



**Amrita School of Medicine
Amrita Institute of Medical Sciences (AIMS)
Kochi-682041**

PROGRAM MD MICROBIOLOGY

(Revised with effect from 2016-2017 onwards)

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AIMS

The aim of this course is to train the students of Medicine in the field of Medical Diagnostic Microbiology. Knowledge and practical skills shall be acquired by the candidates in the sub-specialities of Bacteriology including Mycobacteriology, Virology, Parasitology, Immunology, Serology & Mycology so as to be able to deal with diagnosis and prevention of infectious diseases in the community. They will be trained in basic research methodology including molecular biology so that they are able to conduct fundamental and applied research. They will also be trained in teaching methods so that they can take up teaching assignments.

GOAL:

The goal of the postgraduate medical education shall be to produce a competent specialist and Medical teacher:

- Who shall recognize the health needs of the community and carry out professional obligations ethically in keeping with the objectives of the national health policy;
- Who shall have mastered most of the competencies, pertaining to Medical diagnostic Microbiology that are required to be practiced at the secondary and the tertiary levels of the health care delivery system;
- Who shall be aware of the contemporary advances and developments in the field of medical and diagnostic Microbiology
- Who shall have acquired the spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology
- Who shall have acquired the basic skills of teaching of the medical and paramedical professionals.

EDUCATIONAL OBJECTIVES:

KNOWLEDGE:

At the end of the course the students shall be able to:

1. State and explain the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of infectious diseases and apply that knowledge in the treatment, prevention and control of communicable diseases caused by micro-organisms.
2. State and explain the principles of immunity and immunological phenomenon which help to understand the pathogenesis, laboratory diagnosis of infectious and non-infectious diseases.
3. Establish and practice "laboratory medicine" for diagnosis of infectious diseases in hospitals and community in the field of bacteriology, parasitology, virology, mycology, serology and immunology in the light of clinical findings.
4. Organize the prevention and control of communicable diseases in the community.
5. Understand and practice the principle of prevention and control of health care associated infections and rational antibiotic policy.
6. State the recent advances in the field of Medical Microbiology and apply this knowledge in understanding aetiopathogenesis and diagnosis of diseases caused by micro-organisms.
7. Carry out fundamental or applied research in the branches of medicine involving microbiological work.
8. Develop specialization in any of the above subspecialities.
9. Undertake teaching assignments in the subject of medical Microbiology.

(B) Skills

At the end of the course the student shall be able to

1. Plan the laboratory investigations for the diagnosis of infectious diseases
2. Perform laboratory procedures to arrive at the etiological diagnosis of infectious diseases caused by bacteria, fungi, viruses and parasites including the drug sensitivity profile.
3. Perform and interpret immunological and serological tests.

4. Operate routine and sophisticated instruments in the laboratory.
5. Develop microteaching skills and Pedagogy
6. Successfully implement the chosen research methodology

PROGRAM OUTCOMES

- PO 1 To produce a competent specialist and medical teacher who recognises the health needs of the community
- PO 2 To train postgraduates to carry out professional obligations ethically and in keeping with the objectives of the national health policy
- PO 3 To educate postgraduates so they are aware of contemporary advances in the field of medical and diagnostic microbiology
- PO 4 To enable postgraduates to master the competencies pertaining to diagnostic Microbiology as relevant to secondary and tertiary levels of the health care system
- PO 5 To foster the spirit of scientific enquiry and orient the trainee to the principles of research methodology and epidemiology
- PO 6 To help trainees acquire the basic skills of teaching medical and paramedical professionals
- PO 7 To sensitise postgraduates to the importance of quality control in laboratory medicine.
- PO 8 To enable postgraduates to understand and implement the guidelines for hospital infection control
- PO 9 To help the trainee understand the clinical, therapeutic and preventive aspects of infectious diseases of regional, national and global importance

PROGRAM SPECIFIC OUTCOMES

- PSO 1 To enable the trainee to understand and explain the principles of immunology, etiopathogenesis, laboratory diagnosis and antimicrobial therapy of bacterial, viral, parasitic and fungal diseases
- PSO 2 To involve the trainee in carrying out fundamental or applied research in one of these subspecialties in the form of a dissertation
- PSO 3 To educate postgraduates in the principles of prevention and control of healthcare associated infections and rational antibiotic policy
- PSO 4 To make the postgraduate capable of establishing and practising laboratory medicine for the diagnosis of infectious diseases in the light of clinical findings

COURSE CONTENT (SYLLABUS)

DURATION OF COURSE:

The minimum period of training shall be three calendar years and the candidates can be admitted to this training after their full registration with the Medical Council. No exemption shall be given from this period of training of three years either for doing housemanship or for any other experience or diploma.

TRAINING PROGRAM:

The candidates joining the course must work as full time residents during the whole period of their postgraduate training. They will be required to attend a minimum of 80% of training period. Candidate shall be given full time responsibility and assignments and their participation in all facets of the educational process assured. Postgraduate students must maintain a record book of the work carried out by them and the training undergone by them during the period of training. These record books shall be checked and assessed by the faculty.

TEACHING /LEARNING METHODS:

Learning in M. D. (Microbiology) will essentially be self-learning.
Following teaching-learning methods shall be followed-

Group teaching sessions:

- Journal review
- Subject seminar presentation
- Group discussion
- Slides seminars
- Clinical case presentations pertaining to infectious diseases
- Presentation of the findings of an exercise on any of the sub-specialities
- Participation in CME programs and conferences

Hands on experience (practical training)

Practical training shall be imparted by posting the students in various subspecialities (sections) as detailed in the intrinsic and extrinsic rotation. Student shall be actively involved in day to day working of all the sections. He/she will be trained under the guidance of teachers in all the aspects of Clinical Microbiology and applied aspects of laboratory medicine including collection and transport of specimens, receiving of samples, preparation of requisite reagents, chemicals, media and glassware, processing of specimens, performing required antimicrobial susceptibility testing and reporting on the specimens, interpretation of results, sterilization procedures, bio-safety precautions, infection control practices, maintenance of equipments, record keeping and quality control in Microbiology.

Suggested schedule of rotation:

Intrinsic rotation:

1. Bacteriology(Aerobic and anaerobic) 6 months
2. Mycobacteriology 3 months
3. Hospital infection surveillance 3 months
4. Serology/Immunology 6 months
5. Mycology 3 months
6. Virology/HIV 3 months
7. Parasitology 3 months
8. Clinical Microbiology(OPD) 2 months
9. Molecular Diagnostics 1 month

Extrinsic rotation:

Clinical Pathology 3 months

*Elective posting 3 months

Total 36 months

Emergency duty:

Student shall be posted for managing emergency laboratory services in Microbiology. He/she will deal with all the emergency investigations in Microbiology.

Dissertation

The purpose of dissertation is to impart training in research methodology

Training in research methodology shall be imparted by planning of a research project by the student under the guidance of a recognized guide to be executed and submitted in the form of a dissertation. The dissertation is aimed at training the candidate in research methods and techniques. It will include identification of a research question, formulation of a hypothesis, search and review of relevant literature, getting acquainted with recent advances, designing of research study, collection of data, critical analysis of the results and drawing conclusions.

The topic shall be communicated to the university within six months of registration and at least 12 months should be spent on the research project. The dissertation shall be completed and submitted by the student six months before appearing for the final university examination.

Teaching experience:

Student shall be actively involved in the teaching of undergraduate students.

He/she will be trained in teaching methods and use of audiovisual aids.

BROAD AREAS OF STUDY

General Microbiology; Systematic Bacteriology, Mycology, Virology, Parasitology; Serology, Immunology, Molecular diagnostics and Applied Clinical Microbiology including recent advances in Microbiology.

GENERAL MICROBIOLOGY

1. History and pioneers in Microbiology
2. Microscopy
3. Morphology of bacteria and other micro-organisms.
4. Nomenclature and classification of microbes.
5. Growth and nutrition of bacteria.
6. Bacterial metabolism.
7. Sterilization and disinfection.
8. Biomedical waste disposal
9. Bacterial toxins.
10. Bacterial antagonism: Bacteriocins.
11. Bacterial genetics, gene cloning.
12. Antibacterial substances used in treatment of infections and drug resistance in bacteria.
13. Bacterial ecology-normal flora of human body, hospital environment, air, water and milk
14. Host parasite relationship.
15. Quality control and Quality Assurance in Microbiology.
16. Laboratory Biosafety
17. Health care associated infections- prevention and control

IMMUNOLOGY AND APPLIED ASPECTS

1. The normal immune system.
2. Innate immunity.
3. Antigens.
4. Immunoglobulins.
5. Complement.
6. Antigen and antibody reactions.
7. Hypersensitivity.
8. Cell mediated immunity.
9. Immunodeficiency.
10. Autoimmunity.
11. Immune tolerance.
12. Transplantation immunity.
13. Tumour immunity.
14. Prophylaxis and immunotherapy
15. Measurement of immunity.
16. Immunity and immunopathogenesis of specific infectious diseases
17. Molecular Biology Techniques. For e.g. PCR, DNA probes.

SYSTEMATIC BACTERIOLOGY

1. Isolation, description and identification of bacteria. The epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of disease caused by them
2. Staphylococcus and Micrococcus; Anaerobic Gram positive cocci.
3. Streptococcus and Lactobacillus.
4. Neisseria, Branhamella and Moraxella.
5. Corynebacterium and other coryneform organisms.
6. Bacillus: the aerobic spore-bearing bacilli.

7. Clostridium: the spore-bearing anaerobic bacilli.
8. Non-sporing anaerobes
9. The Enterobacteriaceae.
10. Vibrios, Aeromonas, Plesiomonas, Campylobacter and Spirillum, H. pylori
11. Erysipelothrix and Listeria
12. Pseudomonas.
13. Chromobacterium, Flavobacterium, Acinetobacter and Alkaligenes.
14. Pasteurella, Francisella.
15. Haemophilus and Bordetella.
16. Brucella.
17. Mycobacteria.
18. The spirochaetes.
19. Actinomyces, Nocardia and Actinobacillus.
20. Mycoplasmatales: Mycoplasma, Ureaplasma and Acholeplasma.
21. Rickettsiae.
22. Chlamydiae.
23. Emerging bacterial pathogens.

VIROLOGY

1. The nature of viruses
2. Classification of viruses
3. Morphology :virus structure
4. Virus replication
5. The genetics of viruses
6. The pathogenicity of viruses
7. Epidemiology of viral infections
8. Vaccines and antiviral drugs
9. Bacteriophages
10. Pox viruses
11. Herpes viruses
12. Vesicular viruses
13. Togaviridae
14. Bunyaviridae
15. Arenaviridae
16. Marburg and Ebola viruses
17. Rubella virus
18. Orbi viruses
19. Influenza virus
20. Respiratory disease: Rhinoviruses, adenoviruses, corona viruses
21. Paramyxoviridae
22. Enteroviruses : Polio, Echo, Coxsackie viruses
23. Other enteric viruses
24. Hepatitis viruses
25. Rabies virus
26. Slow viruses
27. Human immunodeficiency viruses
28. Oncogenic viruses
29. Teratogenic viruses
30. Viruses of gastroenteritis
31. Prion diseases
32. Emerging viral infections – SARS, Avian influenza

PARASITOLOGY

1. Protozoan parasites of medical importance : Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Balantidium, Isospora, Cyclospora, Microsporidium etc.
2. Helminthology : All those medically important helminths belonging to Cestoda, Trematoda and Nematoda.
Cestodes : Diphyllbothrium, Taenia, Echinococcus, Hymenolepis, Dypylidium, Multiceps etc.
Trematodes : Schistosomes, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc.
Nematodes : Trichuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus, etc.
3. Ectoparasites : Common arthropods and other vectors viz., Mosquito, Sandfly, Ticks, Mite, Cyclops.

MYCOLOGY

1. The morphology and reproduction of fungi and antimycotic agents
2. Classification of fungi
3. Contaminant and opportunistic fungi
4. Fungi causing superficial mycoses
5. Fungi causing subcutaneous mycoses
6. Fungi causing systemic infections
7. Antifungal agents

APPLIED CLINICAL MICROBIOLOGY

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Infections of various organs and systems of the human body
4. Molecular genetics as applicable to Microbiology
5. Automation in Microbiology
6. Rapid diagnostic techniques for microbial diseases.
7. Vaccinology : principle, methods of preparation, administration of vaccines
8. Outbreak investigations & disaster management
9. Biological warfare

MOLECULAR BIOLOGY

1. Basic Genetics- RNA, DNA, replication, transcription, translation, gene expression, operon concept (lac and tryptophan operons), Coiling and super coiling, topoisomerases, satellite DNA, organization of prokaryotic and eukaryotic genome, chromosomes – structure and organization
2. Recombinant DNA technology- Cloning, Vectors, transgenic animals, Gene therapy
3. DNA techniques basics- PCR Southern, Western, Northern, In situ Hybridization RFLP, HGP, Karyotyping, Microarray with special reference to Microbiology
4. Cell Cycle And Cell Biology- Nuclear and cell division, mitosis, sexual reproduction, meiosis, genetic recombination. Signal transduction, cell communication, Intracellular compartment and protein sorting, Endocytosis, generation of antibody diversity
5. Mutations – Spontaneous, Induced, Point, Silent mutations, frameshift mutations. Physical and chemical mutagens, Site-directed mutagenesis, molecular basis of mutations
6. Bacterial Genetics
Introduction and bacterial transformation Specific bacteria and molecular biology
Mycobacterium tuberculosis, Salmonella, Vibrio, Haemophilus influenzae, drug resistance, Staphylococcus aureus, E. coli, Anaerobes etc.

7. Virology- Rabies, Rota V, HPV, HIV, HBV, HCV, EBV, HSV etc
8. Mycology, Parasitology- Yeast, fungus, malarial parasites, Toxoplasma etc

BIostatistics AND RESEARCH Methodology

1. Introduction to Biostatistics
2. Need for statistical methods in medicine
3. Public health and biology – their uses and misuses
4. Types of variables – data collection methods
5. Population and sampling
6. Protocol writing and study designs
7. Rationale
8. Review of Literature
9. Objectives
10. Prevalence and incidence studies
11. Case-control and cohort studies
12. Experimental studies – randomization
13. Descriptive data analysis methods
14. Statistical Tables
15. Diagrams and Graphs
16. Measures of average and dispersion
17. Correlation and regression analysis
18. Logic of Statistical Inference
19. Concept of Standard error
20. Types I and II error
21. Interval estimation of parameters
22. Principles of tests of significance
23. Estimation of minimum sample size in different designs of studies and sampling methods
24. Methods of tests of significance of statistical hypotheses:
25. Student's 'T' tests and analysis of variance
26. Non-parametric methods
27. Statistical methods in screening and diagnosis (validity parameters)
28. Statistical methods in planning and analysis of clinical trials
29. Multivariate analysis methods
30. Statistical methods in evidence based medicine

PRACTICALS (SKILLS)

BACTERIOLOGY

Must acquire:

1. Care and operation of Microscopes viz. Light, Dark ground, Phase contrast, Inverted, Fluorescent microscopes.
2. Preparation of stains viz. Gram's, Albert's, Ziehl- Neelsen and other special stains - performing of staining and interpretation of stained smears.
3. Washing and sterilization of glassware including plugging and packing.

4. Operation of incubator, autoclave, hot air oven, inspissator, distillation plant, filters like Seitz and membrane and sterility tests.
 5. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
 6. Preparation and pouring of liquid and solid media - Nutrient agar, Blood agar, MacConkey agar, sugars, TSI agar, Robertson's cooked meat, Lowenstein- Jensen's, selective media.
 7. Preparation of reagents – oxidase, Kovac, etc.
 8. Tests for beta-lactamases including ESBLs.
 9. Collection of specimens for Microbiological investigations such as blood, urine, throat swab, rectal swab, stool, pus, OT specimens.
 10. Preparation, examination and interpretation of direct smears from clinical specimens, viz. Sputum for AFB – ZN & auramine O, slit smears for *M. leprae*, -ZN stain, conjunctival smear for Chlamydiae – Giemsa/Iodine.
 11. Techniques of anaerobiosis – Gaspak system, anaerobic jars-evacuation & filling with H₂, CO₂
 12. Identification of bacteria of medical importance upto species level (except anaerobes – upto generic level)
 13. Quantitative analysis of urine by pour plate method and semiquantitative analysis by standard loop test for significant bacteriuria.
 14. Plating of clinical specimens on media for isolation, purification identification and quantitation.
 15. Tests for motility: hanging drop, Craigie's tube, dark ground microscopy for Spirochaetes – Treponema & Leptospira.
 16. In-vitro toxigenicity tests – Elek test, Nagler's reaction
 17. Special tests – Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, catalase test and slide agglutination tests, and other as applicable identification of bacteria upto species level
 18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing by Kirby-Bauer disk diffusion method; estimation of Minimum inhibitory /Bactericidal concentrations by tube/plate dilution methods.
- Tests for drug susceptibility of Mycobacterium tuberculosis
19. Skin tests like Mantoux, Lepromin etc.
 20. Testing of disinfectants- Phenol coefficient and 'in use' tests.
 21. Quality control of media reagents etc. and validation of sterilization procedures.
 22. Aseptic practices in laboratory and safety precautions.
 23. Disposal of contaminated material like cultures.

24. Bacteriology of food, water, milk, air

25. Maintenance of stock cultures.

Desirable to acquire:

1. Care and breeding of laboratory animals viz. Mice, rats, guinea pigs and rabbits.
2. Techniques of withdrawal of blood from laboratory animals including sheep.
3. Inoculation of infective material in animals by different routes.
4. Animal pathogenicity /toxigenicity tests for *C.diphtheriae*, *Cl.tetani*, *S.pneumoniae*, *S.typhimurium*, *K. pneumoniae* etc.
5. Performance of autopsy on animals.
6. Isolation of plasmids and Conjugation experiments for transfer of drug resistance
7. Serum antibiotic assays eg. Gentamicin
8. Phage typing for staphylococci, *S.typhi* etc.
9. Bacteriocin typing eg. Pyocin, Colicin etc.
10. Enterotoxigenicity tests like rabbit ileal loop, intragastric inoculation of mouse, Sereny's test.
11. Mouse foot pad test for *M.leprae*

IMMUNOLOGY/ SEROLOGY

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods.
2. Preparation of antigens from bacteria or tissues for Widal, Weil-Felix, VDRL, etc. and their standardisation.
3. Preparation of adjuvants like Freund's adjuvant.
4. Raising of antisera in laboratory animals.
5. Performance of serological tests viz. Widal, Brucella tube agglutination, indirect haemagglutination, VDRL, Paul-Bunnell, Rose-Waaler, IFA.
6. Immunodiffusion in gels, counter immunoelectrophoresis- visualization and interpretation of bands.
7. Performance and interpretation of Enzyme linked immunosorbent assay.
8. Latex and staphylococcal co-agglutination tests.

Desirable to acquire:

1. Leucocyte migration inhibition test.
2. T-cell rosetting.
3. Flow Cytometry

4. Radial immunodiffusion.
5. Immuno-electrophoresis.
6. Neutrophil phagocytosis.

MYCOLOGY

Must acquire:

1. Collection of specimens for mycology.
2. Direct examination of specimens by KOH, Gram, Kinyoun's, Giemsa, Lactophenol cotton blue stains.
3. Examination of histopathology slides for fungal infections.
4. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
5. Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture.
6. Maintenance of stock cultures.
7. Animal pathogenicity tests viz. Intracerebral and intraperitoneal inoculation of mice for cryptococcus.

PARASITOLOGY

Must acquire:

1. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formol - ether methods) and complete examination for other cellular features.
2. Egg counting techniques for helminths.
3. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears.
4. Examination of other specimens for e.g. urine, C.S.F, bone marrow etc. for parasites.
5. Histopathology sections – examination and identification of parasites.
6. Performance of stains – Leishman, Giemsa, Modified Acid Fast, Toluidine Blue O.
7. Identification of common arthropods and other vectors viz. Mosquito, sand fly, ticks, mite and cyclops.
8. Collection of specimens.
9. Preservation of parasites – mounting, fixing, staining etc.

Desirable to acquire:

1. In-vitro culture of parasites like entamoeba, leishmania, P.falciparum.
2. Maintenance of toxoplasma gondii in mice.
3. Preparation of media – NIH, NNN etc.
4. Copro-culture for larva of hook worms.
5. Antigen preparation viz. Entamoeba , Filarial , Hydatid for serological tests like IHA and skin test like Casoni's .
6. Permanent staining techniques like iron haematoxylin

VIROLOGY

Must acquire:

1. Preparation of glassware for tissue culture (washing, sterilization)
2. Preparation of media like Hanks, MEM.
3. Preparation of clinical specimens for isolation of viruses.
4. Serological tests-ELISA and rapid tests for HIV, RPHA for HbsAg, Haemagglutination inhibition for influenza, AGD and counterimmunoelectrophoresis for detection of viral antigens or antiviral antibodies.
5. Chick embryo techniques- inoculation and harvesting.
6. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

Desirable to acquire:

1. Preparation of Monkey Kidney Cells (Primary) maintenance of continuous cell lines by subcultures. Preservation of cell cultures.
2. Recognition of CPE in tissue cultures.
3. Performance of haemadsorption, haemagglutination, immunofluorescence , neutralization tests for identification of viruses.

COURSES

Course I General Microbiology and Immunology (MDMI1)

CO1: To understand the history and pioneers in microbiology

CO2: To identify the morphology of bacteria and other micro-organisms

CO3: To understand the various methods of sterilisation and disinfection and its application in laboratory medicine

CO4: To help the trainee acquire knowledge about biological waste disposal

CO5: To understand the various hospital acquired infections and their preventive and control measures

CO6: To involve the trainee in quality control and quality assurance in microbiology

CO7: To understand and interpret the various antigen antibody reactions, hypersensitivity reactions and their clinical applications

CO8: To educate the postgraduates on the types of immunity, immunopathogenesis of diseases and measurement of immunity

GENERAL MICROBIOLOGY

1. History and pioneers in Microbiology

2. Microscopy

3. **Morphology of bacteria and other micro-organisms.**

4. Nomenclature and classification of microbes.

5. Growth and nutrition of bacteria.

6. Bacterial metabolism.

7. Sterilization and disinfection.

8. Biomedical waste disposal

9. Bacterial toxins.

10. Bacterial antagonism: Bacteriocins.

11. Bacterial genetics, gene cloning.

12. **Antibacterial substances used in treatment of infections and drug resistance in bacteria.**

13. Bacterial ecology-normal flora of human body, hospital environment, air, water and milk

14. **Host parasite relationship.**

15. Quality control and Quality Assurance in Microbiology.

16. Laboratory Biosafety

17. Health care associated infections- prevention and control

IMMUNOLOGY AND APPLIED ASPECTS

1. The normal immune system.

2. **Innate immunity.**

3. Antigens.

4. **Immunoglobulins.**

5. Complement.

6. Antigen and antibody reactions.

7. **Hypersensitivity.**

8. Cell mediated immunity.

9. Immunodeficiency.

10. Autoimmunity.

11. Immune tolerance.

12. Transplantation immunity.

13. Tumour immunity.

14. **Prophylaxis and immunotherapy**

15. Measurement of immunity.

16. Immunity and immunopathogenesis of specific infectious diseases

17. Molecular Biology Techniques. For e.g. PCR, DNA probes.

Course II Systematic Bacteriology (MDMI2)

CO1: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Staphylococcus aureus

CO2: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Corynebacterium diphtheriae

CO3: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Clostridium perfringens

CO4: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Enterobacteriaceae

CO5: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Pseudomonas aeruginosa

CO6: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of spirochaetes

CO7: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Brucella

CO8: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Mycobacteria

CO9: To understand the isolation, description, identification , epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of Vibrio cholerae

SYSTEMATIC BACTERIOLOGY

1. Isolation, description and identification of bacteria. The epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of disease caused by them

1. 2. Staphylococcus and Micrococcus; Anaerobic Gram positive cocci.
2. Streptococcus and Lactobacillus.
3. Neisseria, Branhamella and Moraxella.
4. Corynebacterium and other coryneform organisms.
5. Bacillus: the aerobic spore-bearing bacilli.
6. Clostridium: the spore-bearing anaerobic bacilli.
7. Non-sporing anaerobes
8. The Enterobacteriaceae.
9. Vibrios, Aeromonas, Plesiomonas, Campylobacter and Spirillum, H.pylori
10. Erysipelothrix and Listeria
11. Pseudomonas.
12. Chromobacterium, Flavobacterium, Acinetobacter and Alkaligenes.
13. Pasteurella, Francisella.
14. Haemophilus and Bordetella.
15. Brucella.
16. Mycobacterium tuberculosis
17. Microbacterium avium complex
18. The spirochaetes.
19. Leptospira interrogans
20. Actinomyces, Nocardia and Actinobacillus.
21. Mycoplasmatales: Mycoplasma, Ureaplasma and Acholeplasma.
22. Rickettsiae.
23. Chlamydiae.
24. Emerging bacterial pathogens.

Course III Mycology & Virology (MDMI3)

CO1: To help them to understand the morphology, pathogenesis, laboratory diagnosis, prophylaxis of HIV, Hepatitis B

CO2: To develop skills to identify outbreaks due to viral diseases and to implement appropriate control measures

CO3: To educate the postgraduates on the morphology, pathogenesis, laboratory diagnosis, preventive and control measures of clinically significant yeasts and molds

CO4: To identify the methods of antifungal susceptibility testing

VIROLOGY

1. The nature of viruses

2. Classification of viruses

3. Morphology :virus structure

4. Virus replication

5. The genetics of viruses

6. The pathogenicity of viruses

7. Epidemiology of viral infections

8. Vaccines and antiviral drugs

9. Bacteriophages

10. Pox viruses

11. Herpes viruses

12. Vesicular viruses

13. Togaviridae

14. Bunyaviridae

15. Arenaviridae

16. Marburg and Ebola viruses

17. Rubella virus

18. Orbi viruses

19. Influenza virus

20. Respiratory disease: Rhinoviruses, adenoviruses, corona viruses

21. Paramyxoviridae

22. Enteroviruses : Polio, Echo, Coxsackie viruses

23. Other enteric viruses

24. Hepatitis viruses

25. Rabies virus

26. Slow viruses

27. **Human immunodeficiency viruses**

28. Oncogenic viruses

29. Teratogenic viruses

30. Viruses of gastroenteritis

31. Prion diseases

32. Emerging viral infections – SARS, Avian influenza

MYCOLOGY

1The morphology and reproduction of fungi and antimycotic agents

2 Classification of fungi

3. Contaminant and opportunistic fungi

4. Fungi causing superficial mycoses

5. Fungi causing subcutaneous mycoses

6. Fungi causing systemic infections

7. Antifungal agents

Course IV Parasitology, Applied Microbiology and Recent Advances (MDMI4)

CO1: To understand the isolation, description, identification, epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of intestinal protozoans and nematodes

CO2: To understand the isolation, description, identification, epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of hemoflagellates

CO3: To understand the isolation, description, identification, epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of malaria and filaria

CO4: To utilise automation in microbiology and molecular genetics for identification of infectious agents

CO5: To understand the concepts of vaccinology

PARASITOLOGY

1. **Protozoan parasites of medical importance** : Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Nigleria fowleri

Sarcocystis, Cryptosporidium, Balantidium, Isospora, Cyclospora, Microsporidium etc.

2. **Helminthology** : All those medically important helminths belonging to Cestoda, Trematoda and Nematoda.

Cestodes : Diphyllbothrium, Taenia, Echinococcus, Hymenolepis, Dypylidium, Multiceps etc.

Trematodes : Schistosomes, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc.

Nematodes : Trichuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus, etc.

3. **Ectoparasites** : Common arthropods and other vectors viz., Mosquito, Sandfly, Ticks, Mite, Cyclops.

APPLIED CLINICAL MICROBIOLOGY

1. **Epidemiology of infectious diseases**

2. **Methods of sterilisation**

3. Hospital acquired infections

4. Infections of various organs and systems of the human body

5. Molecular genetics as applicable to Microbiology

6. Control of Hospital acquired infections

7. Automation in Microbiology

8. **Rapid diagnostic techniques for microbial diseases.**

9. Vaccinology : principle, methods of preparation, administration of vaccines

10. Outbreak investigations & disaster management

11. **Biological warfare**

Course V Soft Skills (MDMI5) – Elective Course

CO1: The postgraduate will develop skills in research, be able to investigate emerging infections and implement appropriate research methodology

CO2: The postgraduate shall develop skills in teaching medical microbiology to medical and laboratory students

CO3: The postgraduate student will develop skills in team work and administration of a department.

SUGGESTED READING:

BOOKS:

Reference books (Please refer the most recent edition)

1. Topley and Wilson's Microbiology and Microbial infections. 8 volumes 2005, 10th edition

2. Color Atlas and Textbook of Diagnostic Microbiology: Elmer W Koneman -2006, 6th edition

3. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases -2005, 6th edition
4. Microbiology in Clinical Practice: Shanson-1999, 3rd edition
5. Immunology: Janis Kuby- 2003.
6. Basic Clinical Immunology., Fudenburg, Stites, Caldwell, Weils.
7. Control of Hospital Infection- A practical handbook (most recent edition)
8. Bailey and Scott's Diagnostic Microbiology by Forbes/ Sahn/Weissfeld
9. Text book of Parasitology., Chatterjee K.D.
10. Textbook of Microbiology – by R.Ananthanarayanan / C.K. Jayaram Panicker
11. Textbook of Medical Parasitology – by C.K. Jayaram Panicker
12. Medical Microbiology by Greenwood / Slack / Peutherer
13. Textbook of Medical Mycology- Jagdish Chander
14. Medical Microbiology & Immunology by Warren Levinson / Ernest Jawetz
15. Medical Parasitology by RL Ichhpujani / Rajesh Bhatia
16. Textbook of Virology by Rhodes/ Van Rooyen
18. Clinical Mycology by Smith / Conant
19. Mackie & McCartney – Practical Medical Microbiology by Collee/Fraser/Marmion/Simmons

20. Manual of Clinical Microbiology- Patrick R Murray /Ellen Jo Baron/ James H Jorgensen
21. Fundamentals of Diagnostic Mycology- Fran Fisher & Norma B Cook

22. Genes VII –Benjamin Lewin
23. Atlas of Clinical fungi-2nd edition G.S.de Hoog, J.Guarro, J.Gene & M.J.Figueras

Further Reading

1. Mycology - Rippons
2. Essentials of Immunology- Roitt
3. Virology - Clinical Virology by Rich
4. Gradwohl's Clinical Laboratory Methods and Diagnosis.

Journals

1. Indian Journal of Medical Microbiology
2. Clinical Microbiology Reviews
3. Journal of Clinical Microbiology
4. Journal of Medical Microbiology
5. Journal of AIDS
6. Journal of Hospital Infection
7. Indian Journal of Tuberculosis and Lung Diseases.
8. Indian Journal of Medical Research
9. JAAC
10. Parasitology Today
11. Journal of Infection
12. Infection Control and Hospital Epidemiology
13. Indian Journal of Tuberculosis
14. Journal of Associations of Physicians of India
15. Lancet-Infectious Diseases
16. Emerging Infectious Diseases-online

17. New England Journal of Medicine- online
18. British Medical Journal
19. Scandinavian Journal of Infectious Diseases
20. ICMR Bulletin
21. AIDS Research & Review
22. MMWR
23. Tubercle
24. WHO Bulletin
25. Journal of American Medical Association
26. Paediatric infectious diseases
27. Indian Journal of Leprosy
28. International Journal of Leprosy
29. Immunology
30. American journal of Epidemiology

Important Websites:

1. Center for Disease Control -www.cdc.gov
2. World Health Organization- www.who.int
3. Infectious Disease Society of America- www.idsociety.org
4. United Nations Program on HIV/ AIDS- www.unaids.org
5. Johns Hopkins Infectious Diseases- www.hopkins-id.edu
6. National Library of medicine- www.pubmed.com
7. MD Consult- www.mdconsult.com
8. Global Infectious Disease epidemiology network www.gideononline.com
9. National AIDS Control Organization- www.nacoinia.org
10. Tuberculosis Research Centre- www.trc-chennai.org

EVALUATION :

Evaluation shall be done on the basis of Theory, Practical and Oral (Viva-voce) examination and internal assessment.

All the evaluation heads namely Theory, Practical (including oral) and internal assessment shall be marked as marks.

PASSING:

Separate minimum of 50% in theory in all papers taken together ; 50% in practical and 50% in oral examination, 50% in internal assessment shall be necessary for passing. A successful candidate passing the university examination in first attempt will be declared to have passed the examination with distinction, if the grand total aggregate mark is 70% and above . The mark distribution is as detailed below.:-

EVALUATION HEAD	MAXIMUM MARKS	MINIMUM FOR PASSING
THEORY	400	200
PRACTICAL	200	100
ORAL	100	50
INTERNAL ASSESSMENT	100	50

THEORY:

Theory will consist of FOUR papers with following distribution-

PAPER I General Microbiology & Immunology

PAPER II Systematic Bacteriology

PAPER III Mycology & Virology

Paper IV Parasitology, Applied Microbiology & Recent Advances

DURATION: Each paper will be of three hours duration.

FORMAT:

All papers will have the following format:

SECTION A – Structured essay question (30)

SECTION B – Short essay questions (15x 2=30)

SECTION C – Short answer questions (8x5=40)

MARKING PATTERN FOR THEORY EXAMINATION

PAPER	MAXIMUM MARKS			TOTAL	MINIMUM FOR PASSING IN EACH PAPER	MINIMUM FOR PASSING
	SECTION A	SECTION B Short essay	SECTION C Short answer			
PAPER-I	30	15x2=30	8 x 5 =40	100	50	
PAPER-II	30	15x2=30	8 x 5 =40	100	50	
PAPER-III	30	15x2=30	8 x 5 =40	100	50	
PAPER-IV	30	15x2=30	8 x 5 =40	100	50	
TOTAL MARKS				400	--	200

PRACTICAL:

DURATION: Practical examination shall be conducted on THREE consecutive days. The time shall be adjusted by the examiners to cover all exercises.

EXERCISES: The practical examination will consist of following exercises conjointly conducted and evaluated by the four examiners (Two internals and two externals).

EXERCISES:**A. Long Exercise:**

Exercise in Clinical Bacteriology: Problem Solving Exercise: where a brief history along with relevant clinical findings should be given. Student should be asked to list relevant investigations required & clinical specimen to be given. Isolation and identification of bacteria from the given clinical specimen and antimicrobial sensitivity of the isolated organism to be performed.

B. Short Exercises:

1. Exercise in Bacteriological/Mycobacteriological Techniques: Identification of bacteria (aerobe/anaerobe/Mycobacteria) in given pure culture.

2. Ziehl-Neelsen Staining :

Preparation of smear; staining of prepared / given smear and reporting on findings. This exercise shall include acid - fast staining for tubercle bacilli or lepra bacilli or modified acid fast staining (for e.g. parasites/spores).

3. Exercise in Virology:

The following exercises to be performed –

A) Embryonated egg inoculation / harvesting

A) ELISA for HIV/ ELISA ,for detection of HBsAg, any rapid test for HIV antibodies or any other serological test for detection of viral antigen / antibody (eg. CIEP).

4. Identification of fungi in minimum two given cultures – one yeast and one mould.

5. Exercise in Parasitology. Any one of the following exercises to be performed –

- Examination of stool for ova/cyst by direct/ concentration method.

- Preparation of peripheral smear and staining by Leishman stain.

Reporting of parasites in the prepared/given smear.

6. Exercise in Immunology/Serology:

- Any one of the Serology/Immunology techniques commonly used in diagnostic clinical microbiology to be performed. Serological test – (For e.g. Latex agglutination(ASO, CRP, RA etc.), tube agglutination (Widal, Brucella, Paul-Bunnell etc.), slide flocculation (VDRL), Passive haemagglutination(e.g. TPHA), RPHA (e.g. for HBsAg), Dot blot assay (e.g. HIV Rapid test).

NOTE: The test to be performed in this exercise should be different in serological / immunological principle from that performed in Exercise 3.

7. Animal experiment : Details regarding care, handling and experimentation on animals shall be evaluated through simulations. Any common experimental procedure given to the student shall be subject to strict adherence to rules regarding handling, care and experimentation of animals.

8. Identification of microbiological findings in the given set of slides – parasitology, immunology, mycology, bacteriology or histopathology slides (10 slides).

Parallel testing of given exercise shall be done at the examination centre for checking the quality of chemicals, media, reagents and the test material.

ORAL (VIVA -VOCE)

Student will be examined by all the examiners together regarding his knowledge of basic aspects and recent advances in the field of microbiology and its subspecialities. Student will be assessed about his comprehension, analytical approach, expression, interpretation of data and his approach in solving the problem. Oral examination will also include presentation and discussion on dissertation.

DAY- WISE DISTRIBUTION OF EXERCISES:

DAY	DAY 2	DAY 3
Long exercise	Long exercise (contd)	Long exercise (contd)
Bacteriological techniques	Bacteriological techniques(contd)	Identification of slides
Ziehl Neelsen staining	Bacteriological techniques (contd)	Oral (Viva- voce)
Exercise in virology	Exercise in parasitology	
	Serology / Immunology techniques	

Day-wise distribution of exercises may be changed as per the convenience of the examiners.

EXERCISE / VIVA	MAXIMUM MARKS	MINIMUM PASSING IN EACH EXERCISE	TOTAL MINIMUM OF PASSING
A) LONG EXERCISE	30	----	15
B) SHORT EXERCISE			
Bacteriological techniques	20	4	--
Ziehl Neelsen staining	10	4	--
Exercise in Virology	20	4	--
ELISA for HIV	20	4	--
Exercise in Mycology	20	4	--
Exercise in Parasitology	20	4	--
Serology/ Immunology	20	4	--
Identification of slides	20	4	--
Animal experiment	20	4	--
Total of short exercises	170	--	85
C) ORAL (VIVA VOCE)	100	--	50
TOTAL A, B, C	300	--	150

INTERNAL ASSESSMENT:

Internal assessment shall be done by evaluation of the student in Theory and practical examinations conducted in 2nd, 4th and 5th term.

Student shall maintain a ' Record book' detailing the work done during his/her posting in various sub-specialties, participation in teaching-learning activities, progress of dissertation and involvement in undergraduate teaching program.

The internal assessment shall consist of:

- Annual evaluation at the end of second term - 25
- Annual evaluation at the end of fourth term – 25
- Evaluation at the end of fifth term - 25
- Student's application in each section - 15

e) Student's application in teaching –learning activities – 10
The total obtained out of hundred marks is to be added to final examination.
Internal assessment marks will be communicated to the university one month prior to the examination.

**MD MICROBIOLOGY
SAMPLE QUESTION PAPER
GENERAL MICROBIOLOGY & IMMUNOLOGY**

PAPER I

Time: 3hrs

Max marks: 100

I Essay

Define Sterilisation. Classify the various agents used in sterilization. Discuss moist heat sterilization. Write a brief note on newer methods of sterilization.

30 marks

II Short essay

- A. Type III Hypersensitivity
- B. Healthcare associated infections

15x 2=30 marks

III Short notes

- A. Immune mechanism of graft rejection
- B. DNA sequencing
- C. Applications of Immunotherapy
- D. Scanning electron microscope
- E. Fimbriae

8x5=40 marks

**MD MICROBIOLOGY
SAMPLE QUESTION PAPER
SYSTEMATIC BACTERIOLOGY**

PAPER II

Time: 3hrs

Max marks: 100

I Essay

Name the etiological agents, discuss the pathogenesis, laboratory diagnosis including recent advances and prophylaxis of Enteric fever

30 marks

II Short essay

A. Invasive pneumococcal disease: Clinical features, lab diagnosis, treatment and prophylaxis.

C. The recent advances in laboratory diagnosis of Tuberculosis

15x 2=30 marks

III Short notes

- A. Legionella pneumophila
- B. Pseudomembranous colitis
- C. Granuloma inguinale
- D. Stenotrophomonas maltophilia
- E. Scrub typhus

8x5=40 marks

**MD MICROBIOLOGY
SAMPLE QUESTION PAPER
MYCOLOGY & VIROLOGY
PAPER III**

Time: 3hrs

Max marks: 100

I. Essay

Describe the structure of HIV . Explain the pathogenesis and immune evasion mechanisms of HIV. Discuss the Clinical features and lab diagnosis of HIV infection. Add a brief note on antiretroviral drugs and current status of HIV vaccines

30 marks

II . Short essay

A. Oculomycoses

B. What are interferons ? Explain their mechanism and clinical applications.

15x 2=30 marks

III. Short notes

A. Hepatitis A Virus

B. Lab diagnosis of Influenza

C. Histoplasmosis

D. Trichophyton spp

E. Cryptococcal meningitis

8x 5 =40 marks

**MD MICROBIOLOGY
SAMPLE QUESTION PAPER
PARASITOLOGY, APPLIED MICROBIOLOGY & RECENT ADVANCES**

PAPER IV

Time: 3hrs

Max marks: 100

I. Essay

Discuss the life cycle, clinical features and laboratory diagnosis of Plasmodium vivax.
Write a note on drug resistant malaria.

30 marks

II . Short essay

A. Automated blood culture

B. Quality control in microbiology

15x 2=30 marks

III. Short notes

A. LAMP assay

B. Role of MALDI -TOF in Clinical Microbiology

C. Leishmania tropica

D. Sparganosis

E. Schistosoma mansoni

8x 5 =40 marks