

# Microbiology

## Marks distribution of Assessment of Microbiology:

### Total marks – 300

- Written= 100 (MCQ 20+SAQ & SEQ 70+formative Assessment Marks 10)
- MCQ=20 (Multiple T-F 10 + SBA 10)
- SAQ + SEQ = 70
- Structured oral examination (SOE) =100
- Practical =100 (OSPE-50 +Traditional- 40+ Practical note book-05+ Integrated teaching-05).  
[Students will prepare a short case report after each integrated teaching and will submit to all the departments of respective phase. If total 5 classes of integrated teaching occur, students will submit 5 such reports.]

## Learning Objectives and Course Contents in Microbiology

### General Bacteriology

#### Contents

#### **CORE:**

#### **Introduction of Microbiology:**

- Brief historical background
- Branches of Microbiology
- Legends in the field of Microbiology
- Koch's postulate, molecular Koch's postulate, the limitations and new adjusts.
- Concept of medical biotechnology in relation to Microbiology
- Importance and scope of microbiology in medical science.

#### **Bacterial cell:**

- Prokaryotic and Eukaryotic cells with examples
- Different structures of bacterial cell and their functions.
- Brief description of cell wall of Gram positive and Gram negative bacteria.
- Spores structure and clinical importance.
- L-forms, protoplast, spheroplast, Clinical importance of L-form.

#### **Bacterial classification and staining:**

- Nomenclature of Bacteria.
- Classification by staining, morphology, Oxygen requirement, temperature requirement.
- Staining- Theoretical basis and clinical significance of Gram and Z-N stain, Albert stain, Auramin-Rodamin stain
- Practical on staining: Gram, Z-N staining and Albert stain.

#### **Nutrition and Cultivation of bacteria:**

- Nutritional requirement for the growth of bacteria.
- Growth curve: phases with clinical significance
- Common bacteriological media: classification and uses.

#### **Sterilization and Disinfection:**

- Definition, classification and applications of sterilization, disinfection and antisepsis
- Methods of sterilizations: details of autoclaving, hot air oven and chemical methods.
- Sterilization of medical equipment and culture media.
- Disinfection of body fluid spillage and equipment.
- Preparation of disinfectants and their use.

#### **Antimicrobial agents:**

- Definition of antibiotics, antimicrobial agents, chemotherapeutics, bacteriostatic, bacteriocidal, synergism, antagonism, selective toxicity etc.
- Classification of anti microbial agents
- Mechanism of action on bacteria with examples
- Drug resistance: origin, mechanism, transmission and prevention
- Indication of combination of antibiotics in bacterial infection
- Hazards of indiscriminate use of antibiotics
- Defining MDR, XDR and PDR bacteria.
- Definition and importance of ESBL, MBL, MRSA, VRSA, VRE.
- Definition and importance of Biofilm.

**Host-Parasite relationship:**

- Terms and Definitions.
- Parasite and Host attributes
- Normal flora, opportunistic pathogens and their clinical importance.

**Pathogenesis of bacterial diseases:**

- Transmission of bacterial agents.
- Virulence factors: e.g. antigens, toxins, enzymes, invasiveness and their role in pathogenesis of diseases with examples.

**Bacterial Genetics:**

- Bacterial genome, DNA, chromosome, plasmid, transposon etc.
- Gene transfer in bacteria.
- Bacterial DNA replication.
- DNA recombination, principles of Cloning and genetic engineering.

**Septic Shock**

**Systemic Bacteriology**

- Staphylococci: *S. aureus*, *S. epidermidis*, *S. saprophyticus*, Enterococcus(VRE), MRSA, VRSA.
- Streptococci: Group A Streptococcus, Streptococcus agalactiae and Streptococcus pneumoniae
- Neisseria: *N. gonorrhoea*, *N. meningitidis*
- Corynebacterium diphtheriae
- Enterobacteriaceae: Classification: Salmonella, Shigella, Esch. Coli and other Enterobacteriaceae, definition and clinical significance of ESBL, MBL and NDM-producing bacteria.
- Vibrio cholerae
- Helicobacter pylori
- Mycobacterium: *M. tuberculosis*, Atypical mycobacteria and *M. leprae*. MDR, XDR TB.
- Anaerobic bacteria: Clostridium: *Cl. tetani*, *Cl. botulinum*, *Cl. Perfringens* and other anaerobic bacteria
- Bacillus: *B. Anthracis*, *B. Cereus*, *B. Subtilis*..
- Spirochaetes: *Treponema pallidum*
- Important characteristics and diseases produced by: Rickettsia Haemophilus influenzae, Haemophilus ducrey, Mycoplasma, Chlamydia, , Nocardia, Actinomycetes species

**Additional:**

- Streptococcus Group D
- Klebsiella, Proteus , Pseudomonas: *Ps. aeruginosa* , *Aeromonas*, *Plesiomonas*,
- Campylobacter jejune
- Bacteroides species
- Clostridium domicile

- Listeria
- Barkholderia
- G. vaginalis
- Probiotics

## Immunology

### **CORE:**

#### **1. Introduction:**

- Brief historical background
- Basic concepts of immunity: Definition, classification, types and components with examples.

#### **2. Immune system:**

- Organs, cells and soluble components

#### **3. Antigens and Immunogens:**

- Terms and definitions: antigen, immunogen, hapten, epitope, paratope. Criteria of immunogenicity.

#### **4. Major histocompatibility complex (MHC/ HLA):**

- Terms and definitions, types and distribution, clinical and biological significance.

#### **5. Immunoglobulins and Antibodies:**

- Terms and definitions, classification, structure, biological properties and functions.
- Monoclonal antibodies.

#### **6. Complements:**

- Terms and definitions, activation, biological functions and clinical significance, deficiency disorders.

#### **7. Mechanisms of immune response:**

- Antibody and cell mediated immune response.
- Primary and secondary immune response

#### **8. Hypersensitivity:**

- Terms and definitions, classifications, mechanisms, clinical significance with examples.
- Atopy, desensitization.
- Tests for Type-I reaction: Patch test, RAST, serum IgE assay.

#### **9. Transplantation and Tumor immunity:**

- Terms and definitions, types and outline of prevention of graft rejection.
- Tumor antigens, role in diagnosis and clinical significance.
- Immunosurveillance

#### **10. Tolerance and Autoimmunity:**

- Definition and classification of tolerance
- Terms and definitions, basic concepts and mechanism of development of autoimmunity.

#### **11. Immunodeficiency disorders and immunotherapy:**

- Classification with examples

#### **12. Agents of immunotherapy and biologics.**

#### **13. Immunodiagnostic tests**

- Terms and definitions, types and applications in diagnostic medicine
- Agglutination, precipitation, ELISA, Western blot test, PCR and RT-PCR

## Parasitology

### **CORE:**

#### **Introduction:**

Introduction to parasitology, common parasitic diseases of Bangladesh, Terms and definitions, classifications of parasites according to habitat,

Host: definition, classification with examples.

**Intestinal, luminal and free-living protozoa:**

**Entamoeba:**

- Classification
- Geographical distribution, morphology, disease, clinical features, pathogenesis, laboratory diagnosis and treatment.
- Extraintestinal amoebiasis.

**Giardia intestinalis and Trichomonas vaginalis:**

- Morphology, transmission, disease, clinical features, pathogenesis, laboratory diagnosis and treatment.
- Acanthamoeba, Naegleria, Balamuthia and Sappinia

**Blood and Tissue Protozoa:**

**Leishmania species:** Classification, morphology, disease production.

**Leishmania donovani and PKDL:**

- Geographical distribution morphology, lifecycle, disease, clinical features, pathogenesis laboratory diagnosis and treatment.
- Cutaneous leishmaniasis: Causative agents, pathogenesis, lab diagnosis and management.
- Mucocutaneous leishmaniasis (MCL).

**Plasmodium species:**

Epidemiology, morphology, lifecycle, disease, clinical features, pathogenesis, complications, laboratory diagnosis, treatment and prevention.

**Acanthamoeba , Negleria, Balamuthia and Sappinia**

**Toxoplasma gondii, Cryptosporidium, Balantidium coli**

**Cestodes and Trematodes:**

- Classify according to habitat with examples
- Common characteristics of Cestodes, Trematodes and Nematodes.
- Morphology, lifecycle, diseases, clinical features, pathogenesis, laboratory diagnosis of Taenia saginata and Taenia solium, T. asiatica.

**Echinococcus: Different species**

- Morphology, lifecycle, disease, clinical features, pathogenesis and laboratory diagnosis and treatment.

**Intestinal Nematodes:**

- Geographical distribution, morphology, lifecycle, disease, clinical features, pathogenesis, laboratory diagnosis of Ascaris lumbricoides, Hook worm, Trichuris trichiura, Enterobius vermicularis, Strongyloides stercoralis.
- Larva migrans and larva currens.
- Hyperinfection syndrome

**Tissue nematodes: Classification, morphology and mode of transmission, diseases produced.**

**Wuchereria bancrofti, Brugia malayi, B. timori**

- Morphology, lifecycle, disease (classical and occult filariasis, tropical pulmonary eosinophilia), clinical features, pathogenesis, complications, laboratory diagnosis and treatment of filariasis. Periodicity of microfilaria. Provocative test.
- Parasites associated with cancer.

**Additional:**

1. Important characteristics and disease produced by:

- Hymenolepes nana, Diphylobothrium latum, Dipylidium
- Schistosoma
- Trypanosoma
- Loa loa, Onchocercous volvulus
- D. medinansis
- Fasciolopsis buski, Fasciola hepatica: habitat, disease, clinical features, laboratory diagnosis and treatment.
- Anisakis
- Cyclospora, Cystoisospora, Sarcocystis
- Trichinella

## Virology

### CORE:

**1. General virology:**

- Introduction to virology, common viral diseases in Bangladesh.
- Basic structure of virus
- Outline of viral replication
- Classification
- Lab diagnosis of viral diseases
- Antiviral agents

**2. Herpes viruses:**

- Classification, important characteristics, diseases, important clinical features, transmission, pathogenesis, complications, laboratory diagnosis, treatment and prevention.
- Latency and reactivation of Herpes viruses.

**3. Orthomyxo and paramyxo viruses**

- Important characteristics, diseases, important clinical features, transmission, pathogenesis, complications, laboratory diagnosis and prevention, management.

**4. Hepatitis viruses:**

- Classification, important characteristics, diseases, transmission, pathogenesis, complications, laboratory diagnosis, prevention and management.

**5. Polio virus**

- Important characteristics, diseases, transmission, pathogenesis, laboratory diagnosis and prevention
- Merits and demerits of oral and injectable polio vaccine

**6. Rabies virus:**

- Important characteristics, diseases, transmission, pathogenesis, laboratory diagnosis and prevention and treatment, merits and demerits of different types of vaccines

**7. Rota virus:**

- Diseases, transmission, pathogenesis, laboratory diagnosis, prevention and treatment

**8. HIV:**

- Classification, important characteristics, diseases (AIDS), transmission, pathogenesis, laboratory diagnosis, prevention and treatment.

**9. Dengue**

- Important characteristics, diseases (DHF, DSS), transmission, pathogenesis, laboratory diagnosis, prevention and treatment.

10. **Chikungunya:** Important characteristics, transmission, epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment.
11. **Coronavirus:** Important characteristics, epidemiology, transmission, pathogenesis, organs involved, clinical features, laboratory diagnosis, prevention and treatment of COVID-19 and other Coronaviruses.
12. **Other Emerging viral diseases**  
**Avian flue, SARS, MERS, Nipah, Swine flue, Zika, Ebola etc.**
  - Important characteristics of virus, important clinical features, transmission, pathogenesis, laboratory diagnosis and prevention
13. **Oncogenic viruses**
  - Definitions, list of oncogenic viruses with their associated tumours.
14. Latent and chronic viral infections.

### **Mycology**

#### **CORE:**

##### **1. Introduction:**

- Introduction to Mycology, beneficial and detrimental effects, morphology, classification
- Difference between fungus and bacteria
- Antifungal agents and antifungal drug resistance

##### **2. Superficial and cutaneous mycoses:**

- Aetiological agents and diseases
- Transmission and pathogenesis, laboratory diagnosis of Pityriasis versicolor, Dermatophytosis, Candidiasis.

##### **3. Subcutaneous**

- Aetiological agents and diseases
- Transmission, pathogenesis and Lab diagnosis.
- Rhinosporidiosis and Madura foot

##### **4. Systemic mycoses:**

- Aetiological agents and diseases
- Transmission, pathogenesis and lab diagnosis.
- Histoplasmosis, Cryptococcal meningitis, Candidiasis, Pneumocystis jirovecii, fungus ball, mycotoxin.

##### **5. Opportunistic fungal diseases.**

### **Clinical Microbiology**

#### **CORE:**

1. Collection of samples, transportation and storage
2. Microbial diseases of Gastrointestinal and Hepatobiliary diseases and Food poisoning
3. Microbial diseases of Genito-Urinary system
4. Microbial diseases of upper and lower Respiratory Tract
5. Microbial diseases of CNS.
6. Hospital Acquired Infections
7. Microbial diseases of Bone and Soft Tissue
8. Microbial diseases of Cardiovascular System
9. Microbial diseases of eye, ear, nose and throat
10. Pyrexia of unknown origin (Microbial cause with emphasis on blood culture).
11. Infectious disease control and prevention.

12. Collection, transport, preservation and lab tests of samples collected from COVID-19 patients.
13. Use of different types of masks, sanitizers, PPE in the prevention of viral infections.

### **Practical**

1. Gram's staining
2. Z-N staining, Albert stain, Auramin-Rodamin stain.
3. Demonstration of culture media namely Nutrient agar, Blood agar, Chocolate agar, MacConkey's agar, Lowenstein Jensen, Robertson's cooked meat media, Blood culture media, transport media (Carry-Blair/Stuart/Peptone water) with and without bacterial growth
4. Demonstration of colony morphology of common bacteria: Staphylococci, Streptococcus Lactose fermenters, Lactose nonfermenters, Proteus, Klebsiella, E. coli, Pseudomonas, Mycobacterium.
5. Demonstration of inoculation, incubation (aerobic, CO<sub>2</sub> and Anerobic condition) and plate reading.
6. Demonstration of catalase, coagulase, and oxidase, TSI, MIU and Simmon's citrate tests
7. Demonstration of in vitro antibiotic sensitivity test by disk diffusion method,
8. Demonstration of sterilization by chemical agents autoclaving and hot air oven.
9. Demonstration of donning and doffing, wearing PPE, hand washing/sanitization.
10. Preparation of disinfectants.

### **Demonstration**

- Microscopic examination of stool for demonstration of cyst/trophozoites of protozoa, ova/larva of intestinal helminthes, pus cells, macrophage and RBC.
- Microscopic examination of urine for demonstration of epithelial cells, pus cells, RBCs, casts and parasites.
- Examination of blood smear for demonstration of malarial parasites
- Examination of bone marrow smear for LD body
- Microscopic examination of Gram stain smear of throat swab, wound swab, urethral discharge.
- Examination of throat swab by Albert stain.
- Microscopic examination of sputum and urine by Z-N stain for AFB.
- Modified Z-N stain for Cryptosporidium in stool.
- Immunological tests: Demonstration and interpretation of Widal test, RPR, ICT for HBsAg, Dengue, Chikungunya, HIV, HCV, COVID-19, Plasmodium, LD body and Filaria.
- Microscopic examination of skin scrapping for demonstration of fungal elements (dermatophytes and candida).
- PCR and RT-PCR.