Bio Technology (BT)

- **Microbiology:** Prokaryotic and eukaryotic cell structure; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration, photosynthesis); Nitrogen fixation; Chemical basis of mutations and mutagens; Microbial genetics (plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses.
- **Biochemistry:** Biomolecules and their conformation; Weak inter-molecular interactions in biomacro molecules; Chemical and functional nature of enzymes; Kinetics of single substrate and bi-substrate enzyme catalyzed reactions; Bioenergetics; Metabolism (Glycolysis, TCA and Oxidative phosphorylation); Membrane transport and pumps; Cell cycle and cell growth control; Cell signaling and signal transduction;
- **Molecular Biology and Genetics:** Molecular structure of genes and chromosomes; DNA replication and control; Transcription and its control; Translational processes; Regulatory controls in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extra chromosomal inheritance; Chromosomal variation; Population genetics; Transposable elements, Molecular basis of genetic diseases and applications.
- **Process Biotechnology:** Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exopolysacharides, antibiotics and pigments etc.; Microbial production, purification and bioprocess application(s) of industrial enzymes; Production and purification of recombinant proteins on a large scale; Chromatographic and membrane based bioseparation methods; Immobilization of enzymes and cells and their application for bioconversion processes. Aerobic and anaerobic biological processes for stabilization of solid / liquid wastes; Bioremediation.

- **Bioprocess Engineering:** Kinetics of microbial growth, substrate utilization and product formation; Simple structured models; Sterilization of air and media; Batch, fed-batch and continuous processes; Aeration and agitation; Mass transfer in bioreactors; Rheology of fermentation fluids; Scale-up concepts; Design of fermentation media; Various types of microbial and enzyme reactors; Instrumentation in bioreactors.

- **Plant and Animal Biotechnology:** Special features and organization of plant cells; Totipotency; Regeneration of plants; Plant products of industrial importance; Biochemistry of major metabolic pathways and products; Autotrophic and heterotrophic growth; Plant growth regulators and elicitors; Cell suspension culture development: methodology, kinetics of growth and production formation, nutrient optimization; Production of secondary metabolites by plant suspension cultures; Hairy root cultures and their cultivation. Techniques in raising transgencies.

- **Characteristics of animal cells:** Metabolism, regulation and nutritional requirements for mass cultivation of animal cell cultures; Kinetics of cell growth and product formation and effect of shear force; Product and substrate transport; Micro & macro-carrier culture; Hybridoma technology; Livestock improvement; Cloning in animals; Genetic engineering in animal cell culture; Animal cell preservation.
- **Immunology:** The origin of immunology; Inherent immunity; Humoral and cell mediated immunity; Primary and secondary lymphoid organ; Antigen; B and T cells and Macrophages; Major histocompatibility complex (MHC); Antigen processing and presentation; Synthesis of antibody and secretion; Molecular basis of antibody diversity; Polyclonal and monoclonal antibody; Complement; Antigen-antibody reaction; Regulation of immune response; Immune tolerance; Hyper sensitivity; Autoimmunity; Graft versus host reaction.
- **Recombinant DNA Technology:** Restriction and modification enzymes; Vectors: plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; cDNA and genomic DNA library; Gene isolation; Gene cloning; Expression of cloned gene; Transposons and gene targeting; DNA labeling; DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In-situ hybridization; RAPD; RFLP; Site directed mutagenesis; Gene transfer technologies; Gene therapy.
- **Bioinformatics:** Major Bioinformatics resources (NCBI, EBI, ExPASy); Sequence and structure databases; Sequence analysis (bimolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategies; Comparative genomics; Understanding DNA micro arrays and protein arrays); Molecular modeling and simulations (basic concepts including concept of force fields).

BIOCHEMISTRY/ENVIRONMENTAL SCIENCE/FORENSIC SCIENCE / FERMENTATION TECHNOLOGY/GENETICS/MICROBIOLOGY (BCESFSFTG&M)

BCESFSG&M

Coordination Compounds, Applications of Coordination Compounds, Organo metallic Chemistry, Metal Carbonyls and Related Compounds, Bioinorganic Chemistry, Hard and Soft Acids and Bases (HSAB). Carboxylic Acids and Derivatives, synthesis Based on Carbanions, Nitro Hydrocarbons, Amines, Cyanides and Isocyanides, Heterocyclic Compounds, Carbohydrates, Amino Acids and Proteins, Electrochemistry and Emf, Chemical Kinetics, Thermodynamics. Photochemistry.

P-Block Elements, Chemistry of Zero Group Elements, Chemistry of d-Block Elements, Chemistry of f-Block Elements, General Principles of Inorganic Qualitative Analysis, Chemical Bonding, Molecular Orbital Theory, Theory of Quantitative Analysis, Theories of Bonding in Metals. Structural Theory in Organic Chemistry, Acyclic Hydrocarbons, alicyclic Hydrocarbons, aromatic Hydrocarbons, Halogen Compounds, Alcohols, Phenols, Ethers and Epoxides, Carbonyl Compounds, Conformational Analysis, Stereochemistry of Carbon Compounds. Atomic Structure and Elementary Quantum Mechanics, Gaseous State, Liquid State, Solutions, Dilute Solutions and Colligative Properties, Solid State Chemistry, Phase Rule, Colloids and Surface Chemistry, adsorption, Evaluation of Analytical Data.

BOTANY

Microbial Diversity:

Bacteria: Structure, Nutrition, reproduction and economic importance. An outline of plant diseases of important crop plants caused by bacteria and their control with reference to Angular leaf spot of cotton and Bacterial blight of Rice. Brief account of Archaebacteria, Actinomycetes. General account of Mycoplasma with reference to Little leaf of brinjal and Papaya leaf curl.

Viruses: Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro.

Algae

Algae: General characters, structure, reproduction and classification of algae (Fritsch**).**

Cyanobacteria: General characters, cell structure, thallus organisation and their significance as biofertilizers with special reference to Oscillatoria, Nostoc and Anabaena.

Structure and reproduction of the following:

Chlorphyceae-*Volvox, Oedogonium,*
Chara.Phaeophyceae-*Ectocarpus*.
Rhodophyceae-*Polysiphonia*.

Fungi: General characters and classification of fungi (Ainsworth). Structure and reproduction of thefollowing:
Mastigomycotina-
Albugo Zygomycotina-
Mucor
Ascomycotina-*Saccharomyces,*
*Penicillium*Basidiomycotina- *Puccinia*
Deuteromucotina-*Cercospora.*

Lichens: Structure and reproduction; ecological and economic importance.

<u>Bryophytes, Pteridophytes, Gymnosperms and Paleobotany:</u>

Bryophytes: Structure, reproduction, life cycle and systematic position of *Marchantia, Anthoceros and Polytrichum*. Evolution of Sporophyte in Bryophytes. **Pteridophytes**: Structure, reproduction, life cycle and systematic position of *Rhynia, Lycopodium, Equisetum* and *Marsilea*. Stelar evolution, heterospory and seed habit in Pteridophytes. **Gymnosperms**: General characters, structure, reproduction and classification (Sporne's). Distribution and economic importance of Gymnosperms. Morphology of vegetative and reproductive parts, systematic position and life cycle of *Pinus* and *Gnetum*.

Palaeobotany: Introduction, Fossils, types of fossils and fossilization, Importance of fossils. Geological time scale.

Taxonomy of Angiosperms:

Principles of plant systematic, 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 ICN, Shenzencode - a brief account. Herbarium: Concept, techniques and applications. Systematic study and economic importance of plants belonging to the families; Annonaceae, Capparidaceae, Rutaceae, Fabaceae (Faboideae/papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae, Apiaceae, Asteraceae, sclepiadaceae, Lamiaceae, Amaranthaceae,Euphorbiaceae, Monocotyledons: Orchidaceae and Poaceae, Zinziberaceae.

Ecology:

Component of eco system, energy flow, food chain and food webs. Plants and environment, ecological adaptations of plants, Hydrophytes, Xerophytes and Mesophytes. Plant Succession serial stages, modification of environment, climax formation with reference to Hydrosere and Xerosere. General account of adaptations in xerophytes and hydrophytes.

Plant 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, Boerhaavia, Bignonia, Dracaena*; Root– *Beta vulgaris*. Wood structure: General account. Study of local timbers – Teak, Rosewood, Red sanders, Nallamaddi and Neem.

Embryology:

History and importance of Embryology. Anther structure, Microsporogenesis and development of male gametophyte. Ovule structure and types; Megasporogenesis; types and development of female gametophyte. Pollen morphology, pollination and fertilization, Pollination – Types, Pollen - pistil interaction, double fertilization. Seed structure appendages and dispersal mechanisms. Endosperm - Development and types. Embryo - development and type, Polyembryony and Apomixis - an outline.

Cell Biology

Plant cell envelops: Ultra structure of cell wall, Models of membrane structure, structure and functions of Semi permeable Plasma membrane. **Cell Organelles**: Structure and semiautonomous nature of Mitochondria and Chloroplast. **Nucleus:** Ultra structure, types and functions of DNA & RNA. Mitochondrial DNA & Plastid DNA and Plasmids. Chromosomes: Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype. Special types of chromosomes: Lampbrush and Polytene chromosomes. **Cell division**: Cell and its regulation; mitosis, meiosis and their significance

Genetics

Mendelism: History, Principles of inheritance, Chromosome theory of inheritance, Autosomes and sex chromosomes, Incomplete dominance and Co-dominance. Multiple alleles, Lethal alleles, Epistasis, Recessive and Dominant traits, Polygenic inheritance. Linkage and crossing over, Recombination frequency, two factor and three factor crosses; Interference and coincidence. Numericals based on gene mapping; Sex Linkage.Variation in chromosome number and structure: Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy. Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens-physical and chemical (Base analogs, deaminating, alkylating and intercalating agents).

Plant Physiology

Plant -water Relations: Water potential, osmosis, osmotic and pressure potential, absorption and transport of water. **Mineral Nutrition**: Essential micro & macro nutrients and symptoms of mineral deficiency. **Transpiration**: Stomatal structure and movement. Mechanism of phloem transport. Enzymes: Nomenclature, properties, Classification and factors regulating enzyme activity.

Photosynthesis: Photosynthetic pigments, Cyclic and Non-cyclic Photophosphorylation. Carbon assimilation pathways: C3, C4 and CAM**. Respiration**: Aerobic and Anaerobic; Glycolysis, Krebs cycle and oxidative phosphorylation. **Nitrogen Metabolism**: Biological nitrogen fixation. Physiological role of Phytohormones: Auxins, gibberellins, cytokinins, ABA, ethylene and Brassinosteroids.

SECTION – III: ZOOLOGY

Physiology and Biochemistry:

Digestion Digestion definition and extra and intracellular digestion. Digestion of Carbohydrates, Proteins, Lipids and Cellulose. Absorption and Assimilation of digested food; role of Gastrointestinal hormones in digestion **Respiration** Definition of Respiration and Respiratory mechanisms-External, Internal and cellular. Respiratory Pigments; Transport of oxygen, Oxygen dissociation curves. Bohr's effect. Transport of CO_2 – Chloride shift; Regulation of respiration – nervous and chemical **Circulation** Types of circulation - Open and Closed circulation Structure of Mammalian Heart, Types of hearts – Neurogenic and Myogenic; Heart function -Conduction and regulation of heart beat. Regulation of Heart rate – Tachycardia and Bradycardia; Blood Clotting mechanism. **Excretion** Classification of Animals on the basis of excretory products- Ammonotelic, Uricotelic, Ureotelic, Structure and function of Nephron. Urine formation, Counter current mechanism.

Physiology

Muscle Contraction: Types of Muscles, Ultra structure of skeletal muscle fibre, Sliding Filament theory, muscle contraction mechanism and energetics. **Nerve Impulse** Structure of Neuron, Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse, Synapse, types of synapses and Synaptic transmission. **Endocrine System** Endocrine glands - Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal glands and Pancreas, Hormone action and concept of Secondary messengers, Male and Female Hormones, Hormonal control of Menstrual cyclein humans.

Physiology and Biochemistry:

Homeostasis and Enzymes Concept of Homeostasis. Mechanism of Homeostasis. Osmoregulation - Water and ionic regulation by freshwater, brackish water and marine animals, Enzymes: Definition, Classification, Inhibition and Regulation. **Biomolecules and Metabolism** Carbohydrates**:** Classification and function of Carbohydrates, Carbohydrate metabolism - Glycolysis, Krebs cycle, Electron transport and oxidative phosphorylation. Proteins**:** Classification of proteins based on functions and Chemical nature, Protein Metabolism - Transamination, Deamination and Urea Cycle, Lipids**:** Classification of Lipids, Lipid Metabolism - Fatty acid synthesis and Fatty acid oxidation.

Immunology and Animal Biotechnology:

Immunology – Basic concepts; antigens and antibodies Basic concepts of immunology. Cells of immune system, Primary and secondary Organs of immune system, Types of Immunity – Innate and acquired, Basic properties of antigens, Structure, function and types of an antibody. B and T cell epitopes, haptens, adjuvants. Antigen-antibody reactions, T-Cell and B-Cell activation, Monoclonal antibodies and their production. **Working of an Immune system; Immune system in health and disease** Structure and functions of major histocompatibility complex. Basic properties and functions of Cytokines, Interferons and complement proteins,

Humoral and Cell mediated immunity. Types of hyper sensitivity. Concepts of autoimmunity and immunodeficiency. Introduction to Vaccines and types of Vaccines. **Animal Biotechnology and Genetically modified organisms** Concept and Scope of Animal Biotechnology. Cloning vectors - Plasmids, Cosmids, Lambda bacteriophage, YAC Cloning- Cloning methods (Cell, Animal and Gene cloning) Animal Cell culture - Equipment and materials for animal cell culture; applications of cell culture techniques Recombinant DNA technology and its applications, Transgenesis – Methods of Transgenesis. Production of Transgenic animals and Application of Transgenic animals in Biotechnology. Stem cells –types and their applications.

Animal Diversity – Invertebrates

Brief history of Invertebrates: Kingdom Animalia, Brief history of Invertebrates. **Protozoa** General characters Classification up to classes with examples, Type study – *Elphidium,* Life cycle of *Plasmodium.* Locomotion, Reproduction and Diseases. **Porifera** General characters, Classification of Porifera up to classes with examples, Type study – *Sycon,* Canal system in sponges and Spicules. **Cnidaria** General characters, Classification of Cnidaria up to classes with examples, Type study – *Obelia,* Polymorphism in hydrozoa, Corals and coral reef formation. **Platyhelminthes** General characters Classification of Platyhelminthes up to classes with examples, Type study-*Schistosoma.* **Nemathelminthes** General characters Classification of Nemathelminthes up to classes with examples Type study-*Dracunculus,* Parasitic Adaptations in Helminthes.

Annelida: General characters, Classification of Annelida up to classes with examples Type study - *Hirudinaria granulosa.* Evolutionary significance of Coelome and Coelomoducts and metamerism. **Arthropoda** General characters, Classification of Arthropoda up to classes with examples, Type study – Prawn, Crustacean larvae, Insect metamorphosis, *Peripatus* - Structure and affinities. **Mollusca** General characters, Classification of Mollusca up to classes with examples, Type study – *Pila*, Pearl formation, Torsion and detorsion in gastropods. **Echinodermata** General characters, Classification of Echinodermata up to classes with examples, Water vascular system in star fish, Echinoderm larvae and their significance. **Hemichordata** General characters, Classification of Hemichordata up to classeswith examples, *Balanoglossus* - Structure and affinities.

Ecology, Zoogeography and Animal Behavior:

Ecology-I: Ecosystem structure and functions. Types of Ecosystems –Aquatic and Terrestrial. Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water. Energy flow in ecosystem. Food chain, food web and ecological pyramids. Animal Associations - Mutualism, commensalism, parasitism, competition, predation.

Ecology – II: Concept of Species, Population dynamics and Growth curves. Community Structure and dynamics and Ecological Succession. Ecological Adaptations. Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise Pollution. Wildlife conservation - National parks and Sanctuaries of India, Endangered species. Biodiversity and hotspots of Biodiversity in India.

Zoogeography: Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities, Wallace line, Discontinuous distribution Continental Drift.

Animal Behaviour: Types of Behaviour- Innate and Acquired, Instinctive and Motivated behavior, Taxes, Reflexes, Tropisms, Biological rhythms and types of rhythms, trial and error learning, Imprinting, habituation, Classical conditioning, Instrumental conditioning, Social behavior, Communication, Pheromones, Biological rhythms, Biological clocks, Circadian rhythms.

Animal Diversity- Vertebrates and Developmental Biology:

Urochordata, Cephalochordata, Cyclostomata: Salient features of Urochordata, Retrogressive, metamorphosis and its significance in Urochordata, Salient features and affinities of Cephalochordata General characters of Cyclostomata, Comparison of the *Petromyzon* and *Myxine*, General characters and classification of Chordata upto orders with examples. **Pisces** General characters of Fishes, Classification of fishes up to order level with examples, *Scoliodon* – Respiratory, Circulatory and Nervous system. Types of Scales and types of Fins

Amphibia: General characters of Amphibians, Classification of Amphibians up to orders with examples. *Rana tigrina*-Respiratory, Circulatory and Nervous system. Parental care in amphibian; neoteny and paedogenesis.

Reptilia: General characters of Reptilia, Classification of Reptilia up to orders with examples, *Calotes* - Respiratory system, Circulatory and Nervous system. Temporal fossae in reptiles and its evolutionary importance, Distinguished characters of Poisonous and Non poisonous snakes. Rhynchocephalia. **Aves** General characters of Aves, Classification of Aves up to orders with examples. *Columba livia* -, Digestive system, Circulatory systems, Respiratory system and Nervous, system. Migration in Birds, Flight adaptation in Birds, **Mammalia** General characters of Mammalia, Classification of Mammalia up to orders with examples Rabbit –Digestive, Respiratory, Circulatory and Nervous system. Dentition in mammals. Aquatic adaptations in Mammals. **Developmental Biology and Embryology** Gametogenesis (Spermatogenesis and Oogenesis) Fertilization, Types of eggs, Types of cleavages, Development of Frog up to formation of primary germ layers Formation of Foetal membrane in chick embryo and their functions, Types and functions of Placenta in mammals, Regeneration in Turbellaria and Lizards.

Cell Biology, Genetics & Evolution:

1. **Cell Biology** Ultrastructure of animal cell, Structure and functions of plasma membrane proteins. Structure and functions of cell organelles –Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus Chromosomes – Structure, types, giant chromosomes, Cell Division - Mitosis, Meiosis.

2. **Molecular Biology** DNA (Deoxyribo Nucleic Acid) – Structure, RNA (Ribo Nucleic Acid) - Structure, types, DNA Replication, Protein Synthesis – Transcription and Translation, Gene Expression – Genetic Code; operon concept, Molecular Biology Techniques- Polymerase Chain Reaction, Electrophoresis
3. **Genetics** Mendals laws of Inheritance and Non-Medelian Inheritance, Linkage and Crossing over, Sex determination and sex-linked inheritance, Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy. Gene mutations- Induced versus Spontaneous mutations. Inborn errors of metabolism.
4. **Evolution** Theories of evolution – Lamarckism and Neo-Lamarckism, Darwinism and Neo- Darwinism, Modern synthetic theory. Evidences of Evolution and Hardy Weinberg Law. Forces of Evolution – mutation, gene flow, genetic drift, and natural selection. Isolation – Pre- mating and post mating isolating mechanisms, Speciation: Methods of speciation-Allopatric and sympatric.

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: GENETICS

CLASSICAL GENETICS

Mendelian Inheritance & extensions: Terminology and definitions –phenotypes, genotype, locus, allele, homozygotes, heterozygotes, Johanssen's pure line concept, filial generations, reciprocal cross, back cross, test cross; 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, and Pseudoalleles**;** Features of Quantitative Inheritance, Multifactorial inheritance, Extrachromosomal inheritance, Sex linked inheritance: X—linked and Y-linked traits, Sex chromosome inactivation –dosage compensation, Gynandromorph; **Linkage and gene mapping:** Cytological proof of crossing over, Phases of linkage, test cross, recombination

frequency, gene mapping, determination of map distances based on two and three point test crosses, coincidence, interference, Tetrad analysis –Neurospora, Mitotic crossing over-Drosophila**; Organellar inheritance:** Non-Mendelian inheritance, Chloroplast and Mitochondrial inheritance, Chloroplast and Mitochondrial genomes

CYTOGENETICS

Eukaryotic Cell cycle -Phases of cell cycle G0, G1,S, G2, Genes that determine the cell cycle – cyclins, CDK proteins, role of p53 in cell cycle, Mitosis –stages, significance of mitosis, Meiosis I & II- Stages, formation of synaptonemal complex, crossing over, chiasma formation, significance of meiosis**; Chromosome structure, chromatin organization and variation:** Chromosome morphology- size and shape; Euchromatin and Heterochromatin-constitutive and facultative heterochromatin, Components of chromatin, histones & non-histones, Packing of DNA into chromatin –Nucleosome and higher order organization, Specialized Chromosomes – Lampbrush chromosomes, Polytene Chromosomes, Super numerary chromosomes, Chromosome Variation- Structural and Numerical aberrations; **Cell communication and signaling:** Basics of cell signaling – paracrine, endocrine, autocrine, tight junctions and gap junctions, Secondary messengers - cAMP, phosphotidyl inositol, Ca+2and IP3, G-protein coupled receptors and Tyrosine Kinase receptors**; Dysregulation of Cell cycle:** Necrosis, senescence, programmed cell death (apoptosis-intrinsic and extrinsic factors), Cancer

MOLECULAR GENETICS

Nucleic acids: DNA as the genetic material and experimental evidences, RNA as genetic material, Chemistry of Nucleic acids, Forms of DNA and types of RNA, Models and methods of DNA replication, Mechanism of DNA replication and enzymes involved**; Gene expression and regulation in prokaryotes and eukaryotes:** Structure of prokaryotic and eukaryotic gene, Transcription and Translation mechanisms, Genetic code and properties, Operon concept- lac operon & glucose effect, tryptophan operon, Post-transcriptional and Post-translational modifications in eukaryotes**; Mutations and repair mechanisms:** Mutations-spontaneous and induced mutations, Types of mutations, DNA damage & repair mechanisms, Diseases caused due to mutation-sickle cell anaemia and cystic fibrosis

MICROBIAL GENETICS & GENETIC ENGINEERING

Bacterial recombination and mapping: Bacteria- structure, Transformation and gene mapping, Conjugation and gene mapping High frequency recombination, interrupted mating experiment; **Genetics of bacteriophages:** Structure and classification of bacteriophages, Lytic cycle, Lysogeny, Generalized and specialized transductions**;** Enzymes used in molecular cloning, Vectors used in cloning, Genomic and cDNA libraries, Blotting techniques and PCR, Screening for detection of cloned genes, **Applications of genetic engineering-** Gene products in medicine, DNA based vaccines, Subunit vaccines, Attenuated vaccines, genetically engineered microorganisms for bioremediation, phytoremediation, Transgenic plants, Transgenic animals, Molecular pharming, Industrial products

BIOSTATISTICS & BIOINFORMATICS

Measures of central tendency and measures of dispersion, Grouped data and graphical methods, Probability, Binomial, Poisson and Normal distributions, t-test, z-test, chi-square test**;** Computer and Internet Basics, Biological databases, DNA Sequence and Protein sequence databases, Sequence retrieval from Genbank, ENA, Swissprot

POPULATION GENETICS & EVOLUTION

Allele frequencies and genotype frequencies at a locus, Hardy-Weinberg Law, Linkage disequilibrium, Snyder's ratios; Selection–fitness, patterns of natural selection, general selection equation, equilibrium under selection, Selection favoring heterozygote, selection against heterozygote, complete elimination of recessive gene; Mutation–mutation models, influence of mutation on allele frequency & autozygosity, balance between forward & backward mutation, interaction of mutation with selection; Genetic load, Gene flow, Wahlund effect, Inbreeding, construction of pedigrees inbreeding coefficient and inbreeding depression; Genetic Drift -Bottle neck effect, Founder effect, effective population size, consequences of a decreasing population size; Origins of genomes - Acquisition of new genes by gene duplication and from other species, Origin of non- coding DNA, transposable elements and introns, Molecular phylogenetics, Molecular Evolution, Molecular clock

SECTION – VI:
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, General characteristics and classification of virus. Morphology and structure of T4, lambda phages; TMV and HIV. Nutritional types of bacteria, Bacterial growth, Respiration, Fermentation.

Biomolecules: Carbohydrates, amino acids, proteins, Biochemical techniques. 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: methodology and application. 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 and water borne diseases. General principles of diagnostic microbiology. Elements of chemotherapy-therapeutic drugs, Drug resistance. Concept of Biodiversity. Microbial diversity. Microorganisms of the environment (soil, water and air). Microbial interactions. Microorganisms in relation to plant growth and biological control, Biological nitrogen fixation, Biofertilizers. Biopesticides, Bioremediation. Microbiology of potable and polluted water. Microorganisms of food spoilage and their sources. Methods of food preservation. Microorganisms as food – SCP, edible mushrooms. Fermented foods. Screening and isolation of industrially useful microorganisms, strain improvement strategies and immobilization methods. Fermentor. Types of fermentations. Industrial production of Alcohol, Glutamic acid, Citric acid, vitamin B12, Enzymes, Antibiotics and Vaccines. Basics of Bioinformatics and computational tools in microbial sciences; Genomics, Proteomics and Metabolomics.

CHEMISTRY

Coordination Compounds, Applications of Coordination Compounds, Organo metallic Chemistry, Metal Carbonylsand Related Compounds, Bioinorganic Chemistry, Hardand Soft Acids and Bases (HSAB). Carboxylic Acidsand Derivatives, synthesis Basedon Carbanions, Nitro Hydrocarbons, Amines, Cyanidesand Isocyanides, Heterocyclic Compounds, Carbohydrates, Amino Acids and Proteins, Electrochemistryand Emf, Chemical Kinetics, Thermodynamics. Photochemistry. P-Block Elements, Chemistry of Zero Group Elements, Chemistry of d-Block Elements, Chemistry off- Block Elements, General Principles of Inorganic Qualitative Analysis, Chemical Bonding, Molecular Orbital Theory, Theory of Quantitative Analysis, Theories of Bonding in Metals. Structural Theory in Organic Chemistry, Acyclic Hydrocarbons, alicyclic Hydrocarbons,

aromatic Hydrocarbons, Halogen Compounds, Alcohols, Phen ols, Ethersand Epoxides, Carbonyl Compounds, Conformational Analysis, Stereoche mistry of Carbon Compounds. Atomic Structure and Elementary Quantum Mechanics, Gaseous State, Liquid State, Solutions, Dilute Solutions and Colligative Properties, Solid State Chemistry, Phase Rule, Colloids and Surface Chemistry, adsorption, Evaluation of Analytical Data.

Chemical Food Management Lab safety (Chemical hazard), first aid for various spillages.