Pharmacognosy:** Introduction and scope. Adulteration of plant crude drugs and methods of identification – some examples. Indian Pharmacopoeia, **Plant crude drugs:** Types, methods of collection, processing and storage practices. Evaluation of crude drugs.

Cell Biology: Plant cell envelopes: Ultra structure of cell wall, molecular organization of cell membranes, **Nucleus:** Ultrastructure, Nucleic acids – Structure and replication of DNA; types and functions of RNA, **Chromosomes:** Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype, Special types of chromosomes: Lampbrush, Polytene and B-chromosomes, **Cell division:** Cell cycle and its regulation; mitosis, meiosis and their significance.

Genetics: Mendelism: Laws of inheritance, Genetic interactions – Epistasis, complementary, supplementary and inhibitory genes, **Linkage and crossing over:** A brief account, construction of genetic maps-2 point and 3 point test cross data, **Mutations:** Chromosomal aberrations – structural and numerical changes; Gene mutations, **Gene Expression:** Organization of gene, transcription, translation, mechanism and regulation of gene expression in prokaryotes (Lac and Trp Operons), **Extra nuclear genome:** Mitochondrial and plastid DNA, plasmids.

Ecology: Concept and components of Ecosystem. Energy flow, food chains, food webs, ecological pyramids, biogeochemical cycles – Carbon, Nitrogen, Phosphorus, **Plants and environment:** Ecological factors – Climatic (light and temperature), edaphic and biotic. Ecological adaptations of plants, **Population ecology:** Natality, mortality, growth curves, ecotypes, ecads, **Community ecology:** Frequency, density, cover, life forms, biological spectrum, ecological succession (Hydrosere, Xerosere), **Production ecology:** Concepts of productivity, GPP, NPP, CR (Community Respiration) and secondary production, P/R ratio and ecosystems.

Biodiversity and Conservation: Biodiversity: Concepts, Convention on Biodiversity – Earth Summit. Types of biodiversity, Levels, threats and value of Biodiversity, Hot spots of India – Endemism, North Eastern Himalayas, Western Ghats, **Agro-biodiversity:** Vavilov centres of crop plants, Principles of **conservation:** IUCN threat-categories, RED data book – threatened & endangered plants of India. Role of organizations in the conservation of Biodiversity – IUCN, UNEP, WWF, NBPGR.

Physiology: Water Relations: Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis; water, osmotic and pressure potentials; absorption, transport of water, ascent of sap; transpiration; Stomatal structure and movements. **Mineral Nutrition:** Essential macro and micro mineral nutrients and their role; symptoms of mineral deficiency; absorption of mineral ions; passive and active processes. **Enzymes:** Nomenclature, characteristics, mechanism and regulation of enzyme action, enzyme kinetics, factors regulating enzyme action. **Photosynthesis:** Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect; concept of two photo systems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation; Carbon assimilation pathways: C₃, C₄ and CAM; photorespiration. **Translocation of organic substances:** Mechanism of phloem transport; source-sink relationships.

OUCET-2017 Syllabus

Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, pentose phosphate pathway, **Nitrogen Metabolism:** Biological nitrogen fixation, nitrate reduction, ammonia assimilation, amino acid synthesis and protein synthesis, **Growth and Development:** Definition, phases and kinetics of growth. Physiological effects of phytohormones- auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids. Physiology of flowering and photoperiodism, role of phytochrome in flowering.

Tissue Culture and Biotechnology: Tissue culture: Introduction, sterilization procedures, culture media – composition and preparation; explants. Callus culture; cell and protoplast culture, Somatic hybrids and cybrids. Applications of tissue culture: Production of Pathogen free plants and somaclonal variants, production of stress resistance plants, secondary metabolites and synthetic seeds. **Biotechnology:** Introduction, history and scope, **rDNA technology:** Vectors and gene cloning and transgenic plants.

Seed Technology and Horticulture: Seed: Structure and types, Seed dormancy; causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability, genetic erosion. Seed production technology; seed testing and certification, **Horticulture techniques:** Introduction, Cultivation of ornamental and vegetable crops, Bonsai and landscaping, **Floriculture:** Introduction. Importance of green house, polyhouse, mist chamber, shade nets; Micro Irrigation systems. Floriculture potential and its trade in India, Vegetative Propagation of Plants: Stem, root and leaf cuttings. Layering and bud grafting. Role of plant growth regulators in horticulture.

SECTION – III: ZOOLOGY

Animal Physiology, Genetics & Evolution: Physiology of Digestion: Definition of digestion and types of digestion-extra and intracellular; Digestion of Carbohydrates, proteins, lipids and cellulose digestion; Absorption and assimilation of digested food materials; Gastrointestinal hormones-control of digestion **Physiology of respiration:** Types of respiration-external and internal respiration; Structure of mammalian lungs and gaseous exchange; Transport of oxygen-formation of oxyhaemoglobin and affinity of hemoglobin for Oxygen, Oxygen dissociation curves; Transport of CO₂-Chloride shift, Bohr effect; Cellular respiration- Main steps of glycolysis, Krebs cycle, electron transport, Oxidative phosphorylation and ATP production (Chemiosmotic theory); **Physiology of Circulation:** Open and closed circulation; Structure of mammalian heart and its working mechanism-Heartbeat and cardiac cycle. Myogenic and neurogenic hearts; Regulation of heart rate-Tachycardia and Bradycardia; **Physiology of Excretion:** Definition of excretion; Forms of nitrogenous waste material and their formation: classification of animals on the basis of excretory products; Gross organization of mammalian excretory system and structure of kidney; Structure and function of Nephron-Counter current mechanism; **Physiology of muscle contraction:** General structure and types of muscles: Ultra structure of skeletal muscle; Sliding filament mechanism of muscle contraction; Chemical changes during muscle contraction-role of calcium, ATP utilization and its replenishment; **Physiology of nerve impulse:** Structure of nerve cell; Nature of nerve impulse-resting potential and action potential. Properties of nerve impulse-threshold value, refractory period, all or none response; Conduction of nerve impulse along an axon-local circuit theory and salutatory conduction theory; Structure of synapse, mechanism of synaptic transmission – electrical and chemical transmissions; **Physiology of Endocrine System:** Relationship between hypothalamus and pituitary gland; Hormones of hypothalamus; Hormones of Adenohypophysis and Neurohypophysis; Hormones of pineal gland, thyroid gland, parathyroid, thymus, adrenal and pancreas; Endocrine control of mammalian reproduction – Male and female hormones- Hormonal control of menstrual cycle in humans; **Physiology of Homeostasis:** Concept of homeostasis and its basic working mechanism; Mechanism of Homeostasis – giving three illustration viz., Hormonal control of glucose levels, Water and ionic regulation by freshwater and marine animals and temperature regulation in man; **Genetics:** Mendel's laws-Law of segregation and independent assortment; Genetic interactions-Incomplete dominance, codominance and epistasis; Identification of DNA as the genetic material-Griffith's experiment and Hershey-Chase experiment; Central dogma of molecular biology-Brief account of DNA replication (Semi-conservative method), Replication fork (Continuous and discontinuous synthesis); Transcription-Brief account initiation, elongation and termination in eukaryotes; Translation; Genetic code; gene regulation as exemplified by lac operon; Human karyotyping, barr bodies and Lyon hypothesis and Amniocentesis chromosomal disorders-Autosomal and sex chromosomes; **Organic Evolution:** Genetic basis of Evolution, Gene pool and gene frequencies, Hardy-Weinberg's Law, Force of destabilization, natural selection, genetic drift, Mutation, Isolation and Migration; Speciation – Allopatry and sympatry. **Fisheries and Aquaculture, Hematology, Immunology, Animal Biotechnology: Fisheries and Aquaculture:**

OUCET-2017 Syllabus

Capture fisheries-Introduction; Types of fisheries, Fishery resources from Freshwater, Brackish water and Marine habitats; Finfish and shell fisheries; Fishing gears and fishing crafts; Freshwater, Brackish water and Mariculture; Site selection criteria; Aquaculture systems; induced breeding; Hatchery design and Management; Larval rearing-Nursery ponds, rearing and grow out ponds; Shrimp and Prawn culture; Hatchery systems, Seed transport, common diseases and control; Post-harvest technology; Preservation and processing-Freezing, solar drying, Canning, salting smoking, By product of fish cool mineral; **Clinical Science: Hematology:** Blood composition and functions; Blood groups and transfusion problems; Blood diseases-Anemia, Leukemia, Leucocytosis, Leucopenia; Biopsy and autopsy-Clinical importance; **Immunology:** 2.2.1. Types of Immunity-Innate and Acquired; Antigens-Haptenes and epitopes and their properties; Structure and biological properties of human immunoglobulin G (IgG); Hypersensitivity-immmediate and delayed; **Important Human Parasites** Blood parasites (structure and Clinical significance of *Plasmodium*); Intestinal parasites-Structure and clinical significance *Entamoeba*, *Giardia*, *Taeniasolim*, *Ancylostoma*, *Enterobius*; **Animal Biotechnology:** Scope of Biotechnology, Cloning vectors-Characteristics of vectors, Plasmids; Gene Cloning-Enzymatic cleavage of DNA, Restriction enzymes (Endonucleases) and Ligation; Transgenesis and Production of transgenic animals (Fish and Goat); Application of stem cell technology in cell based therapy (Diabetes and Parkinson's diseases).

Biology of Invertebrates and Cell Biology: Phylum protozoa: General characters and outline classification up to classes. Type study: *Paramecium*; Phylum Porifera: General characters and outline classification up to classes. Type study: *Sycon*; Canal system in Sponges; Phylum coelenterate: General characters and outline classification up to classes. Type study: *Obelia*; Polymorphism in Coelenterates; Corals and coral reef formation; Phylum Platyhelminthes: General characters and outline classification up to classes. Type study, *Fasciola hepatica*; Phylum Nematheiminthes: General characters and outline classification up to classes. Type study: *Ascaris lumbricoides*; Phylum Annelidia: General characters and outline classification up to classes Type study: Leech; Coelom and coelomoducts in Annelids; Phylum Arthropoda: General characters and outline classification of up to classes Type study; Prawn; Crustacean larvae; *Peripatus*-Characters and Significance; Phylum Mollusca: General characters and outline classification of up to classes Type study: *Pila*; Pearl formation in Molluses; Phylum Echinodermata: General characters and outline classification of up to classes. Type study: Star fish; General characters of Hemichordata: Structure and affinities of *Balanoglossus*; **Cell Biology:** Cell theory; Ultra structure of Animal cell; Structure of Plasma membrane-Fluid-mosaic mode. Transport functions of Plasma membrane-Passive transport, active transport (Antiport, symport and uniport) and bulk transport; Structure and functions of Endoplasmic reticulum Golgi body, Ribosomes, lysosomes and Mitochondrion; Chromosomes-nomenclature types and structure. Giant chromosomes-Polytene and Lampbrush chromosomes; Cell division-Cell-cycle stages (G₁, S, G₂ and M phases), Cell-cycle check points and regulation. Mitosis; Meiosis-and its significance; **Biomolecules of the cell: Carbohydrates:** Classification of Carbohydrates; Structure of Monosaccharides (Glucose and Fructose); Structure of Disaccharides (Lactose and Sucrose); Structure of Polysaccharides (Starch, Glycogen and Chitin); **Proteins:** Amino acids: General properties, nomenclature, classification and structure; Classification of proteins based on functions, chemical nature and nutrition, peptide bond and structure (Primary, Secondary, Tertiary and Quaternary structures); **Lipids:** Classification. Structure of Fatty acids (Saturated and unsaturated); Triacylglycerols, Phospholipids (Lecithin and cephalin) and Steroids (Cholesterol); **Nucleic acids:** Structure of purines, pyrimidines, ribose and deoxyribose sugars; Watson and crick model of DNA – Nucleoside, Nucleotide, Chargaff's rule Structure of RNA, Types of RNA – rRNA, tRNA and mRNA; **Biology of Chordates, Embryology, Ecology and Zoogeography:** Protochordates: Salient features of Urochordata and Cephalochordata Structure and life-history of *Herdmania*, Significance of retrogressive Metamorphosis; General organization of chordates; General characters of Cyclostomes; General characters of fishes, classification up to sub-class level with examples; Type study – *Scoliodon*: Morphology, respiratory system, circulatory system, excretory system, nervous system and sense organs; Migration in fishes and types of scales; General characters and classification of Amphibia up to order level; Type study-*Rana*: Morphology, digestive system, respiratory system, circulatory system, excretory system, nervous system and reproductive system; Parental care in amphibians; General characters and classification of Reptilia up to order level; Type study-*Calotes*: Morphology, digestive system, respiratory system, circulatory system, urinogenital system and nervous system; General characters and classification of Aves up to order level with examples; Type study-Pigeon (*Columbia livia*): Exoskeleton, respiratory system, circulating system and excretory system; significance of migration in birds; Flight adaptation in birds; General characters and classification of Mammalia up to order level with examples; Dentition in mammals; **Embryology:** Spermatogenesis, Oogenesis and Fertilization; Types of eggs; Types of cleavages; Development of frog up to gastrulation and formation of primary germ layers; Foetal membranes and their significance placenta: types and functions; Regeneration with reference to Turbellarians and lizards; **Ecology and Zoogeography:** Biogeochemical cycles or nutrient cycles-Gaseous cycles of Nitrogen and carbon;

OUCET-2017 Syllabus

Sedimentary cycle – phosphorus; Definition of community-Habitat and ecological niche; Community interactions: Brief account on Competition, predation, mutualism, commensalisms and parasitism; Ecological succession: Primary and Secondary, seral stages, climax community with examples; Population ecology: Density and dispersions of animal populations; growth curves and growth of animal populations-r-selected and k-selected species; Population regulation mechanisms–both biotic and abiotic; Growth of human population its control. Future of human population; Zoogeographical realms and their characteristic fauna.

SECTION – IV: BIOCHEMISTRY

Elementary aspects of cell structure–function, tissues and body fluids. 2. Chemistry, physiological role and metabolism of biomolecules like carbohydrates, amino-acids, proteins, Lipids & nucleic acids. 3. Basic aspects of nutrition, endocrinology & Physiology, clinical biochemistry, enzymology, biological oxidations, photosynthesis. 4. Physiological role of vitamins and minerals. 5. Basic aspects of immunology. 6. Replication, transcription and protein synthesis. 7. Fundamental aspects of microbiology. 8. Elementary aspects of r-DNA technology and genetic engineering. 9. Principles, methodology and applications of various biochemical techniques used in biochemistry.

SECTION – V: BIOTECHNOLOGY

Fundamentals Of Biotechnology: Perspectives of Biotechnology - Nature and properties of biomolecules involved in information storage retrieval signaling and executing mediator and catalytic function: DNA, RNA, Proteins and other signal molecules., basic units of living systems, classification, ultra structure and composition of cells, cell division, cell cycles, cell to cell interactions, Laws of inheritance, linkage and crossing over, sex determination and sex linked inheritance, mapping, genetic recombination (Prokaryotes & Eukaryotes). Classification, structure function of micro-organisms-microscopy and microbial techniques. Measures of central tendencies and distribution probability distribution, sampling theory, confidence levels - Applications of computers in biological system.

Biochemical Techniques Intermediary metabolism and biocatalysis: Spectrophotometry and colorimetry - Beer Lambert Law - physical methods of determining molecular structure - Methods of cell disruption and analysis by fractionation - dialysis centrifugation, chromatography, Electrophoresis, manometry and its application, Intermediary metabolism - glycolysis, TCA cycle, electron transport, photosynthesis, respiration and fermentation, Biosynthesis of amino acids, nucleotides, polysaccharides and lipids, Biocatalysis - Enzymes, their catalysis, inhibition and regulation.

Molecular Biology and Genetic Engineering: Nucleic acids as genetic material structure replication of DNA & RNA. Mutation and damage to DNA - Molecular basis, Gene expression: Transcription & Processing of RNA - Genetic code - Regulation. Plasmids and transposable elements. Outlines of DNA technology - enzymes used in gene cloning, vectors, genomic DNA and cDNA libraries and expression of cloned genes. Applications. Immune system and their functions. Antibody diversity - vaccines and their production. Purification antigens and antibodies, Hybridoma technology and Monoclonal antibodies ELISA, RIA synthetic vaccines.

Application of Biotechnology: Animal Cell Biotechnology, Plant Biotechnology, Microbial Biotechnology, Environmental Biotechnology.

SECTION – VI: GENETICS

Genetic Analysis:

Mendelian Principles: Law of segregation-Law of Independent Assortment, Extension to mendelian segregation patterns: Co-dominance, Incomplete dominance, Lethals, gene interaction - Epistasis - paramutation-Environmental effects on gene expression-Penetrance-Expressivity, Multiple alleles, Isoalleles and Pseudoalleles. Chromosomal basis of inheritance: Eucaryotic cell cycle - S and G phases, Chromosomal replication and segregation, Mitosis, Meiosis. Chromosome structure and organisation: Size and shape of chromosomes, structure of chromosomes, Packing of DNA, Specialised chromosomes, Lampbrush chromosomes, Polytene chromosomes, puffing and genetic activity at puffs. Supernumerary chromosomes. Chromosomal changes: Inversions Duplications, Deficiencies, Change in chromosomes number; Linkage, recombination and mapping phases of linkage, chiasmata and crossing over, Cytological proof for crossing over and recombination, complete and partial linkage, Linkage analysis and gene mapping, Gene mapping in Neurospora - Tetrad analysis, Recombination in bacteria, Transduction, Transformation, Recombination in viruses, Genetics of sex determination and sex linked inheritance: Sex determining mechanisms in Birds, Drosophila, Plants and Man, Sex chromatin and inactivation of X chromosomes, sex linked inheritance, Holandric genes, Incompletely sex linked genes, sex limited genes, Sex influenced genes, Cytoplasmic inheritance: Chloroplast and mitochondrial genomes, Their evolutionary significance.

Molecular Genetics:

DNA as the genetic material: Evidences for DNA as Genetic material, Transforming Principle - Avery et al experiment, Labelling experiment of Hershey and Chase, Tobacco Mosaic virus infectivity, **Nucleic acids:** Structure of DNA and RNA, Watson and Crick model, Biosynthesis of nucleic acid, Replication of DNA, Models of DNA replication - linear and circular DNA, Enzymes involved in DNA Replication. **Genome organisation:** C value paradox, Gene Families and their evolutionary significance, Satellite DNA, Selfish DNA, Intervening sequences - introns, Ribosomal genes. **Gene mutation and repair mechanisms:** Spontaneous mutations and induced mutations, Mode of action of mutagens, Repair of mutations, Photoreactivation, Excision repair **SOS** repair Recombinational repair, Error prone repair, Detection of mutations - Prokaryotes and Eucaryotes. **Fine structure analysis of the gene:** Compound locus in Drosophila, One gene - one enzyme concept, Analysis of rII locus, Colinearity between gene and polypeptide - Tryptophan synthetase, Intra codon recombination. **Gene expression:** Transcription, Formation of RNA transcripts - mRNA, Reverse transcription, translation, genetic code-codons and amino acids, anticodon and wobble hypothesis, structure and function of RNA - mRNA, tRNA and rRNA, structure and function of ribosomes - subunits of ribosomes, ribosomes and polyribosomes, polypeptide synthesis - initiation, elongation and termination, **Regulation of gene expression:** Regulation in bacteria - Operon, Regulator genes, Structural genes, Terminators, Positive and negative Control, Catabolite repression - cAMP and CRP, Tryptophan regulation - operator, Attenuation, Regulation of termination Antitermination, Lytic cascade in phage, Regulation in eucaryotes, Gal locus regulation in yeast, Regulation of mating type in yeast. **Transposable elements:** Transposable elements in different organisms, Maize-Dt, Ac Ds and Spm systems, Drosophila - copia, p element, yeast - Ty elements, bacterial plasmids, Transposon - structure and physical characteristics, **Recombinant DNA technology:** Restriction enzymes, Cloning, Vectors, Gene isolation and identification, chromosome walking, Gene libraries, Expression of cloned genes. **Genes in population and evolution Genetic diversity in natural populations:** The concept of populations, structure of populations, Random mating and genetic equilibrium, Hardy Weinberg law. **Quantitative traits and population improvement:** Multiple factor inheritance, Breeding plans and selection in plants and animals, Inbreeding, and genetic basis of inbreeding Cross breeding and Heterosis. **The origin of life:** Origin of primary compounds, colloidal systems and primary proteins, Formation of RNA and DNA, origin of the genetic code. **Rhylogenetic analysis and evolutionary trends:** Evolution of hemoglobin and cytochrome - Molecular clocks DNA and amino acid sequences - phylogenetic relationship, Protein phylogeny and human evolution.

Applied Genetics: Industrial applications of microbial genetics: Vaccines, Synthetic peptide - vaccines, Live attenuated vaccines, Killed vaccines, Subunit vaccines, Biofertilisers and pesticides, Polymers, Biodegradation of petroleum, Biodegradation of xenobiotics. **Immunogenetics:** Basic immunology, Genetics of immunoglobulins, Immunogenetics of transplantation, Monoclonal antibodies - Hybridoma technique, **Genetic engineering and crop improvement** Cell and tissue culture techniques, Somatic cell hybrids, Transgenic plants. **Genetic engineering and animal improvement :** Cloning transgenic animals for improving protein, milk yield, etc., **Genetics of human diseases and gene therapy:** Metabolic disorders - PKU, Alkaptonuria etc., Syndromes, Disorders of the blood, Types of blood groups in man, Inheritance of blood groups, Blood group incompatibility, Genetic basis of cancer, Diagnosis, Prenatal diagnosis, Diagnosis by gene cloning, Diagnosing mutations by linkage association, Genetic counseling, Human gene products in therapy - Insulin, Interferon, Blood protein etc., Examples of gene therapy in diseases like retinoblastoma, Muscular Dystrophy etc., **Genetics and society:** Euphenics, Eugenics, Genetics and law, Usefulness of prenatal diagnosis, genetic counseling and genetic engineering techniques.

SECTION – VII: MICROBIOLOGY

Scope and importance of Microbiology. Spontaneous generation-biogenesis theory; Germ theory of diseases; Recent developments of Microbiology. Principles of microscopy. Principles of staining. Culture media. Sterilization methods. Isolation of pure cultures, maintenance and preservation of microbial cultures. Morphology and ultra structure of typical eubacterial cell. Bacterial classification. Discovery and nature of viruses. TMV, HIV, T4 and lambda phages. Cultivation and assay of phages, plant and animal viruses. Nutritional types of bacteria. Bacterial growth. Respiration. Fermentation. Antibiotics. DNA and RNA structures and their role as genetic materials. Transcription and translation. *Lac* operon. Bacterial plasmids and transposons. DNA damage and repair mechanisms. Mutations. Gene transfer mechanisms in bacteria. Recombinant DNA technology. Types of immunity. Organs of immune system. Cells of immune system. Antigens. Antibodies. Antigen-antibody reactions. Normal flora of human body. Infection, Disease, Defense mechanisms. Bacterial toxins, virulence and attenuation. Airborne diseases, Food water borne diseases and Blood borne diseases. General principles of diagnostic microbiology. Elements of chemotherapy-therapeutic drugs. Drug resistance. Microorganisms in relation to plant growth. Biological nitrogen fixation, Biofertilizers. Microorganisms of the environment (soil, water and air). Microbial interactions. Microbiology of potable and polluted waters. Microorganisms of food spoilage and their sources. General account of food preservation. Microorganisms as food – SCP, edible mushrooms. Screening and isolation of industrially useful microbes, strain improvement and fermentation. Fermentor. Immobilization Industrial production of Alcohols, Glutamic acid, Citric acid, vitamin B12, Enzymes, and Antibiotics.