

MICROBIOLOGY

GOALS AND OBJECTIVES

A MBBS student at the end of the microbiology course will be able to :

1. Describe the mechanisms of host parasite relationship
2. List the normal flora of the human body.
3. Describe the etiology and pathogenesis of common infectious diseases.
4. List the microbes that cause opportunistic infections in humans and describe their pathogenesis.
 - a. Choose appropriate laboratory investigations required for a clinical diagnosis.
 - b. Sample the right specimen, at the right time, by the right method.
 - c. Analyze and interpret the results of laboratory tests.
 - d. Perform some simple tests, which help to arrive at rapid diagnosis.
5. Apply the principles of immunology in the pathogenesis, diagnosis and prevention of infectious and non-infectious diseases.
6. Practice the techniques of asepsis, antisepsis and sterilization in day-to-day procedures and apply universal precautions in laboratory and clinical practice.
7. Organize the prevention and control of communicable diseases in the community or hospital.
8. Understand the ecology (microbial) of specialized areas like hospital, water, food and prevent the possible spread of infections.

OBJECTIVES

MBBS student at the end of Microbiology Courses will be able to :

- Describe the etiology and Pathogenesis of common infectious diseases.
- Describe the mechanisms of host-parasite relationship.
- Investigate common infectious diseases with particular emphasis to appropriate methods of specimen collection and laboratory diagnosis and proper interpretation of laboratory test results.
- Be aware of salient features of uncommon infectious diseases.
- Apply the principles of immunology in the pathogenesis, diagnosis and prevention of infectious and non-infectious diseases.
- Practice laboratory guided antimicrobial therapy
- Practice the techniques of asepsis, antisepsis and sterilization in day to day procedures and apply universal precautions in laboratory and clinical practice.
- Organize the prevention and control of communicable disease in the community or hospital.
- Understand different types of Bio-medical waste, their potential risks and their management.

COURSE CONTENTS

THEORY

I. INTRODUCTION

Must know

1. Morbidity and mortality data of infectious diseases prevalent in the country with reference to the National Health Programmes and in the local geographic area.

Desirable to know

1. Significant milestones in the history of Microbiology

II GENERAL MICROBIOLOGY

Must know

1. Definitions : infections, parasite, host, vector, fomite, contagious disease infectious disease, epidemic, endemic, pandemic, Zoonosis, Epizootic, Attack rate.
2. Normal flora of the human body.
3. Routes of infection and spread; endogenous and exogenous infections; source at reservoir of infections.
4. Bacterial cell. Morphology limited to recognizing bacteria in clinical samples Shape, motility and arrangement. Structures, which are virulence, associated.
Physiology : Essentials of bacterial growth requirements.
5. Sterilization, disinfection and universal precautions in relation to patient care an disease prevention. Definition of asepsis, sterilization, disinfection.
6. Antimicrobials : Mode of action, interpretation of susceptibility tests, resistance spectrum of activity.
7. Bacterial genetics.

III IMMUNOLOGY

Must know

1. Basic principles of immunity immunobiology : lymphoid organs and tissues.
Antigen, antibody reactions with relevance to pathogenesis and serological diagnosis.
2. Humoral immunity and its role in immunity
3. Cell mediated immunity and its role in immunity.
4. Immunology of hypersensitivity,
5. Measuring immune functions.
6. Immunological basis of the autoimmune phenomena.
7. Immunodeficiency with relevance to opportunistic infections.
8. Basic principles of transplantation immunity
9. Basic principles of tumour immunity.

SYSTEMATIC MICROBIOLOGY

IV BACTERIOLOGY

To be considered under the following headings

Morphology, classification according to pathogenicity, mode of transmission, methods of prevention, collection and transport of samples for laboratory diagnosis, Interpretation of laboratory reports, Rapid bedside diagnosis where feasible, list of antimicrobial agents and control measures with special relevance to the National Control and Eradication programmes, in respect of

Must know

1. Staphylococci,
2. Streptococci and pneumococci,
3. Neisseriae,
4. Corynebacterium diphtheria,
5. Mycobacteria : Tuberculosis, M.leprae, atypical mycobacteria,
6. Enterobacteriaceae,
7. Parvobacteria : Haemophilus, Bordetella, Brucella, Pasteurella, Gardnerella,
8. Vibrios : V. cholerae and other medically important vibrios,
9. Campylobacters and Helicobacters,
10. Pseudomonas,
11. Bacillus anthracis,
12. Sporing and non-sporing anaerobes : Clostridia, Bacteroides and Fusobacteria,
13. Chlamydiae : Mycoplasma
14. Actinomycetales : Actinomycetes and Nocardia,
15. Spirochaetes,
16. Rickettsiae

Desirable to know

Listeria monocytogenes

V GENERAL VIROLOGY

Must know

General properties : Basic structure and broad classification of viruses. Pathogenesis and pathology of viral infections. Immunity and prophylaxis of viral diseases. Principles of laboratory diagnosis of viral diseases. List of commonly used antiviral agents. Bacteriophage with relation to virulence mechanism and epidemiology.

Desirable to know

Replication and genetics.

VI SYSTEMATIC VIROLOGY

Must know

1. Herpes viruses : List of viruses included, lesions produced, pathogenesis and latency principles and Laboratory diagnosis.
2. Arbo viruses : List of arboviruses prevalent in India, general properties, mode of transmission, disease syndromes produced, common diagnostic tests, prevention of spread.
3. Picoma viruses : Common infections produced, classification and general properties, pathogenesis of poliomyelitis, immunoprophylaxis of poliomyelitis.

4. Myxoviruses : General properties, classification according to diseases produced, antigenic variations in influenza virus with relevance to vaccine efficacy; measles, mumps and rubella; important features and prophylaxis.
5. Rabies virus : General properties; antirabies vaccine, antemortem diagnosis in rabies.
6. Hepatitis virus : List of viruses, pathogenesis, mode of infection, list of diagnostic tests and their interpretation, methods of prevention and control.
7. Human immunodeficiency virus : Structure with relevance to laboratory diagnosis and type of infection, laboratory tests and their interpretation, universal precautions, specific precautions, recent trends in diagnosis and prophylaxis.
8. Rota virus : laboratory diagnosis.
9. Adenovirus - Infections caused and Laboratory diagnosis.

Desirable to know

1. Slow virus infection.
2. Poxviruses.
3. Oncogenic viruses.

VII MYCOLOGY

Must know

General properties of fungi. Classification based on disease: superficial, subcutaneous, deep mycoses opportunistic infections including Mycotoxins, systemic mycoses. General principles of fungal diagnosis, Rapid diagnosis. Method of collection of samples. Antifungal agents.

VIII. PARASITOLOGY

1. Protozoans :
 - i) Intestinal,
 - ii) Genital,
 - iii) Protozoans in blood
 - iv) Opportunistic protozoans.
2. Helminths : Cestodes : Taenia, Echinococcus, Hymenolepis
3. Nematodes : Intestinal, Tissue
4. Medical entomology with reference to vectors.

Desirable to know

1. Trematodes of medical importance.

IX CLINICAL/APPLIED MICROBIOLOGY

Must know

1) Streptococcal infections : Rheumatic fever and Rheumatic heart disease, 2) Meningitis, 3) Tuberculosis, 4) Enteric fever, 5) Dysentery, 6) Diarrhoeal diseases, 7) Pyrexia of unknown origin, 8) Eye-infections, 9) leprosy, 10) Sexually transmitted diseases, 11) Poliomyelitis, 12) Hepatitis, 13) Acute-respiratory infections, 14) Central nervous System infections, 15) Urinary tract infections, 16) Pelvic inflammatory disease, 17) Wound infection, 18) Opportunistic infections, 19) HIV infection, 20) Malaria, 21) Filariasis, 22) Zoonotic diseases.

(Integrated teaching suggested for the above topics)

Desirable to know

1) Bone and joint infections, 2) Food poisoning, 3) Exanthematous conditions. 4) Organisms used in bioterrorism.

X. BIO-MEDICAL WASTE : Types, potential risks and their safe management.

SKILLS

Must know

1. Do stool exam for ova and cysts; and hanging drop for vibrio for vibrio cholera.
2. Do and examine a wet film of vaginal smear for Trichomonas and fungus.
3. Perform and interpret Gram's stain, and Ziehl-Neelsen or modified Ziehl Neelsen's stain.
4. Perform skin scrapings and do a KOH preparation for fungal infection.
5. Do cell counts and gram stain of CSF and other body fluids.
6. Interpret blood smear for parasites like malaria and filaria.
7. Interpret antimicrobial sensitivity reports.
8. Interpret serological tests such as VDRL, ASLO, WIDAL, HIV, Rheumatoid factor, hepatitis and TORCH infections, Treponema pallidum Haemagglutination, Haemagglutination in Virology, Haemagglutination inhibition.
9. Be able to collect and transports following clinical samples for microbiological tests : Blood, pus, urine, CSF, body fluids, stool, sputum, throat swabs and serum.
10. Adopt universal precautions for self precaution against HIV and hepatitis.

TEACHING HOURS

THEORY

No. of hours of teaching : 120 hrs.

- | | |
|--|---------|
| 1. Introduction To Microbiology and General Bacteriology : | 10 hrs. |
| 2. Immunology : | 20 hrs. |
| 3. Systematic Bacteriology : | 35 hrs. |
| 4. Virology : | 20 hrs. |
| 5. Mycology : | 05 hrs. |
| 6. Parasitology : | 25 hrs. |
| 7. Applied Microbiology : | 05 hrs. |

PRACTICAL

PRACTICAL EXERCISES IN MICROBIOLOGY

The students would perform the following procedures :

- i) Gram stain, ii) Ziehl Neelsen stain, iii) Modified Ziehl Neelsen stain, iv) Albert stain, v) Hanging drop vi) Wet mount for stool examination, vii) Iodine mount for stool examination, viii) Lactophenol cotton blue mount for fungus examination, ix) Simple stain

I MICROSCOPE

- a) Principles and use of compound Microscope in detail
- b) Dark ground Microscope
Fluorescent Microscope
Phase Contrast Microscope
Electron Microscope

II STERILIZATION :-

- a) Principle, Uses and Demonstration of common sterilization equipment namely, Autoclave, Hot Air Oven, Serum Inspissator, Arnold Steriliser, Filters.

III CULTURE MEDIA :

Classification of culture media, Principles, main ingredients and uses of common culture media. Namely-Peptone water, Nutrient Broth, Nutrient Agar, Blood Agar, Chocolate agar, Mac Conkey, Wilson Blair, TCBS, LJ, Potassium telluride, Dorset egg, Loeffler's serum slope, RCM, milk agar, Selenite F-broth, Blood culture broth. Media for Biochemical reaction - Sugar Fermentation, Urease, Citrate, Indole Media with growth of common organisms for demonstration namely Staphylococci, C. diphtheria, Mycobacterium tuberculosis, Salmonella on W.B., Vibrio on TCBS, Mac-Conkey with LF & NLF, Milk Agar with Staphylococci, Proteus on Nutrient Agar. Antibiotic sensitivity - methods & principles.

IV STAINING AND HANGING DROP :

- 1) Demonstration of motility by hanging drops method.
- 2) Gram Stain
- 3) ZN Stain

V PARASITOLOGY :

Examination of faeces for helminthic Eggs, (Round worm, hook Worm, Whip Worm, H. nana)

VI APPLIED BACTERIOLOGY :

Demonstration of specimen collection.
Growth on appropriate media
Biochemical reactions.

Appropriate special tests for the lab-diagnosis of common infectious diseases. Namely :

- 1. Pyogenic Infection
- 2. Enteric Fever
- 3. Bacillary Dysentery
- 4. Cholera
- 5. U.T.I.
- 6. Infantile Diarrhoea
- 7. Tuberculosis

VII DEMONSTRATION OF SEROLOGICAL TEST : Widal Test, VDRL, ELISA.

VIII DEMONSTRATION OF FUNGUS : Growth, Slide mounts of common fungi, *Candida*, *Aspergillus*, *Mucor*, *Rhizopus*, *Penicillium*, Dermatophytes (one or two)

IX USES OF LABORATORY ANIMALS : Rabbit, Guinea Pig & Mouse

X DEMONSTRATION OF SLIDES & INSTRUMENTS

XI MEDIA & SPECIMENS (DEMONSTRATION)

The following procedures are only for demonstration. Students will interpret results, but need not perform the procedure of tests. Serological demonstration of - WIDAL, VDRL. Haemagglutination, Haemagglutination inhibition, Complement fixation test, Viral Haemagglutination, ELISA.

XII INTEGRATED TEACHING:

1. Enteric fever
2. Cholera
3. HIV & AIDS
4. Tuberculosis
5. Hospital infection & Control Measures
6. Malarías

The following materials are to be procured for the conduct of practical classes.

i. SLIDES

- | | |
|------------------------------------|------------------------------|
| 1. Staphylococci | 2. Streptococci |
| 3. Gonococci | 4. <i>M. tuberculosis</i> |
| 5. <i>M. Leprae</i> | 6. <i>C. diphtheriae</i> |
| 7. <i>T. pallidum</i> | 8. <i>C. tetani</i> |
| 9. Negative Staining (Pneumococci) | 10. Malarial Parasite |
| 11. Microfilaria | 12. Cyclops |
| 13. Hydatid cyst wall | 14. Negri Bodies |
| 15. <i>Molluscum contagiosum</i> | 16. Rhinosporidiosis |
| 17. <i>Candida</i> | 18. <i>Cryptococcus</i> |
| 19. <i>Aspergillus</i> | 20. <i>Penicillium</i> |
| 21. <i>Mucor/Rhizopus</i> | 22. Pneumococci - Gram stain |
| 23. <i>Y. pestis</i> | 24. Mycetoma - H & E Stain |
| 25. Cestode - Segment | |

ii. MEDIA

1. Without Growth :

Peptone Water, Nutrient broth; Nutrient agar, Blood agar, Chocolate agar, Mac-Conkey agar, Wilson & Blair medium, T.C.B.S., L.J. Medium, Robertson Cooked meat medium, Milk agar, Selenite F Broth, Blood culture Broth, Dorset egg medium & Loeffler's Serum Slope.

2. With Growth :

1. Staphylococcus - albus, aureus on Nutrient agar
2. Staphylococcus - albus, aureus on milk agar
3. Potassium tellurite medium with C. diphtheria
4. L.J. with M. tuberculosis
5. Mac Conkey with LF & NLF
6. Wilson & Blair with growth
7. TCBS with growth
8. Proteus - on Nutrient agar or on Blood agar
9. Sugar fermentation - Indole - Negative & Positive
10. Urease - Negative & Positive
11. Citrate - Negative & Positive
12. Sabouraud's glucose agar with Candida / Aspergillus
13. Sabouraud's glucose agar with any Dermatophyte.

iii. LIST OF INSTRUMENTS

- | | |
|---------------------------|-----------------------|
| 1. Seitz filter | 6. Sterile swab |
| 2. Candle filter | 7. Tuberculin syringe |
| 3. Macintosh filter's jar | 8. Microtitre plate |
| 4. VDRL slide | 9. Inoculation loop |
| 5. Widal rack with tubes | 10. Pasteur pipette |

iv LIST OF SPECIMENS

- | | |
|--------------|--------------------|
| 1. Roundworm | 5. Hydatid cyst |
| 2. Hookworm | 6. Embryonated egg |
| 3. Whip worm | 7. Suckling mouse |
| 4. Tapeworm | 8. Guinea worm |

v EXPERIMENTAL ANIMALS :

1. Rabbit
2. Guinea pig.
3. Mouse

TERM WISE DISTRIBUTION OF THEORY PORTIONS

IV TERM : GENERAL BACTERIOLOGY, IMMUNOLOGY & SYSTEMATIC BACTERIOLOGY (COCCI)

V TERM : REMAINING SYSTEMATIC BACTERIOLOGY & PROTOZOLOGY

VII TERM : HELMINTHOLOGY, VIROLOGY, MYCOLOGY & APPLIED MICROBIOLOGY.

SCHEME OF EXAMINATION INTERNAL ASSESSMENT

It shall be based on evaluation of assignment, preparation of seminar, clinical presentation etc., (see Annex-I for examples). Regular periodic examinations should be conducted throughout the course. Although the question of number of examinations is left to the institution, there should be a minimum of at least three (3) sessional examinations during Phase-II of the course and average of best two examination marks should be taken into consideration while calculating the marks of the internal assessment. Day to day records should be given importance in the internal assessment.

Proper record of the work should be maintained which will be the basis of all students' internal assessment and should be available for scrutiny.

THEORY : 60 Marks

Minimum of three examinations are recommended. The examination preceding the University examination will be similar to the University examination. The total marks would be 60. Average marks of best of two notified internal examinations should be reduced to 60 and should be sent to the University.

PRACTICAL : 20 Marks

A minimum of three practical tests is to be conducted one at the end of each term. Five marks will be for records and 15 marks for terminal examinations. Average marks of the best of the two of three terminal examinations shall be reduced to 15 marks and added to the marks obtained for records and sum of the two shall be sent to the University.

UNIVERSITY EXAMINATION : A. WRITTEN PAPER : 200 Marks

There shall be two theory papers of 100 marks each and duration of each paper will be of 3 hours. The pattern of questions would be of three types.

Type of Questions	Number of questions	Marks for each questions	Total
Long Essay	2	10	20
Short Essay	10	5	50
Short Answer	10	3	30
Total Marks			100

The distribution of topics and weightage of marks for University examination is as under *: Paper I : 100 Marks

General Bacteriology	20 Marks
Immunology	30 Marks
Systemic Bacteriology	50 Marks

Paper II : 100 Marks

Virology	40 Marks
Parasitology	40 Marks
Mycology	10 Marks
Applied Microbiology	10 Marks

* The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.

B. PRACTICAL EXAMINATION : 80 Marks

It shall carry 80 marks. The distribution of marks for different components are :-

Spotters **	10	
Gram's Stain	- 15	
Special (ZN or Alb) Stain	- 15	
Parasitology (Stool Examn)	- 15	} Clinical Microbiology can be kept together as charts or culture and slide
Clinical Bacteriology	- 15	
Clinical Virology (Charts) or	- 10	
Clinical Mycology (Slide & Culture)		

List of Spotters recommended and distribution of marks for each Spotter

** Spotter	Marks
Slides	2 + 2
Media	3
Instrument	1
Specimen	1
Animal	1
Total Marks	10

C. VIVA VOCE EXAMINATION : 40 Marks

The Viva-Voce Examination shall carry 40 marks and all examiners will conduct the Viva-Voce.

Distribution of Topics & Marks

General Bacteriology & Immunology	10 Marks
Systematic Bacteriology	10 Marks
Virology & Mycology	10 Marks
Parasitology	10 Marks

RECOMMENDED BOOKS (Recent Editions)

1. Ananthanarayan : (Ananthanarayan and Jayaram Paniker's) Textbook of Microbiology, Et. & Orient Longman Ltd., Chennai.
2. Jawetz (Melnick) et al, Medical Microbiology, ed. Z Appleton and Lange, USA.

3. Zinsser (Joklik and Willett) et. Al, Microbiology, Appleton and Lange, USA.
4. Chatterjee (KDC), Parasitology, Chatterjee Medical Publishers, Calcutta.
5. Paniker (C.K. Jayaram), Text book of Medical Parasitology, Jaypee, New Delhi.
6. Bhatia and Ichhpujani, Essential of Medical Microbiology, Jaypee, New Delhi.
7. A text book of Microbiology by Chakraborty, New Delhi.

REFERENCE BOOKS :

LEVEL - I

1. Green wood, Medical Microbiology, Ed-15, Churchill Livingstone.
2. Roitt (Ivan.M), Essential Immunology, Ed.6, ELBS, Hong Kong.
3. MIMS (Cedric, Playfair) et al, Pathogenesis of Infectious diseases, Academic Press, London.
4. RIPPON, Medical Mycology, Ed.2, W.B. Saunder's and Co.
5. KONEMAN (Allen and Janda et al), Diagnostic Microbiology, J.B. Lippincott Co.
6. BELLANTI, Immunology, Ed.3, W.B. Saunder's and Company.

LEVEL - II

1. BALOWS, Manual of clinical Microbiology, ASM, Washington DC.
2. STITES (Terr and Parslow), Medical Immunology, Appleton and Lange USA.
3. ROITT (Brostoff and Male), Immunology, Mosby, London.
4. EMMONS (Binford) et al, Medical Mycology, K.M. Varghese Co., Bombay.
5. MANSON-BARR (BELL), Monson's Tropical diseases, ELBS.
6. BEAVER, (Jung and Corpp), Clinical Parasitology.

LEVEL III

1. TOPELY AND WILSON - Principles of Bacteriology, Virology, Immunity, Edward Arnold.
2. BERGEY'S manual, (Holt and Kreig) et al, Determinative bacteriology, Williams and Wilkins, Maryland, USA.
3. Roitt, Encyclopedia of Immunology, Academic Press Ltd., London
4. HOEPRICH, Infectious diseases, Harper and Row Publishers, Philadelphia.
5. MENDELL (Donerglas Aan Benett), Principles and Practice of Infections diseases, Churchill Livingstone.

DIAGNOSIS MICROBIOLOGY

1. BAILEY AND SCOTT, Diagnostic Microbiology, Mosby Publishers
2. MACKIE & MACCARTNEY - Vol II (Collee & Duguid) et al, Churchill Livingstone.
3. Clinical Microbiology procedures Handbook, Henry D. et al, ASM.
4. COWAN & STEEL (Barrow & Feltham), Manual for the identification of medical bacteria, Cambridge University Press.
5. STOKES (Ridgeway & Wren), Clinical Microbiology, Edward Arnold, London.
6. Basic Laboratory Procedures in Clinical Bacteriology, WHO, Vandepitte et al, Jaypee.
7. Basic Laboratory Procedures in Medical Parasitology, WHO, Vandepitte et al, Jaypee.
8. COLLINS & Lyne, Microbiological Methods, Butterworth - Heinemann Ltd.

* Specification mentioned such as edition, number of pages, cost etc., subject to change with newer edition.