

Paper II: Technical Subject

1. General Microbiology:

- 1.1 History and development of microbiology, Eukaryotes & prokaryotes, microbial world
- 1.2 Nomenclature and classification of microbes. Determinative characteristics of medically important bacteria, viruses, fungi and protozoan parasites
- 1.3 Growth and nutrition of microbes, microbial metabolism
- 1.4 Bacterial ecology-normal flora of human body, hospital environment, air, water and milk
- 1.5 Host-parasite relationship
- 1.6 Methods of anaerobiosis
- 1.7 Different types of instruments used in microbiology and their working principle, Different types of microscopes, including phase contrast and interference microscope. Maintenance of microscope
- 1.8 Techniques of cultivation, isolation and preservation of various microorganisms
- 1.9 Microscopy, culture sensitivity, serological and molecular methods for identification of various microorganisms
- 1.10 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 .
- 1.11 Media preparation, preparation of reagents and stains
- 1.12 Collection and transportation of specimens for Microbiological investigations such as Blood, Urine, Throat swab, Rectal swab, Stool, Pus, OT specimens and other body fluids
- 1.13 Care and maintenance of common laboratory equipment
- 1.14 Staining techniques in microbiology
- 1.15 Quality control and Quality Assurance in Microbiology.
- 1.16 Various levels of Biosafety and their requirements, biorisk groups
- 1.17 Health care associated infections- prevention and control, laboratory waste management
- 1.18 Water culture for coliform organisms
- 1.19 Air sampling for organism isolation
- 1.20 Accreditation of laboratories
- 1.21 Care of Laboratory animals
- 1.22 Ethics in research in microbiology

2. Bacteriology:

- 2.1. Bacterial anatomy, Properties, epidemiology, transmission, methods of isolation, identification, pathogenesis, toxins and enzymes production, antigen structures and laboratory diagnosis of
 - 2.1.1 Aerobic/microaerophilic gram negative rods and cocci: Campylobacter, Helicobacter, Brucella, Legionella, Neisseria, Branhamella, Kingella, Moraxella, Acinetobacter, Alcaligenes, Bordetella, Pseudomonas, Francisella
 - 2.1.2 Facultative anaerobic gram negative rods: Providencia, Salmonella, Shigella, Yersinia, Gardnerella, Vibrio, Pseudomonas, Aeromonas, Escherichia coli, Citrobacter, Hafnia, Morganella, Enterobacter, Klebsiella, Proteus, Serratia, Pasteurella, Hemophilus

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नेपाल स्वास्थ्य सेवा, मडिकल ल्याब टेक्नोलोजी समूह, मेडिकल माइक्रोबायोलोजी उपसमूह, नवौं तह, उपप्रमुख
माइक्रोबायोलोजिष्ट पदको खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

- 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: Coxiella, Rickettsia, Chlamydia
- 2.2. Isolation and Enumeration techniques of bacteria
- 2.3. Identification based on morphological, cultural and biochemical properties
- 2.4. Bacteria, isolation, detection and identification using rapid and automated methods
- 2.5. Principle, Procedure and application of Bio typing, Sero typing, Phage typing
- 2.6. Types of antibiotics, Mechanism of action of various antibiotics, spectrum, antibiotic resistance
- 2.7. Antibiotic susceptibility test: principle, procedure and interpretation
- 2.8. Collection and processing of various clinical samples.
- 2.9. Preservation of bacteria

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), other medically important and new emerging viruses,
- 3.3 Principles of Bio-safety and biosecurity requirements of virology laboratory
 - 3.3.1 International Health Regulation 2005 (IHR 2005): Introduction, Scope and Application
 - 3.3.2 Classification of Biological Substances : IATA Guideline
- 3.4 Biological Sample handling, Packaging and transportation of Risk group A, Risk group B and Exempt
- 3.5 Methods of cultivation and purification of viruses
- 3.6 Principle, procedure and applications of serodiagnostic methods in virology- haemagglutination and haemagglutination-inhibition tests, Complement fixation, neutralization, Western blot, flowcytometry and immunochemistry and other recent techniques
- 3.7 Principle, procedure and application of Nucleic acid based diagnostic methods in virology: Nucleic acid hybridization, polymerase chain reaction, microarray and nucleotide sequencing
- 3.8 Microscopic techniques- Fluorescence, confocal and electron microscopic techniques in virology
- 3.9 Diagnostic Virology procedures:
 - 3.9.1 Preparation of tissue media and reagents sterility checking Glassware decontamination, washing, sterilization
 - 3.9.2 Propagation of viruses; Tissue culture and egg inoculation technique for the isolation of common medically important viruses; Routes of inoculations in embryonated eggs

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3.9.3 Preparation of virus stocks; plaque assay and determination of TCID₅₀

3.9.4 Detection of Virus Antigen by ELISA; Immunofluorescence assay; Hemagglutination; Agar gel diffusion; Polymerase chain reaction

4. Mycology

4.1 General properties and classification of fungi

4.2 Morphology, pathogenesis and diagnostic laboratory tests for superficial, deep and systemic mycosis

4.3 Classification of medically important fungi and general characteristics of Aspergillus, Candida, Fusarium, Cryptococcus, Histoplasma, Trichophyton, Epidermophyton, Blastomyces, Cryptococcus, Tinea, Microsporium, Coccidioidomyces, Paracoccidioidomyces; Fungal toxins and Allergies,

4.4 Laboratory Diagnosis of Fungal diseases: Sample collection and processing for diagnosis of Subcutaneous, Systemic and Opportunistic Mycoses

4.5 Diagnostic procedures :

4.5.1 Preparation of fungal stains and staining techniques

4.5.2 Fungal culture techniques

4.5.3 Isolation and characterization of medically important fungi from clinical specimens

5. Parasitology

5.1 Study of morphology, developmental stages, symptoms, pathogenesis, epidemiology, diagnosis, treatment and prevention of following parasites: Entamoeba, Giardia, Trichomonas, Ascaris, Ancylostoma (Hook worm), Enterobius, Trichuris, Strongyloides, Taenia, Echinococcus, Hymenolepis, Brugia, Loa loa, Onchocerca, Dracunculus, Plasmodium, Leishmania, Toxoplasma, Wuchereria

5.2 Entomology: common arthropods and other vectors viz. mosquito, sand fly, ticks, mites, cyclops, louse

5.3 Diagnostic Parasitology Experiments :

5.3.1 Stool sample collection and processing for parasites by microscopy

5.3.2 Occult blood test in the stool sample

5.3.3 Stool culture

5.3.4 Microscopic observation of Entamoeba, Giardia, Plasmodium, Leishmania, Taenia, Ascaris and other medically important protozoa and helminthic parasites, ova count

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

5.3.6 Routine and special tests done on stool

6. Immunology

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

6.2 Immunoglobulin: Structure and function; regulation of immune response

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

6.4 Complement system and its roles in disease

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- 6.5 Transplantation Immunology: Major histocompatibility complex, their types, genetics, Role of MHC in organ transplant, MHC association with diseases, Principle of transplantation, Graft rejection
- 6.6 Advances in the development of vaccines
- 6.7 Principle, procedure and applications of Serological and immunological Methods: Agglutination and Precipitation tests, Immuno staining and Immunofluorescence test, ELISA, Complement fixation, Radioimmunoassay (RIA) and Immuno-electrophoresis
- 6.8 Quality control and evaluation of kits used in laboratory
- 6.9 Immunological techniques:
 - 6.9.1 Antigen preparation- Protein antigen, Carbohydrate antigen, synthetic peptide, recombinant protein antigens; Basic concepts, methods, purification and applications
 - 6.9.2 Optimization of antigen and antibody
 - 6.9.3 Monoclonal and polyclonal antibodies; preparation, applications
 - 6.9.4 Preparation, preservation and titration of complement
 - 6.9.5 HLA typing and cross matching

7. Molecular Biology

- 7.1 Chromosomes structure, chromosomal abnormalities, mutations, Genome organization in prokaryotes and eukaryotes. Plasmids: nature, classification, properties and replication
- 7.2 Collection, preservation and transport of specimen for molecular testing
- 7.3 Procedure of Karyotyping and other methods of chromosomal analysis in various specimens
- 7.4 Recombinant DNA technology: Principles, concept, application
- 7.5 Gene library
- 7.6 Use of Internet, Public domain databases for molecular biology
- 7.7 Molecular Techniques:
 - 7.7.1 Isolation of plasmids, DNA, RNA, Proteins
 - 7.7.2 PCR
 - 7.7.3 Electrophoresis
 - 7.7.4 Chromatography
 - 7.7.5 Blot techniques
 - 7.7.6 Hybridization techniques
 - 7.7.7 Microarray; DNA and Protein Microarray
 - 7.7.8 Gene sequencing
 - 7.7.9 Recent advances in molecular medical biology

8. Public Health Microbiology:

- 8.1 Epidemiology of infectious diseases
- 8.2 Microbial infections and intoxications: Outbreak investigations, laboratory testing procedures and preventive measures for food borne, water borne, airborne, vector borne diseases
- 8.3 Laboratory based surveillance in microbiology (ie. Influenza surveillance, Antimicrobial resistance surveillance, HIV/ Hepatitis Surveillance, Microbiological Surveillance of drinking water)
- 8.4 Biostatistic methods useful in public health