

**GARDEN CITY UNIVERSITY**  
**SEMESTER- II**  
**B.Sc. Biotechnology, Biochemistry, Genetics**

**TITLE OF THE COURSE: GENERAL MICROBIOLOGY**  
**CODE: 02ABBGR17211**

**CREDITS – 4**

**UNIT I: Fundamental, History and Evolution of Microbiology.**

- 1.1 Classification of microorganisms - criteria used including molecular approaches to determine microbial taxonomy,
- 1.2 Microbial phylogeny
- 1.3 Microbial Diversity - Distribution and characterization of Prokaryotic and Eukaryotic cells
- 1.4 Morphology & functions of microorganisms e.g. Bacteria, Algae, Fungi, Protozoa and features of viruses.

**UNIT II: Instrumentation in Microbiology:**

- 2.1 Microscopy: Working principle, Resolving power, numerical aperture, Compound Microscope, Phase contrast microscope, dark field microscope, fluorescent microscope and Electron microscope: TEM & SEM
- 2.2 Working principle and applications of instruments: centrifuge, ultracentrifuge, spectrophotometer, colorimeter, membrane filter & Seitz filter
- 2.3 Auxochrome; Chromophores; Acidic and Basic dyes
- 2.4 Classification of stains; Simple and differential staining: Brief description on Gram staining, endospore staining, Endospores and sporulation in bacteria, negative staining, capsule staining, acid fast staining

**UNIT III: Cultivation and Maintenance of microorganisms:**

- 3.1 Nutritional categories of micro-organisms- different methods of isolation, Purification and preservation techniques
- 3.2 Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria
- 3.3 Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways
- 3.4 Bacterial Reproduction: Transformation, Transduction and Conjugation.

**UNIT IV: Sterilization - Types**

- 4.1 Sterilization, disinfection, disinfectant, antiseptic, germicide, sanitizer, microbicidal agents, microbiostatic agent, antimicrobial agent.
- 4.2 Evaluation of antimicrobial agent: tube dilution and agar plate techniques.
- 4.3 Physical methods of control: Principle, Moist heat sterilization- Boiling, Pasteurization, Fractional sterilization-Tyndallization and Autoclave. Dry heat Sterilization-Incineration and hot air oven. Filtration –Diatomaceous earth filter, laminar air flow, Radiation: ionizing radiation and non-ionizing radiations.
- 4.4 Chemical methods: Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents.

**UNIT I: CARBOHYDRATES**

- 1.1 Carbohydrates: Definition, empirical formulae, classification, biological importance.
- 1.2 Monosaccharides: Configuration, relationship of D-aldoses, D-ketoses. General properties of aldoses and ketoses. Oxidation, reduction, reducing property, formation of glycosides, acylation, methylation, condensation – phenyl hydrazine, addition – HCN. Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers, and diastereoisomers.
- 1.3 Glucose: Elucidation of open chain structure and ring structure of glucose. Conformation of glucose, mutarotation, biological importance of amino sugars, deoxy sugars, sugar acids, neuraminic and muramic acid.
- 1.4 Disaccharides: Structures of Sucrose and Lactose, Biological Importance and structure of Isomaltose, Trehalose and Maltose.
- 1.5 Polysaccharides: Partial structure, occurrence and importance of Starch, Glycogen and Cellulose.
- 1.6 Qualitative tests – Molisch, Benedicts / Fehling's, Picric acid, Barfoed's, Bial's, Seliwanoff's, Osazone tests.

**UNIT II - AMINO ACIDS & PROTEIN:**

- 2.1 Structure and classification of amino acids- based on polarity, charge etc.
- 2.2 Zwitterionic properties. Pka values.
- 2.3 Peptides - Peptide bond, structure and biological importance of Glutathione & Valinomycin.
- 2.4 Proteins: Isolation, methods of purification-dialysis salting out, pH precipitation and solvent precipitation.
- 2.5 Classification of proteins based on solubility, structure and functions with examples. Colour reactions of proteins – Biuret, Xanthoproteic & Millon's.)
- 2.6 Structure of proteins - Primary Structure of proteins, methods of determining N- and C-terminal amino acids, amino acid composition. Secondary Structure –  $\alpha$  Helix.  $\beta$ -sheet,  $\beta$ -bend. Tertiary of myoglobin and quaternary

**UNIT III- LIPIDS:**

- 3.1 Classification and biological role, -Fatty acids, Nomenclature of saturated and unsaturated fatty acids. Physiological properties of fatty acids.
- 3.2 Saponification, Saponification value, Iodine value, rancidity. Phosphoglycerides, Sphingolipids: Sphingomyelin. Glycosphingo lipids: Gangliosides and Cerebrosides. Eicosanoids: Biological role of Prostaglandins
- 3.3 Plasma lipoproteins: Types – Chylomicrons, VLDL, LDL and HDL and their significance.
- 3.4 Biological Membrane: Composition of membrane, micelles and liposomes.
- 3.5 Fluid Mosaic Model, functions of the plasma membrane

## **UNIT IV - NUCLEIC ACIDS:**

4.1 Isolation of DNA and RNA.

4.2 Composition of DNA. Nucleosides and Nucleotides. Chargaff's rule.

4.3 Watson and Crick model of DNA. (K, L)

4.4 RNA: Composition, types (mRNA, tRNA and rRNA), Secondary structures of tRNA – Clover leaf model.

4.5 Chemical reactions of RNA and DNA with acid and alkali, colour reactions of DNA and RNA.

**Title of the course: Cytogenetics**

**CODE: 02ABBGR17213**

**CREDITS-4**

### **UNIT I**

- 1.1 Genetic material in a cell
- 1.2 Molecular organization of Eukaryotic chromosome - Nucleosomes, Telomeres, Kinetochore, Centromere
- 1.3 Histone and Non-Histone proteins- Properties & functions
- 1.4 Euchromatin & Heterochromatin - Constitutive and facultative heterochromatin
- 1.5 Chromosome number – autosomes & Allosomes  
Types of Human Chromosomes – Metacentric, Sub metacentric, Acrocentric & Telocentric

### **UNIT II: Mutations:**

- 2.1 Key concepts of mutation  
Forward mutations at DNA level – Transition & Transversion, at protein level – silent, synonymous, missense, nonsense, frameshift mutations. Reverse mutations: Exact reversion, Equivalent reversion
- 2.2 Intragenic suppressors, Extragenic suppression
- 2.3 Loss of function mutation, Gain of function mutation, isoallelic mutations.
- 2.4 Physical & Chemical mutagens: Base analogues, Nitrous acid, Hydroxylamine, Hydrazine, Alkylating agents
- 2.5 Detection of mutations – Bacteria: replica plating technique, Ames test

### **UNIT III: Genetic Recombination:**

- 3.1 Mechanism of recombination – Holliday - White House Model, Double strand break model, Meselson-Radding heteroduplex model
- 3.2 Site specific recombination and enzymes involved
- 3.3 Bacterial Recombination – Conjugation, Hfr Conjugates.
- 3.4 Mechanism of transformation in *Bacillus subtilis*.
- 3.5 Transduction – Generalized & Specialized

### **UNIT IV: Chromosomal aberrations –**

- 4.1 Chromosomal structural rearrangements – Deletion (Terminal Deletion, Ring Chromosome, Interstitial Deletion, Micro deletion), Duplication (Direct, Inverted, Isodicentric chromosome, microduplication) Inversion (paracentric & Pericentric) & Translocation (Reciprocal & Robertsonian).
- 4.2 Numerical Aberrations in chromosomes: Centric fusion and Centric fission, Aneuploidy (Monosomy, Trisomy) Polyploidy (Triploidy, Tetraploidy)
- 4.3 Chromosomal Breakage Syndromes Ataxia telangiectasia (AT), Bloom syndrome (BS), Fanconi anemia (FA), Xeroderma pigmentosum (XP)
- 4.4 Chromosomal abnormalities in pregnancy
- 4.5 Role in speciation and evolution