

## B.Sc. PART III

### **PAPER I: Molecular Biology**

**Organization of genome in prokaryotes and eukaryotes.** Definitions of gene, genome and chromosome, chemical nature of gene, nucleoid in prokaryotes, arrangement of prokaryotic DNA around scaffold, DNA supercoiling, HU proteins and supercoiling, plasmids, DNA packaging in prokaryotes, Histones in eukaryotes, acetylation of histones, euchromatin, heterochromatin, nucleosomes, chromatins, solenoid model, Structure of nucleic acids. C-value paradox.

**Structure of chromosomes:** Size of genes, Crossing over, the concept of Recombination, the Cell cycle and cell division.

**Replication of DNA:** DNA replication in prokaryotes and eukaryotes, Enzymes and proteins involved in replication, salient features, Semiconservative nature, fidelity, regulation of replication.

**Transcription:** Transcription in prokaryotes and eukaryotes, Structure and Function of Enzymes and proteins involved in transcription, Types of RNA and their structure, visualization of the transcription process, Regulation of transcription in prokaryotes and eukaryotes.

**Translation:** The biosynthesis of proteins in prokaryotes and eucaryotes, Elements of initiation, elongation and termination, regulation of translation.

**The Genetic code:** The concept of codons, Properties of codons, Degeneracy, Universality.

**Regulation of gene expression:** Control of gene expression in prokaryotes and eucaryotes, Regulatory genes, Structural genes, Repressors, the Operon concept.

### **PAPER II: Microbiology**

**Introductory concepts:** Brief history: from the theory of spontaneous generation to modern microbiology and biotechnology

**Classification of microorganisms:** Autotrophs and heterotrophs, other models of classification.

**Structure and properties of microorganisms:** Prokaryotic, Eukaryotic: algae, fungi and protozoa, Viruses

**Microbial cells:** Nutrition, physiology and growth

**Role of microorganisms in:** Diseases, Food spoilage, Crop damage

**Use of microorganisms in:** Fermentation, Sewage purification, Industry

**Control of microbial populations:** Natural and drug-induced

## **PAPER III: Biotechnology and Genetic Engineering**

### **Introduction to Biotechnology and genetic engineering**

**Genetic Recombination in Bacteria:** Transformation, Conjugation and Transduction.

**The Basic Features of Genetic engineering:** Release of DNA from host cells, Construction of recombinant DNA molecules. Role of enzymes- restriction endonucleases, DNA ligases, and reverse transcriptase, Introduction of recombinant DNA into host cells by DNA transformation, Selection and identification of transformed cells.

**Introduction to Cloning:** Expression of cloned genes, Cloning vectors

**Applications of Biotechnology:**

**Ethical Concerns of biotechnology:** Patenting, Health dilemmas, Gene therapy, Genetically modified foods etc.

## **PAPER IV: Biochemistry of health and disease**

**Meaning and scope of Health vs. Disease.** Importance of Clinical Biochemistry.

**Sources of variation in clinical biochemistry:** Analytical, Physiological. Reference Ranges. Clinical Utility: Sensitivity and. Specificity. False positives, false negatives.

**Assessment of health:** Measurement of dietary and nutrient intakes. Anthropometric measures: BMI, other measures and their clinically useful ratios, skinfold thickness, Clinical assessment for anemia, vitamin and mineral deficiencies. Choice of biochemical analytics such as blood, urine, saliva, other tissues. Non-invasive techniques: limitations and interpretation.

**Specimens used in clinical biochemistry:** Collection, storage and use of blood, plasma, serum. Urine. Saliva, other tissues. Significance and limitations.

**Commonly measured analytes in blood:** Complete Blood Count: Hemoglobin, hematocrit, total and differential leukocyte count, microscopy of erythrocytes. Plasma proteins.

**Blood glucose:** Maintenance. Significance. Glucose tolerance test. The glyceimic index.

**Renal function tests:** Kidney functions. Kidney diseases. Blood urea. Serum creatinine. GFR. Applications for disease diagnosis.

**Liver function tests.** Liver functions, including detoxification. Liver diseases: Hepatitis, Cirrhosis. Alanine amino transaminase (ALT) and aspartate amino transferase (AST). Importance of ALT/AST ratio. Applications for disease diagnosis.

**Other Enzymes in diagnosis.** Some examples such as amylase, alkaline and acid phosphatase.

**Lipoproteins:** Classification. Properties. Functions. Diagnosis of dyslipidemia.

**Specialized techniques for disease diagnosis:** PCR, ELISA, fMRI. Advantages and limitations.

## **Section II: Biochemistry of Disease:**

### **The meaning of disease:**

### **Categorization of diseases:**

**Climatic and Environmental factors in disease: Disorders related to heat and cold.**

### **A brief overview of the following categories of diseases:**

**Nutritional diseases:** Marasmus, Kwashiorkor, Beri beri, Scurvy, Rickets

**Metabolic diseases:** Diabetes, Obesity, Alkaptonuria, Phenylketonuria, Goitre

**Parasitic diseases:** Dengue, malaria

**Bacterial diseases:** Plague, Diphtheria, Typhoid, Bacillary dysentery, Cholera

**Viral diseases:** Measles, Mumps, Chicken pox, AIDS, Hepatitis