

AURCET - 2013 SYLLABUS
TEST NO. – 14: MICROBIOLOGY
PAPER - II

1. INTRODUCTION OF MICROBIOLOGY

Contributions of important scientists like Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Joseph Lister, others.

Recent trends and development in modern microbiology. Identification, characterization and classification of microorganisms- Principles of bacterial taxonomy and classification: - Bergy's manual and its importance, Hackel's three kingdom concept. Basis of microbial classification.

Major characteristics used in Taxonomy-morphological, physiological and metabolic, ecological, numerical taxonomy, genetic and molecular classification systems. Distinguishing characteristics between prokaryotic and eukaryotic cells Structure and function.

2. GENERAL & MEDICAL MICROBIOLOGY

General Characteristics of Bacteria

Bacterial Anatomy (Structures external to the cell wall, the cell wall and the structures internal to the cell wall), Growth & Multiplication of bacteria, Bacterial Nutrition and Physical conditions required for growth

Bacteria as Pathogens & Commensals

Basic classification of medically important bacteria.

General Characteristics & Pathogenicity of medically important bacteria:

How pathogens cause disease? Factors which influence the transmission & spread of infection.

Normal bacterial flora of human body.

Basic Microbiological techniques

Sterilization

Physical agents (Heat, Filtration & Radiation) and Chemical agents

Staining techniques: Simple, Gram's, Ziehl-Neelsen, Albert, Capsule & Spore staining.

Culture media: Types, Characteristics & Preparation

Biochemical reaction media: Inoculation & incubation techniques

Safety in Microbiology

Bacterial nutrition and growth kinetics- synchronous, stock, batch and continuous cultures.

Eukaryotic microorganisms: General characteristics, reproduction and economic importance of fungi. Classification, structure, composition, reproduction and other characteristics of fungal divisions-Zygomycota, Ascomycota, Basidiomycota, Deuteromycota and slime & water molds

Classification, structure, reproduction and other characteristics of algal divisions, Distribution of algae. Biochemical classification of algae.

Characteristics of- blue green algae, dinoflagellates, Microalgae, thallus organization, products of algae and their economic importance. Biochemical classification of algae.

Characteristics of Various protozoa-Morphology, nutritional requirements, reproduction.

3. IMMUNOLOGY and INFECTIOUS DISEASES

Immunity: Innate and Acquired

Antigens: Structure and Immunogenicity; Antibodies – Immunoglobulins: Structure and classes

Antigen-Antibody Reactions: Principles and applications of Precipitation, Agglutination, Complement fixation test, Neutralization test, Opsonization, Immunofluorescence, Radioimmunoassay, ELISA, Western Blotting etc.

The Complement System

Structure and Functions of the Immune System: Primary and Secondary Lymphoid organs, Cells of the Immune System, MHC

Immune Response : Humoral and Cellular Immune Response

Immunodeficiency Diseases, Hypersensitivity Reactions, Autoimmunity

Immunology of Transplantation and Malignancy

Immunization: Vaccines – development and production, vaccine expression system.

Production of rabies vaccine, foot & mouth disease vaccine and hepatitis-B vaccine. DNA vaccines.

Types and principles of immunization; vaccinoprophylaxis, vaccinothrapy, serotherapy.

Development of immuno diagnostic kits.

Principles of serologic reactions: Widal, VDRL, Weil Felix, ASO, CRP, RA, CFT

4. VIROLOGY

Introduction & General properties of viruses, Growth and classification of viruses,

Pathogenesis of viral diseases, New emerging viruses, viruses in human welfare.

Systemic virology: Parvoviruses, Adenoviruses, Herpesviruses, Poxviruses, Hepatitis viruses,

Picornaviruses, Reoviruses, Rotaviruses, & Calciviruses, Arthropod-Borne and Rodent-Borne

viral diseases, Orthomyxoviruses, Paramyxoviruses & Rubella virus, Coronaviruses, Rabies, Slow

virus infections & Prion diseases, Human Cancer viruses, AIDS & Lentiviruses.

5. ANALYTICAL TECHNIQUES

Microscopy – Principles of light, phase, fluorescent & electron microscopes; Microtomy –sectioning.

Principles of Centrifugation – Centrifugation techniques-preparative and analytical methods, density gradient centrifugation.

General principles and applications of chromatography – Paper, Column, Thin layer, Gas, Ion exchange, Affinity chromatography, HPLC, FPLC and Gel filtration.

Electrophoresis – moving boundary, zone (Paper Gel) electrophoresis.

Immuno-electrophoresis. Immunoblotting. Isoelectric focusing, 2-D electrophoresis

Visible, ultraviolet, infrared and mass spectrophotometry.

Absorption spectra, fluorescence flame photometry, NMR, ESR,

6. MOLECULAR & MICROBIAL GENETICS

DNA Structure, Replication, Mutations & Repair, RNA/ Protein synthesis, The control of gene expression in prokaryotes & eukaryotes.

Microbial Genetics: Transformation, Transduction & Conjugation

Extrachromosomal elements: Plasmids, Transposons

Recombinant DNA techniques: Cloning, Vectors used in cloning: Plasmids, phages, phagemids,

cosmids. Restriction & Polymerase enzymes. Extraction of DNA and RNA from bacterial cell

Northern, Western & Southern Blot; PCR, RFLP, RAPD, DNA Sequencing, DNA micro array

7. FERMENTATION TECHNOLOGY & INDUSTRIAL MICROBIOLOGY

An introduction to fermentation processes – the range of fermentation processes.

Microorganisms used in industrial microbiological processes – the isolation, preservation

and strain improvement of industrially important microorganisms, screening methods,

isolation of autotrophic mutants. Media and materials required for industrial microbiological

processes – Antifoams. Microbial products from genetically modified (cloned) organisms ex: insulin.

Microbial groups involved in biogas production, design of digester.

8. FOOD MICROBIOLOGY & AGRICULTURAL MICROBIOLOGY

Microbiology of foods – Microbial flora of fruits, vegetables, milk, meat, eggs and fish and their infestation by bacteria, fungi and viruses. Microbiological examination of foods- microscopic techniques and cultural techniques. Direct microscopic examination, total colony counts and differential enumeration. Identification of specific groups – Bacteria, Viruses, Fungi and Protozoa. Microbial spoilage of milk, food, types of spoilage organisms, food poisoning, mycotoxins and bacterial toxins.

9. PHARMACEUTICAL MICROBIOLOGY

Chemical disinfectants, antiseptics and preservatives. Types of Antibiotics-B-lactam antibiotics, tetracycline group Rifamycin, aminoglycoside antibiotics, macrolides, polypeptide antibiotics, glycopeptide antibiotics, miscellaneous antibacterial antibiotics and antifungal antibiotics. Production of antibiotics – Penicillin, Streptomycin, Erythromycin, bacitracin and tetracycline.

Mechanism of action of antibiotics – the bacterial cell wall, protein synthesis, chromosome function & replication, the cytoplasmic membrane. Bacterial resistance to antibiotics - Intrinsic & acquired resistance, biochemical mechanism of resistance.

Industrial Production of Enzymes – amylases, Proteases, organic acids- lactic acid, citric acid, vinegar, aminoacids – L-lysine, L-glutamic acid; Food supplements and hormones.

Production of Vitamin B12