

Syllabus for the post of

(1) Professor, Biochemistry, Class-I (Advt. No.: 39/2019-20)

(2) Associate Professor, Biochemistry, Class-I (Special Recruitment) (Advt. No.: 80/2019-20)

(3) Associate Professor, Biochemistry, Class-I (general Recruitment) (Advt. No.: 81/2019-20)

(4) Assistant Professor, Biochemistry, Class-I (Advt. No.: 103/2019-20)

Marks – 200

Questions – 200

Medium - English

1. BIOMOLECULES

Properties of water, Concept of an acid, a base, pH, pK, buffer and buffering capacity; Classification, structure and functions of amino acids and peptides; Structural organization of proteins and relationship with their functions, Structure-function relationship of proteins; Classification, functions, properties and reactions of carbohydrates; Classification, properties and importance of lipids; nucleotides and nucleic acids.

2. CELL BIOLOGY

Structure of the cell and different subcellular organelles, Structure and functions of cell membrane, solute transport across biological Membranes, Interaction between cells and environment, Glycoprotein's and proteoglycans, Intracellular traffic and sorting of proteins, endoplasmic reticulum, Intracellular signaling pathways, membrane receptors and second messengers, Extracellular matrix: composition, importance and biomedical importance, cellular adhesion molecules and intercellular communication, Cytoskeleton, muscle contraction and cell motility, Cell cycle, mitosis, meiosis and mechanisms of cell death, Red and white blood cells

3. ANALYTICAL TECHNIQUES IN BIOCHEMISTRY

Spectrophotometry (UV and visible spectrophotometry), atomic absorption spectrophotometry, Flame photometry, Fluorometry, Turbidimetry and nephelometry, Gravimetry, Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes), Chemiluminescence, Water testing, Electrophoresis (principle, types, applications; isoelectric focusing capillary electrophoresis; 2-D electrophoresis), Chromatography (principle, types

[including high performance liquid chromatography and gas chromatography],
Techniques in molecular biology: Blotting techniques, polymerase chain reaction (PCR), DNA and protein sequencing, microarrays and DNA chip technology, cloning techniques, genomics, proteomics and metabolomics.

4. Nanotechnology and microfabrication

5. Radioisotope-based techniques and its application

6. Biostatistics and research methodology

7. ENZYMES, BIOLOGICAL OXIDATION, RESPIRATORY CHAIN AND OXIDATIVE PHOSPHORYLATIONS

- **ENZYMES:** Properties, classification, mechanism of action, coenzymes and cofactors, kinetics of enzyme activity, regulation of enzyme activity, isoenzymes, diagnostic and therapeutic enzymes, principles of assays of enzymes, enzymes as therapeutic targets of drugs,
- **Biological oxidation:** Basic concepts of thermodynamics and its laws, as applied to living systems, Exergonic and endergonic reactions and coupled reactions, redox potential, High energy compounds, Classification and role of oxidoreductases, Cytochromes; cytochrome P450 system
- **Respiratory chain and oxidative phosphorylation:** Components, complexes and functioning of the respiratory chain, Process of oxidative phosphorylation Mechanisms of ATP synthesis and regulation, Mitochondrial transport systems and shuttles, Inhibitors, uncouplers and ionophores, OXPHOS diseases.

8. Overview of Metabolism and Intermediary Metabolism:

- Metabolism of carbohydrates,
- Metabolism of lipids,
- Metabolism of amino acids and Proteins,
- Metabolism of nucleotides,
- Metabolism of haem,
- Metabolism in individual tissues and in the fed and fasting states

9. NUTRITION, VITAMINS, MINERALS

- **Nutrition:** Principal food components, General nutritional requirements, Energy requirements Biological value of proteins, Thermogenic effect of food, Balanced diet, diet formulations in health and disease, mixed diet,

Nutritional supplements, Food toxins and additives, Parenteral nutrition, Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, under-nutrition, laboratory diagnosis of nutritional disorders, National Nutrition Programme.

- **Vitamins:** Classification, biochemical role, sources, RDA and deficiency state of each vitamin, (including diagnostic tests for deficiency and treatment)
- **Minerals:** Classification, biochemical role, sources, requirement and deficiency state of each mineral, (including diagnostic tests for deficiency and treatment).

10. MOLECULAR BIOLOGY

Structure and organization of chromosomes and chromatin re-modelling:

DNA replication, Transcription, Genetic code and mutations, Translation, Regulation of gene expression in prokaryotes and eukaryotes, Recombinant DNA technology and its applications in modern medicine

11. Basics of Bioinformatics

- **Principles of Human Genetics:** Alleles, genotypes and phenotypes, Patterns of inheritance: monogenic and polygenic inheritance, Population genetics, Genetic factors in causation of diseases, Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders; Screening for genetic diseases and prenatal testing, Ethical and legal issues related to medical genetics
- **Stem cells in clinical medicine:** Basic concepts regarding stem cells, Types of stem cells: embryonic and induced pluripotent stem cells (iPSC), Potential applications in the clinical medicine, Ethical and legal issues related to use of stem cells in medicine
- **Cancer:** Carcinogens: physical, chemical and biological, Clonal origin of cancers, Genetic basis of carcinogenesis, Role of oncogenes and tumour suppressor genes, Familial cancer syndromes, Cancer stem cells, Epigenetic regulation in cancer, Gene expression profiling in cancer, Cancer cell biology: cell cycle abnormalities, telomerase activity, proliferative capacity and decreased apoptosis, Metastasis, Tumor markers, Biochemical basis of cancer

chemotherapy and drug resistance, New methods of anti-cancer therapy: targeted cancer therapy, cancer immunotherapy.

12. Immunology

Innate and acquired immunity, Humoral and cell-mediated immunity, Cells and organs of the immune system - T and B cells, macrophages, dendritic cells, NK cells, granulocyte, Antigens, epitopes and haptens, Immunoglobulin classes, isotypes, allotypes, idiotypes, monoclonal antibodies, organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching, Antigen-antibody interaction - immunochemical techniques, Major histocompatibility complex, antigen processing and presentation, T cell and B cell receptor, toll like receptors, T cell maturation/activation/differentiation, B cell generation/activation/differentiation Cytokines, Complement system, cell immune response to infections, Hypersensitivity reactions, Vaccines, Immuno-deficiency syndromes, Autoimmunity, Transplantation immunology, Cancer and immune system, Immunodiagnostics, Immunotherapy.

13. CLINICAL BIOCHEMISTRY

Basic principles and practice of clinical biochemistry, analytical techniques and instrumentation, clinical correlates and analytical procedures, regulation of fluid and electrolyte balance and associated disorders, regulation of acid-base balance and associated disorders, biochemistry of the endocrine system, hematopoietic disorders, hemostasis and thrombosis, cardiovascular system, respiratory system, kidney, gastrointestinal system, liver, bone and mineral metabolism, nervous system.

14. RESEARCH METHODOLOGY

15. MEDICO LEGAL ASPECTS RELEVANT TO THE DISCIPLINE.

16. INDIAN MEDICAL COUNCIL (PROFESSIONAL CONDUCT, ETIQUETTE AND ETHICS) REGULATIONS, 2002

17. CURRENT TRENDS AND RECENT ADVANCEMENTS IN THE FIELD OF BIOCHEMISTRY.