AP RCET 2019
SYLLABUS

SUBJECT: APPLIED LIFE SCIENCES Code No. : 41

PART-B will cover 90 Objective Type Questions (Multiple Choice, Matching type, True/False, Assertion – Reasoning type) carrying 90 marks of 90 minutes duration. Each question carries 1 mark.

Biomolecules

Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Structure of atoms, molecules and chemical bonds. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). Conformation of nucleic acids, t-RNA, micro-RNA. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

Cell Biology and Enzymology

Prokaryotic and eukaryotic cells, cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility. Structure of plasma membrane and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle. Enzymes nomenclature and classification. Mechanism of action, active site, regulation of enzyme activity, multienzyme complexes, Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes. immobilized enzymes and protein engineering, immobilized enzymes and their application.

Molecular Biology

DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination). RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport). Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins). Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

Cell communication and Cell signaling

Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing. General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and regulation of hematopoiesis. Cancer and the cell cycle, oncogenes, tumor suppressor genes, , virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth. Different types of stem cells – embryonic stem cells, Cord blood stem cells, fetal tissue stem cells, adult stem cells; stem cell

differentiation, stem cell plasticity – Differentiation versus stem cell renewal. Hematopoietic stem cells and bone marrow transplantation: Cells for hematopoietic reconstitution

Microbiology

Differences between gram positive and gram negative bacteria. Staining techniques. Methods of sterilization, pasteurization and disinfection. Classification and cultivation of bacteria. Bacterial reproduction and growth curve. Microbiology of water, milk, air, soil and sewage. Microbes as pathological agents in plant and animals. Clinically important bacteria. Chemical nature and classification of bacteriophages. Parasitic and temperate phages. Plant and animal viruses – multiplication of viruses. General characteristics of T Phase, ϕx174, SV40, TMV. Clinically important viruses, retroviruses, HIV, Hepatitis B Virus and viral infections. General account of algae molds and yeasts. Economic importance of algae and fungi. Clinically significant protozoans.

Immunology

Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity, autoimmunity and vaccines. Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

Genetics

Mendelian principles-Dominance, segregation, independent assortment. Allele, multiple alleles, pseudoallele, complementation tests. Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Linkage maps, tetrad analysis, Pedigree analysis, genetic disorders. Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Methods of microbial gene transfer – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes. Mutation types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Homologous and non-homologous recombination including transposition.

Bioinformatics

Genomics and Proteomics. Bioinformatics – Online and offline tools. Biological databases. Types of data bases – Gen bank, Swiss port, EMBL, NCBL and PDB. Database searching using BLAST and FASTA. Multiple sequence alignment and Dynamic programming. Gene and Genome annotation – Tools used. Molecular phylogeny-Concept methods of tree construction. Protein secondary and 3D structure prediction. Protein docking. Computer Aided Drug Design (CADD) in Drug discovery.

Applied Biology

Restriction enzymes, cloning and expression vectors. Gene cloning strategies. Basic techniques in plant cell and tissue culture. Somatic hybridization and cybridization. Application of tissue culture in crop improvement. *In vitro* mutagenesis. Transgenic plants - insect-pest resistance, abiotic stress resistance, herbicide resistance, storage protein quality, increasing shelf-life, oil quality. Animal cell and tissue culture. Tissue and organ culture. Production and use of artificial tissues and organs. Production of transgenic animals, Molecular pharming and animal cloning. Transgenic poultry and transgenic insects as bioreactor. Large scale production of recombinant proteins. Principles of microbial growth – Batch fermentation, feed-batch fermentation,

continuous fermentation, high density cell cultures and Bioreactors. Microbial metabolites - Organic solvents, Organic acids Wines and beers, Antibiotics, Vitamins, Amino acids. Health care products from recombinant DNA Technology - insulin, growth hormone, factor VIII, tissue plasminogen activator, interferons, lymphokines and Hepatitis-B vaccines. DNA probes, Enzyme probes. Applications in forensic medicine. Gene therapy. Environmental pollution – types, sources and control. Reduction of industrial effluents, chemical herbicides, fertilizers and oil spills. Bioremediation, Bioleaching. Microbiology of waste water treatment. Renewable sources of energy – Biogas, energy crops, cellulose, Biofuels. Ozone depletion, Green house effect. Biodiversity Conservation, Molecular Markers- RFLP, AFLP, RAPD, SSR and SNPs.

Marine Biotechnology

Culture techniques: Microalgae and fungi , Protozoans and microscopic metazoans Estuarine and mangrove microbiology.Culture of shrimps, crab, oysters , sea-cucumbers, milkfish, mullets, seabass and seaweeds(*Porphyra*) Marine toxins: Saxitoxin, brevitoxin and ciguatoxin Marine peptides & alkaloids: pyridoacridine, pyrrolocridine indole, pyrrole, isoquinoline alkaloids. Marine prostaglandins and marine cosmetic products. Role of biotechnology in marine pollution control. Biofouling and biodeterioration: Agents and protection methods.Global environmental monitoring methods: status , objectives and limitations. Application of biotechnology in disease diagnosis; prevention and control; Gene probes. Remote sensing applications in oceanography and marine biology.

Virology

Nomenclature and classification of viruses: Criteria used for naming and classification. Current ICTV classification of viruses of bacteria, plants and animals and humans. Physical-morphology and structure, sedimentation, electrophoretic mobility, Isolation, cultivation, assay and maintenance of bacterial, plant and animal viruses, Purification of viruses : Need for virus purification. Extraction of viruses from tissues, clarification, concentration of viruses in clarified extracts by physical and chemical methods, further purification of viruses by rate zonal / equilibrium density gradient centrifugation. Criteria of virus purity. Quantitation and

preservation of purified virus preparations. Quantitation of viruses: Infectivity assay methods (plaque, pock, end point, local / systemic assay of plant viruses), physical (EM), serological (HA, HI, immuno fluorescence, ELISA) and chemical (viral protein and nucleic acid based) approaches.

Biophysical Techniques

Light microscopy, resolving powers of different microscopes, scanning and transmission microscopes. Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy. Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods. General principles of electrophoretic techniques. Poly Acryl amide Gel Electrophoresis. Isoelectricfocusing. Isotachophoresis. 2-D Electrophoresis. Capillary electrophoresis. Agarose gel electrophoresis of DNA and RNA. Blotting techniques. DNA fingerprinting. Detection and measurement of different types of radioisotopes normally used in biological tissues and cells.