

**Paper II: Technical Subject**

**1. General Microbiology:**

- 1.1 History and development of microbiology, Eukaryotes & Prokaryotes, Determinative characteristics of medically important bacteria, viruses, fungi and protozoan parasites, Bacterial growth
- 1.2 Prokaryotic genome, Genetic code, Plasmids, Concepts of Bacterial and Viral genetics and role of RNA & DNA, DNA structure and function, RNA types and function, Bacterial recombination i.e. transformation, conjugation & transduction
- 1.3 Nosocomial infections: Epidemiology, bacterial and viral infections, infections in pediatric patients, surveillance and control programmes, organizations and associations involved, role of microbiology lab in prevention and control, devices associated intravascular infections and its control
- 1.4 Different of instruments used in microbiology and their working principle
- 1.5 Different types of microscopes used in microbiology
- 1.6 Sterilization, disinfection and antiseptics, different ways of sterilization by physical, chemical, radiation and filtration and its applications, relationship between disinfectants and antiseptics, disinfection rate of microorganisms
- 1.7 Different types of routine and special stains, their working principle and Staining techniques used in microbiology
- 1.8 Hospitals and Laboratory infection and their diagnosis
- 1.9 Infectious waste management
- 1.10 Techniques of cultivation, isolation and preservation of various microorganisms
- 1.11 Microscopy, culture sensitivity, serological and molecular methods for identification of various microorganisms
- 1.12 Automated methods used in microbiology
- 1.13 Water bacteriology
- 1.14 Air sampling for organism isolation

**2. Bacteriology:**

General characteristics, pathogenesis and medical importance of bacteria:

- 2.1 Aerobic/microaerophilic gram negative rods and cocci: Campylobacter, Helicobacter, Acetobacter, Brucella, Legionella, Neisseria, Branhamella, Kingella, Moraxella, Acinetobacter, Comomonas, Alcaligenes, Bordetella, Pseudomonas, Francisella
- 2.2 Facultative anaerobic gram negative rods: Providencia, Salmonella, Shigella, Yersinia, Gardenella, Vibrio, Pleisomonas, Aeromonas, Escherichia coli, Citrobacter, Hafnia, Morganella, Enterobacter, Klebsiella, Proteus, Serratia, Pasteurella, Hemophilus
- 2.3 Gram negative anaerobic rods and cocci: Bacteroides, Veillonella
- 2.4 Gram positive cocci: Micrococcus, Staphylococcus, Streptococcus, Peptococcus, Peptostreptococcus
- 2.5 Gram positive endospore forming rods and cocci: Bacillus, Clostridium

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- 2.6 Gram positive non sporing rods: Lactobacillus, Listeria
  - 2.7 Actinomycetes and related bacteria: Actinomyces, Nocardia Mycobacterium, Corynebacterium, Mycoplasma
  - 2.8 Spirochetes: Leptospira, Treponema, Borrelia
  - 2.9 Rickettsias: Coxiella, Rickettsia, Chlamydia
  - 2.10 Isolation and Enumeration techniques
  - 2.11 Identification based on morphological, cultural and biochemical properties
  - 2.12 Bacteria, isolation, detection and identification using rapid and automated methods
  - 2.13 Principle, procedure and applications of Serological and immunological Methods: Agglutination and Precipitation tests, Immuno staining and Immunoflourescence test, ELISA, Radioimmunoassay (RIA) and Immuno electrophoresis
  - 2.14 Principle, Procedure and application of Bio typing, Sero typing, Phage typing
  - 2.15 Principle, Procedure and application of Molecular typing methods :DNA extraction & agar gel electrophoresis, PCR, Gene Sequencing techniques, Ribotyping, pulse field gel electrophoresis
  - 2.16 Antimicrobial Susceptibility Testing: Kirby Bauer disc diffusion method, MIC determination, ESBL testing
  - 2.17 Diagnostic bacteriology experiments:
    - 2.17.1 Methods of collection, processing and culture of Stool, Sputum, Blood, Urine, Throat /Nasal swab, Vaginal swabs, Pus, body fluids and diagnosis of bacterial infections, automation in bacteriology, recent advances in microbiology
    - 2.17.2 Processing of clinical samples and diagnosis of: Respiratory Tract Infection; Urinary Tract Infection; Gastrointestinal Tract Infection- Cholera and other diarrheal diseases, food poisoning; Genital Tract Infections-Bacterial Vaginosis, Pelvic Inflammatory Disease (PID); Sexually Transmitted Infections- Gonorrhoea, Syphilis, Chlamydial Infection; Eye infection; Ear infections; Oral infections-Mandibular abscess, Gingivitis and Anaerobic Infections of Oral Cavity; Gas Gangrene; Peptic Ulcer; Tuberculosis; Leprosy; Enteric fever; Bacteremia; Septicemia, Bacterial Endocarditis; Meningitis
- 3. Virology :**
- 3.1 General structure, properties and classification schemes of virus, virus cell interactions and viral replication
  - 3.2 Classification, structure, medical importance, pathogenesis and laboratory diagnosis, prevention and control of: Poxviruses, Herpes viruses, Adenoviruses, Picorna virus, Orthomyxovirus, Paramyxovirus, Arbovirus, Rhabdo viruses, Hepatitis virus, Retroviruses (HIV, HTLV), New emerging viruses, Vaccines, Antiviral drugs
  - 3.3 Principles of bio-safety and requirements of virology laboratory

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- 3.4 Methods of cultivation and purification of viruses
  - 3.5 Principle, procedure and applications of serodiagnostic methods in virology- haemagglutination and haemagglutination-inhibition tests, Complement fixation, neutralization, Western blot, flowcytometry and imunohistochemistry
  - 3.6 Principle, procedure and application of Nucleic acid based diagnostic methods in virology: Nucleic acid hybridization, polymerase chain reaction, microarray and nucleotide, sequencing. Microscopic techniques- Fluorescence, confocal and electron microscopic techniques
  - 3.7 Diagnostic Virology Experiments :
    - 3.7.1 Preparation of media and reagents sterility checking, Glassware decontamination, washing, sterilization
    - 3.7.2 Propagation of viruses; Tissue culture and egg inoculation technique for the isolation of common medically important viruses; Routes of inoculations in embryonated eggs
    - 3.7.3 Preparation of virus stocks; plaque assay and determination of TCID<sub>50</sub>
    - 3.7.4 Detection of Virus Antigen by ELISA; Immunofluorescence assay; Hemagglutination; Agar gel diffusion; Polymerase chain reaction
    - 3.7.5 Electron microscopy
- 4. Mycology**
- 4.1 General properties and classification of fungi
  - 4.2 Classification of medically important fungi and general characteristics of Aspergillus, Candida, Fusarium, Cryptococcus, Histoplasma, Trichophyton, Epidermophyton, Blastomyces Cryptococcus, Tinea, Microsporum, Coccidioidomyces, Paracoccidioidomyces; Fungal toxins and Allergies,
  - 4.3 Antifungal drugs
  - 4.4 Diagnostic Mycology Experiments :
    - 4.4.1 Laboratory Diagnosis of Fungal diseases: Sample collection and processing for diagnosis of Subcutaneous mycosis, Systemic Mycoses, Opportunistic Mycoses
    - 4.4.2 Preparation of fungal stains and staining techniques
    - 4.4.3 Fungal culture techniques
    - 4.4.4 Isolation and characterization of medically important fungi from clinical specimens and report writing
    - 4.4.5 Isolation and characterization of dimorphic fungi
- 5. Parasitology**
- 5.1 Study of morphology, important developmental stages, symptoms, pathogenesis, epidemiology, diagnosis, treatment, prevention of following parasites: Entamoeba histolytica, Giardia lamblia, Trichomonas, Ascaris lumbricoides, Ancylostoma duodenale and Necator amecarinus, Enterobius vermicularis, Trichuris trichiura, Strongyloides stercoralis, Taenia, Echinococcus, Hymenolepsis nana, Brugia,

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Loaloa, Onchocerca, Dracunculosis., Plasmodium, Leishmania, Toxoplasma, Wucheria

5.2 Diagnostic Parasitology Experiments :

5.2.1 Stool sample collection and processing for observation of parasites by microscopy

5.2.2 Occult blot test in the stool sample

5.2.3 Stool culture

5.2.4 Microscopic observation of Entamoeba, Giardia, Plasmodium, Leishmania, Taenia, Ascaris and othermedically important protozoans and helminthic parasites, ova count and report writing

5.2.5 Laboratory diagnosis of blood and tissue parasites - preparation of thick and thin smear of blood sample, staining, identification and report writing

5.2.6 Routine and special tests done on stool

5.2.7 Laboratory diagnosis of blood and tissue parasites

**6. Immunology**

6.1 History of immunology, innate and aquired immunity, mechanisms of innate immunity inflammation-inflammatory cells, mediators, inflammatory response types, antigens, cells and organs of immune system, evolution of immunity

6.2 Immunoglobulin: Structure and function; regulation of immune response

6.3 Advances in the development of vaccines

6.4 Theory of Hypersensitivity reactions, their types, mechanism, examples

6.5 Complement system and its roles in disease.

6.6 Autoimmune diseases: mechanism of common diseases, principle and procedure for test for autoimmune diseases

6.7 Transplantation Immunology: Major histocompatibility complex, their types, genetics, Role of MHC in organ transplant, MHC association with diseases, Principle of transplantation, Graft rejection

6.8 Preparation, preservation and titration of complement

6.9 Monoclonal and polyclonal antibodies preparation, application in biomedical research, clinical diagnosis and treatment.

6.10 Vaccines, their preparation, uses

6.11 Diagnostic procedure of common immunological/serological tests

6.12 Immunological reaction and their various types. Details about agglutination, precipitation, flocculation, complement fixation ,ELISA

6.13 Quality control and evaluation of kits used in laboratory

6.14 Rapid methods used in immulogy

6.15 Serodiagnostic methods in clinical microbiology

6.16 Immunological methods in clinical laboratories

6.17 Immunological methods for disease diagnosis

## 7. Antimicrobials

- 7.1 Types of antibiotics, Mechanism of action of various antibiotics, spectrum, antibiotic resistance
- 7.2 Antibiotic susceptibility testing by various methods

## 8. Molecular Biology

- 8.1 Chromosomes structure, chromosomal abnormalities, mutations and important genetic diseases
- 8.2 Molecular methods used in clinical microbiology for disease diagnosis
- 8.3 Collection, preservation and transport of specimen for molecular testing
- 8.4 Recombinant DNA technology: necessary elements.
- 8.5 Separation of DNA and RNA
- 8.6 Application of genetics in medicine
- 8.7 Polymerase chain reaction: principle, types, procedure, uses in medicine
- 8.8 In situ hybridization: principle, types, procedure, uses in medicine, Chromogenic in situ hybridization, silver enhanced in situ hybridization, genomic in situ hybridization
- 8.9 Gel electrophoresis: principle, procedure, uses

## 9. Systemic Microbiology:

- 9.1 **Blood stream infections:** Bacteremia, Septicemia, Types of Bacteremia, Infective endocarditis, etiology, transmission, pathogenesis, epidemiology and clinical features and laboratory diagnosis of blood/tissue parasites, Leptospirosis, Brucellosis, Typhus fever, Viral hemorrhagic fever, Systemic fungal infections
- 9.2 **Respiratory tract infections:** Various Bacterial, viral and fungal infections of respiratory tract. Etiology, transmission, pathogenesis, epidemiology and clinical features and diagnosis of Common cold, Pharyngitis and Tonsillitis, otitis and sinusitis, acute epiglottitis, oral cavity infections, laryngitis, and tracheitis, diphtheria, whooping cough, bronchitis, pneumonia, tuberculosis, opportunistic infections, Viral respiratory infections
- 9.3 **Urinary tract infections and sexually transmitted diseases :** Various Bacterial, viral and fungal infections of the urinary tract, TORCH, etiology, pathogenesis, transmission, clinical features and diagnosis of syphilis, gonorrhoea, Chlamydial infections, HIV, bacterial, Vaginosis, genital herpes, papilloma virus infections, opportunistic STDs,
- 9.4 **Gastrointestinal tract infections:** Etiology, pathogenesis, clinical features, and laboratory diagnosis of diarrhoea and dysentery, Helicobacter pylori infection, food poisoning, parasites in the GI tract
- 9.5 **Hepatobiliary infections:** Etiology, pathogenesis, clinical features, and laboratory diagnosis of Viral hepatitis, Hepatobiliary parasites

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- 9.6 **Musculoskeletal infections:** Etiology, clinical features and laboratory diagnosis of pyogenic skin infections, viral skin infections, Polio, superficial and subcutaneous mycosis, leprosy and parasitic skin infections, Gas gangrene
- 9.7 **Central nervous system infections:** meningitis caused by bacteria, viruses, fungi and protozoa; viral encephalitis, rabies, brain abscesses, tetanus, botulism.
- 9.8 **Infections of the skin, ear and eye:** Etiology, transmission, diagnosis and prevention

10. Recent advances in clinical microbiology

11. Emerging and re-emerging pathogens