



Unit. 1.

General Microbiology and Microbial Diversity History and Recent developments in Microbiology, Spontaneous generation vs. Biogenesis. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming. Paul Ehrlich, Elie Metchnikoff, Edward Jenner. Germ theory of disease. Microscopy—light, dark field, fluorescence, phase contrast, scanning, transmission and Atomic Force. Five kingdom and three kingdom classification systems. Classification of bacteria according to Bergey's Manual of systematic bacteriology. General characteristics of Acellular microorganisms—Viruses, Viroids, Prions and Cellular microorganisms—Structure of Archaeobacteria, Bacteria, Algae, Fungi and Protozoa. Structural organization and functions of eukaryotic intracellular organelles. Staining methods. Antimicrobial chemotherapy—General characteristics of antimicrobial drugs, determining the level of antimicrobial activities, Antibacterial drugs, Drug resistance.

Unit. 2.

Microbial Physiology and Metabolism Pure culture techniques and preservation of microorganisms. Sterilization and disinfection methods. Growth and nutrition—Growth curve, batch, continuous and synchronous cultures. Carbohydrate catabolism—Pentose phosphate pathway, ED Pathway, Krebs's cycle, Energy yield in glycolysis and aerobic respiration, Anaerobic respiration, Lactic acid fermentation, Alcohol fermentation. Lipid Metabolism—Oxidation of lipids, biosynthesis of fatty acids, triglycerides, phospholipids and sterols. Protein and amino acid catabolism—Oxidation of inorganic molecules – Photophosphorylation, Biochemical pathways of energy use—Photosynthetic fixation of CO₂ – Biosynthesis of peptidoglycan, Biosynthesis of lipids, Biosynthesis of amino acids and its interconversions—Metabolism of nucleotides and vitamins.

Unit. 3.

Bacteriology General properties of pathogenic bacteria, methods of identification, virulence factors. Normal microbial flora of human body. Morphology, classification, cultural characteristics, pathogenicity, diagnosis, treatment and control of human bacterial diseases caused by – Staphylococci, Streptococci, Neisseriae, Mycobacterium, Haemophilus, Salmonella, Shigella, Escherichia coli, Klebsiella, Vibrio, Proteus, Spirochaetes, Rickettsiae, Chlamydiae, Mycoplasmas, Ureplasmas, Pseudomonas, Bacillus, Corynebacterium, Helicobacter, Erysipelothrix, Clostridium, Listeria, Brucella and Yersinia. Zoonotic diseases and their control – Hospital acquired infections – Hospital infection control committee – functions—Hospital waste disposal.

Unit. 4.

Virology General properties of viruses—structure, cultivation, pathogenesis and diagnosis of viruses – Classification of viruses. Control of viral diseases—Viral vaccines and antiviral agents. DNA viruses- Adeno, Herpes, Pox, Papova and Hepatitis viruses. RNA viruses—Picorna, Orthomyxo, Paramyxo, Toga and arthropod borne viruses, Retro, Rota, Rhabdo—Emerging



viruses- Chikungunya, Ebola, Bird flu, swine flu (H1N1, H1N2 and H3N2), Zika, Corona, Dengue and equine encephalitis, Oncogenic viruses and Slow viruses. Bacteriophages – structure and life cycle of ϕ , X174, M13, Mu, T4, λ , Bacteriophage typing.

Unit. 5.

Parasitology & Mycology Taxonomy, Characteristics and diagnosis of pathogenic fungi, Anti-fungal drugs. Morphology, pathogenicity, laboratory diagnosis and control of Superficial mycoses–Malassezia, Piedra, Cutaneous mycoses – Trichophyton, Epidermophyton and Microsporum, Subcutaneous mycoses–Madurella, Sporothrix and Phialophora. Systemic mycoses – Blastomyces, Coccidioides, Cryptococcus and Histoplasma; Opportunistic mycoses – Aspergillus, Candida, Pneumocystis, and Microsporidium. Parasitic infections – Classification, Morphology, Cultivation, Pathogenic mechanisms, transmission and methods of diagnosis of parasitic infections, Antiprotozoal drugs. Protozoans – Entamoeba, Giardia, Trichomonas Toxoplasma, Leishmania, Trypanosoma, Balantidium and Plasmodium, Parasitic infections in AIDS patients – Cryptosporidiosis and Isosporiasis. Helminthes- Cestodes-Taenia solium, Taenia saginata & Echinococcus. Trematodes – Fasciola hepatica- Schistosomes- Schistosoma haematobium, Schistosoma mansoni, Schistosoma japonicum – Nematodes- Ascaris, Ankylostoma, Trichuris, Trichinella, Enterobius and Wuchereria.

Unit. 6.

Molecular Biology Conformation of nucleic acids: DNA (A, B, Z forms), RNA, t-RNA, rRNA, mRNA and micro-RNA. Conformation of proteins Stability of proteins and nucleic acids. DNA replication, DNA damage and repair mechanism and recombination, extra chromosomal replicons, 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 functions 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, aminoacyl tRNA synthetase and translational proof reading, translational inhibitors, Post translational modification of proteins. Control of gene expression at transcription and translation level.

Unit. 7.

Microbial Genetics and Genomics Mendelian principles, Concept of gene and allele, Extensions of Mendelian principles, linkage and crossing over, sex linkage, sex limited and sex influenced characters, Organization of genes and chromosomes, Transformation– mechanism of natural competence, types, Conjugation–mechanism, Hfr and F' strains, Transduction–Generalized and specialized transduction, Gene mapping methods, Extra chromosomal inheritance, Transposable elements–Uses of transposons and transposition, Plasmids- Types of plasmids and its replication, Mutations and mutagenesis, types–Physical and chemical mutagens;



Molecular basis of mutation, uses of mutations, Ames test. Phage Genetics—Features of T4 genetics, Genetic basis of lytic versus lysogenic switch of phage lambda.

Unit.8.

Immunology Concept of Innate and Adaptive immunity; Cells and organs of immune system, Antigens Characteristics, Haptens, Epitopes, T-dependent and T-independent antigens, Adjuvants, Antibodies- Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); Monoclonal and polyclonal antibodies. Major Histocompatibility Complex—Organization of MHC, Structure and Functions of MHC I & II molecules, Antigen processing and presentation, Complement System—Components of the Complement system; Activation pathways—Classical, Alternative and Lectin pathway, Biological consequences of complement Activation, Primary and Secondary Immune Response, Hypersensitivity and its types, Autoimmunity, Immunodeficiency diseases, Tumor Immunology. Vaccines, Vaccination schedule, Serological Techniques— Precipitation, Agglutination, neutralization, Immunodiffusion, Immuno electrophoresis, ELISA, ELISPOT, Western blotting, Immuno fluoresence, Flow cytometry, Immunoelectron microscopy.

Unit. 9.

Food and Industrial Microbiology Sources of contamination of foods, Extrinsic and intrinsic factors , Principles and methods of food preservation, Food borne illness—Bacterial and non-bacterial. Spoilage of fruits, vegetables, meat, poultry, fish and sea foods. Preservation and spoilage of milk and milk products, Milk borne diseases. Fermented foods—Production of Bread, Yogurt and Cheese. Probiotics and Prebiotics, Single Cell Protein (SCP) production—Mushroom production. Detection of food borne pathogens, Food sanitation – Food control agencies and their regulations. Isolation, preservation and improvement of industrially important microorganisms. Raw materials and media design for fermentation processes, Sterilization, Development of inoculum for industrial fermentations, Types of fermentation—Batch, continuous, dual or multiple, surface, submerged, aerobic and anaerobic. Fermenter—Design, instrumentation and control, Types of fermenters; Recovery and purification of fermentation products. Production of primary metabolites- Alcohols, Beverages, Amino acids and Organic acids. Production of secondary metabolites: Antibiotics, Vitamins, Steroids, Enzymes, Biopolymers.

Unit. 10.

Soil and Agricultural Microbiology Characteristics and classification of soils, soil structure, soil microorganisms, Interaction between microorganisms— mutualism, commensalism, ammensalism, synergism, parasitism, predation, competition, interaction of microbes with plants and animals, Rhizosphere, phyllosphere and mycorrhizae. Mechanism of symbiotic and asymbiotic nitrogen fixation -Biogeochemical cycles: carbon, nitrogen, phosphorus, sulfur—Biofertilizers—Soil enzymes—Soil borne plant pathogens. Plant pathogens and classification of plant diseases, Principles of plant infection and defense mechanisms, Plant



disease management of the following plant diseases—mosaic disease of tobacco, bunchy top of banana, leaf roll of potato, bacterial blight of paddy, angular leaf spot of cotton, late blight of potato, damping off of tobacco, downy mildew of bajra, powdery mildew of cucurbits, head smut of sorghum, leaf rust of coffee, blight of maize, leaf spot of paddy, grassy shoot of sugar cane and root knot of mulberry.

Professor Academy