

**Paper II: Technical Subject**

**1. General Microbiology:**

- 1.1 History and development of microbiology.
- 1.2 Eukaryotes & prokaryotes
- 1.3 Nomenclature and classification of microbes. Determinative characteristics of medically important bacteria, viruses, fungi, parasites and prions
- 1.4 Prokaryotic genome, plasmids, bacterial gene transfer i.e. transformation, conjugation & transduction
- 1.5 Host-parasite relationship
- 1.6 Methods of anaerobiasis
- 1.7 Instruments used in microbiology and their working principles.
- 1.8 Different types of microscopes; principles of microscopy
- 1.9 Techniques of cultivation, isolation and preservation of various microorganisms
- 1.10 Automated methods in diagnosis of infectious diseases
- 1.11 Sterilization, disinfection and antiseptics: definition, types, uses; disinfectant testing
- 1.12 Media, reagents and stains used in Microbiology
- 1.13 Choice of specimens, specimen collection, transport and laboratory procedures for diagnosis of infectious diseases.
- 1.14 Antimicrobial agents, mechanism of drug resistance, antimicrobial susceptibility testing, interpretation of results.
- 1.15 Serological tests, principles methods and interpretation.
- 1.16 Common molecular methods for diagnosis of infectious diseases, principles and interpretation of results
- 1.17 Laboratory biosafety levels, biohazard groups, biosecurity
- 1.18 Quality control and Quality Assurance in Microbiology laboratory; Good clinical laboratory practices, laboratory accreditation
- 1.19 Health care associated infections (HCAI):
  - 1.19.1 Definition, types, burden, epidemiological chain, modes of transmission, diagnosis, surveillance for HCAI, measures for control and prevention, organization of Hospital infection control committee; standard and transmission based precautions, outbreak investigation, the role of the laboratory in prevention of HCAI
  - 1.19.2 Infection surveillance and control in functional areas of concern eg new-born nursery, perioperative ward, ICU, ambulatory care setting, long term care facilities, OTs, laboratories, dialysis unit
  - 1.19.3 Endemic and epidemic hospital infections eg UTI, Hospital acquired and ventilator associated pneumonia, nosocomial tuberculosis, surgical site infection, infection of burns, prosthesis, devices, transplant recipients, hospital associated fungal infections. Multidrug resistance and antimicrobial stewardship program
  - 1.19.4 Preventing transmission of bloodborne pathogens in healthcare setting, post exposure prophylaxis
- 1.20 Health care waste management
- 1.21 The microbiology of air

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- 1.22 The bacteriology of water
- 1.23 The microbiology of milk and milk products
- 1.24 Laboratory animals
- 1.25 Public Health Microbiology: Epidemiology of infectious diseases; microbial infections and intoxications: Outbreak investigations, laboratory testing procedures and preventive measures for food borne, water borne, airborne, vector borne diseases; laboratory based surveillance (eg, Influenza surveillance, Antimicrobial resistance surveillance, HIV/ Hepatitis Surveillance, microbiological surveillance of drinking water, HCAI surveillance), biostatistic methods useful in public health

## 2. Bacteriology

- 2.1. Growth and nutrition of bacteria, bacterial metabolism
- 2.2. Bacterial ecology-normal flora of human body, hospital environment, air, water and milk
- 2.3. Bacterial characteristics, clinical spectrum, epidemiology, pathogenesis, laboratory diagnosis, antimicrobial agents and prevention of:
  - 2.1.1 Aerobic/microaerophilic gram negative rods and cocci: Campylobacter, Helicobacter, Brucella, Legionella, Neisseria, Moraxella, Acinetobacter, Alcaligenes, Bordetella, Pseudomonas, Burkholderia, Stenotrophomonas
  - 2.1.2 Facultative anaerobic gram negative rods: Kingella, Providencia, Salmonella, Shigella, Yersinia, Gardnerella, Vibrio, Pleisomonas, Aeromonas, Escherichia coli, Citrobacter, Hafnia, Morganella, Enterobacter, Klebsiella, Proteus, Serratia, Pasteurella, Hemophilus
  - 2.1.3 Gram negative anaerobic rods and cocci: Bacteroides, Veillonella
  - 2.1.4 Gram positive cocci: Micrococcus, Staphylococcus, Streptococcus, Peptococcus, Peptostreptococcus
  - 2.1.5 Gram positive spore forming rods and cocci: Bacillus, Clostridium
  - 2.1.6 Gram positive non sporing rods: Lactobacillus, Listeria
  - 2.1.7 Actinomycetes and related bacteria: Actinomyces, Nocardia, Mycobacterium, Corynebacterium, Mycoplasma
  - 2.1.8 Spirochetes: Leptospira, Treponema, Borrelia
  - 2.1.9 Rickettsias and Chlamydias: Orientia, Ehrlichia, Coxiella, Rickettsia, Chlamydia
- 2.4. Isolation and identification of bacteria based on morphological, cultural and biochemical properties
- 2.5. Bacterial detection and identification using rapid and automated methods
- 2.6. Principle, procedure and application of biotyping, serotyping, phagotyping
- 2.7. Preservation of bacteria

## 3. Virology

- 3.1. General characteristics of viruses: origin and evolution of viruses; nature and classification; morphology and structure, propagation and identification; replication, genetics and virus host interactions.
- 3.2. General characteristics of viral infections: pathogenesis, immune response, role of cytokines, viral oncogenicity and epidemiology of viral infections
- 3.3. Specific viruses and viral infections: structure, medical importance, pathogenesis and laboratory diagnosis, prevention and control of: Parvoviruses, Adenoviruses,

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Papovaviruses, Herpesviruses, Poxviruses, Orthomyxoviruses (influenza), Paramyxoviruses, Coronaviruses, Picornaviruses, Human enteric RNA viruses (Caliciviruses and Astroviruses), Reoviruses, Rubella, Arboviruses, Filoviruses, Rhabdoviruses (Rabies), Hepatitis viruses, Retroviruses and associated diseases, Prions of humans and animals

- 3.4. Syndromes caused by a range of viruses: infections of the CNS, infections of the fetus and neonates, viral infections in the immunocompromised
- 3.5. Principles of diagnosis and control: safety in the virology laboratory, laboratory diagnosis of viral infections, immunoprophylaxis of viral diseases, antiviral chemotherapy, emergence and reemergence of viral infections
- 3.6. Diagnostic Virology procedures : Principle, procedure and application of
  - 3.6.1 Media and reagents
  - 3.6.2 Propagation of viruses; Tissue culture and egg inoculation technique for the isolation of common medically important viruses
  - 3.6.3 Preparation of virus stocks; plaque assay and determination of TCID50
  - 3.6.4 Serodiagnostic methods: ELISA, haemagglutination and haemagglutination-inhibition tests, complement fixation, neutralization, Western blot, flowcytometry and immunohistochemistry
  - 3.6.5 Nucleic acid based diagnostic methods in virology: Nucleic acid hybridization, polymerase chain reaction, microarray and nucleotide sequencing.
  - 3.6.6 Fluorescence, confocal and electron microscopic techniques

## 4. Mycology

- 4.1. General properties and classification of fungi
- 4.2. Epidemiology, pathogenesis, clinical features and laboratory diagnosis of superficial, deep, systemic and opportunistic mycosis
- 4.3. General characteristics of: Agents of white piedra, black piedra and tinea nigra; diseases caused by Malassezia species; dermatophytes, dermatomycotic moulds; Zygomycetes, Aspergillus spp, Penicillium spp, agents of chromoblastomycosis and sporotrichosis, dimorphic fungi, Candida species, Cryptococcus neoformans, Trichosporon, agents of eumycotic mycetomas, agents of phaeohyphomycosis, agents of oculomycosis, anomalous fungal and fungal like organisms
- 4.4. Antifungal agents and antifungal susceptibility testing; resistance to antifungal agents
- 4.5. Fungal toxins
- 4.6. Fungal diseases
  - 4.6.1 Laboratory Diagnosis of Fungal diseases: Sample collection and processing for diagnosis of superficial, deep, systemic and opportunistic mycoses
  - 4.6.2 Staining techniques and microscopic identification
  - 4.6.3 Fungal culture techniques
  - 4.6.4 Fungal serodiagnosis

## 5. Parasitology

- 5.1 General considerations: Epidemiology of parasitic infections, immunology and immunopathology of human parasitic infections, control of parasites, parasitic infections and parasitic diseases
- 5.2 Protozoa: cellular organization of parasitic protozoa, classification of the parasitic protozoa; epidemiology, morphology, life cycle, pathogenesis, clinical features,

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diagnosis, treatment and prevention of intestinal amoeba, opportunistic amoebae, giardiasis, trichomonads and intestinal flagellates, leishmaniasis, trypanosomiasis, toxoplasmosis, Sarcocystis, Cystoisospora and Cyclospora, cryptosporidiosis, babesiosis, malaria, microsporidians, Balantidium coli

5.3 Helminths: nature and classification of parasitic helminthes, epidemiology, morphology, life cycle, pathogenesis, clinical features, diagnosis, treatment and prevention of schistosomes, lung and liver flukes, intestinal tapeworms, larval cestodes, gastrointestinal nematodes (Ascaris, Hookworm, Trichuris, Enterobius), Strongyloides, Capillaria, Trichinella, Toxocara, lymphatic filariasis, onchocerciasis, Angiostrongylus, Dracunculiasis

5.4 Diagnostic Parasitology Procedures :

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

5.4.2 Occult blot test in the stool sample

5.4.3 Parasite culture systems

5.4.4 Microscopic identification of medically important protozoa and helminthes; determination of parasite count and interpretation of results

5.4.5 Serological tests for diagnosis of parasitic diseases

## 6 Immunology

6.1 Overview of immune system: Historical perspective, innate immunity, adaptive immunity, immune dysfunction and its consequences

6.2 Hematopoiesis and cells and organs of immune system

6.3 Generation of B-cell and T-cell responses: antigens, immunoglobulin structure and function, organization and expression of immunoglobulin genes, antigen-antibody interactions, major histocompatibility complex, antigen processing and presentation, T-cell receptor, T-cell maturation, activation and differentiation, B-cell generation, activation and differentiation

6.4 Immune effector mechanism: Cytokines, the complement system, cell mediated effector responses, leukocyte migration and inflammation, hypersensitivity reactions

6.5 The immune system in health and disease: immune response to infectious diseases, vaccines, AIDS and other immunodeficiencies, autoimmunity, transplant immunology, cancer and immune system

6.6 Experimental systems: experimental animal models, cell culture systems, protein biochemistry, recombinant DNA technology, gene transfer into mammalian cells

## 7 Molecular Biology

7.1 Genome organization in prokaryotes and eukaryotes; genetic mutations types and significance; Plasmids: nature, classification, properties and replication

7.2 Collection, preservation and transport of specimen for molecular testing

7.3 Recombinant DNA technology: Principles, concept, application

7.4 Molecular Techniques:

7.4.1 Isolation of plasmids, DNA, RNA, Proteins

7.4.2 PCR

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- 7.4.3 Electrophoresis
- 7.4.4 Chromatography
- 7.4.5 Blot techniques
- 7.4.6 Hybridization techniques
- 7.4.7 Microarray; DNA and Protein Microarray
- 7.4.8 Gene sequencing
- 7.4.9 Recent advances in molecular biology

### 8 Systemic Microbiology:

Bacterial, viral, fungal and parasitic infections of different systems. Etiology, transmission, epidemiology, pathogenesis, clinical features, laboratory diagnosis, prevention of:

- 8.1 Respiratory tract infections: common cold, pharyngitis and tonsillitis, otitis and sinusitis, acute epiglottitis, infections of the oral cavity, laryngitis, tracheitis, bronchitis, pneumonia, diphtheria, whooping cough, tuberculosis, plague, melioidosis, opportunistic infections
- 8.2 Urinary tract infections: upper and lower urinary tract infection, prostatitis
- 8.3 Reproductive tract infections: Sexually transmitted infections, pelvic inflammatory diseases, vaginoses, TORCH syndrome
- 8.4 Gastrointestinal and hepatobiliary tract infections: H. pylori infection, diarrhoeal diseases, gastroenteritis, food poisoning, infections of the hepatobiliary system, Clostridium difficile diarrhoea
- 8.5 Central nervous system infections: meningitis, encephalitis, meningoencephalitis, tetanus, botulism, rabies, poliomyelitis, slow viral infections, prion diseases, brain abscesses, neurocysticercosis
- 8.6 Infections of the integumentary system: bacterial skin infection (leprosy, cutaneous anthrax, mycobacterial skin infections, staphylococcal, streptococcal, corynebacterial infections), viral infections with cutaneous manifestations, parasitic infections with cutaneous manifestation.
- 8.7 Infections of musculoskeletal system: arthritis, osteomyelitis, myonecrosis, subcutaneous and deep mycoses, cysticercosis, trichinellosis
- 8.8 Infections of the hemopoetic and cardiovascular system: bacteremia, septicemia, infective endocarditis, brucellosis, leptospirosis, tularaemia, bartonellosis, rickettsial diseases, candidemia/fungemia, parasitic infections eg malaria, leishmaniasis, filariasis, babesiosis, trypanosomiasis, schistosomiasis; viral infections eg EBV, CMV, VZV, HIV Erythrovirus B 19, dengue
- 8.9 Infections of eyes and ears: conjunctivitis, keratitis, blepharitis, retinitis, trachoma, ophthalmitis, otitis media, otitis externa

पाठ्यक्रम लागू मिति: नेपाल स्वास्थ्य सेवा, प्याथोलोजी समूह, माइक्रोबायोलोजी उपसमूह, एघारौं तह, प्रमुख कन्सल्टेण्ट माइक्रोबायोलोजिष्ट पदको आ.व. २०७७-७८ मा प्रकाशित विज्ञापन देखि लागू ।