# Curriculum

## DNB Broad Specialty

# Microbiology

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# INDEX

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# I. INTRODUCTION

The main aim of this course is to train students in the field of medical Microbiology. Theoretical and practical training is imparted to the candidates in subspecialties viz., Bacteriology, Virology, Parasitology, Immunology and Mycology so that they can participate in good patient care and prevention of infectious diseases in the community. They are introduced to basic research methodology so that they can plan and conduct fundamental and applied research. They are also imparted training in teaching methods in the subject which may enable them to take up teaching assignments in medical colleges/institutes.

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

**COURSE OVERVIEW:**

**1. Cognitive domain:**

1. To have knowledge about the clinical features, etiology, pathogenesis and laboratory diagnosis of communicable diseases caused by micro- organisms and apply that knowledge in the treatment, prevention and control of such diseases.
2. To know the principles of immune mechanism which help to understand the pathogenesis and laboratory diagnosis of infectious and non-infectious diseases.
3. To become a competent Microbiologist and to establish diagnostic Microbiology laboratory in hospitals and community for patient care
4. To have sound knowledge of skills in microbiological laboratory methods
5. To aquire teaching ability and to handle classes for undergraduates
6. To prepare the student for fundamental and applied research

**2. Psychomotor domain:**

1. To give guidelines for proper collection, transport and processing of clinical specimen
2. To have a sound knowledge of techniques of sterilization, preparation of media, disposal of biomedical waste and implementation of infection control measures
3. To learn serological and immunological techniques for diagnosis of infectious diseases

3. **Affective domain:**

1. To acquire competency in teaching and diagnostic work
2. To develop team spirit in organizing academic activities
3. To follow ethics in routine and research activities

## II. OBJECTIVE OF THE PROGRAMME

### 1. PROGRAMME GOAL

The main goal of this course is to train students of Medicine in the field of Medical Microbiology: The goal of the postgraduate medical education shall be to produce a competent specialist and Medical teacher.

Theoretical as well as practical training is imparted to the candidates in the subspecialties viz. Bacteriology, Virology, Parasitology, Immunology and Mycology so that they can participate in good patient care and prevention of infectious diseases in the community.

They are introduced to basic research methodology so that they can conduct fundamental and applied research.

They are also imparted training in teaching methods in the subject which may enable them to take up teaching assignments in Medical Colleges/Institutes.

### 2. PROGRAMME OBJECTIVES

**Objectives (General)**

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

- Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology
- Plan, execute and evaluate teaching assignments in medical microbiology and
- Plan, execute, analyses and present the research work in medical microbiology shall recognize the health needs of the community and carry

out professional obligations ethically in keeping with the objectives of the national health policy

- 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;
- Shall be aware of the contemporary advances and developments in the field of medical and diagnostic Microbiology.
- Shall have acquired the spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology
- Shall have acquired the basic skills of teaching of the medical and paramedical professionals.
- Establish good "laboratory medicine" in hospital and community in the field of Bacteriology, Virology, Parasitology, Immunology and Mycology.
- Plan, execute and evaluate teaching assignments of Microbiology in medical college.
- Undergo specialization in any of the above subspecialties.
- Plan, execute and analyse applied and fundamental research in various branches of microbiology involving other related disciplines for health care
- Subject himself/herself to continuing education and constantly update his/her knowledge of recent advances in microbiology and allied subjects
- Maintain accurate records of tests and their results for reasonable periods of time so that these may be retrieved as and when necessary
- To acquire skills necessary to recognize and manage hospital acquired infections, and be a part of control systems, and management of operative, postoperative and intensive care related illness.
- Acquire competence in diagnosis, investigation and management of imported infections with the knowledge to advise in relation to infections acquired through travel
- Acquire competence in all aspects of the management of antibiotic use.To be part of training programmes related to advancement in diagnosis and management of Infectious Diseases
- Make and record observations systematically that is of use of archival purposes and for furthering the knowledge of microbiology.
- Always adopt ethical principles and maintain proper etiquette in his/her dealings with patients, relatives and other health personne
- Respect the rights of the patient including the right to information and second opinion

- Provide leadership and inspire members of the team with whom he/she is involved within the field of microbiology, teaching and research
- Develop communication skills not only to word reports and professional opinions but also to interact with patients, relatives, peers and paramedical staff
- Able to supervise and work with subordinates and colleagues in a laboratory

**Educational Objectives**

**1. Knowledge**

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

- 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 microorganisms.
- State and explain the principles of immunity and immunological phenomenon, which help to understand the pathogenesis, laboratory diagnosis of infectious and non-infectious diseases.
- 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. Organize the prevention and control of communicable diseases in the community.
- Understand and practice the principle of prevention and control of health care associated infections and rational antibiotic policy.
- State the recent advances in the field of Medical Microbiology and apply this knowledge in understanding aetiopathogenesis and diagnosis of diseases caused by microorganisms.
- Carry out fundamental or applied research in the branches of medicine involving microbiological work.
- Develop specialization in any of the above subspecialities.
- Undertake teaching assignments in the subject of medical Microbiology

**2. Skills**

- At the end of the course the student shall be able to:
- Plan the laboratory investigations for the diagnosis of infectious diseases.

- Perform laboratory procedures to arrive at the etiological diagnosis of infectious diseases caused by bacteria, fungi, viruses and parasites including the drug sensitivity profile
- Perform and interpret immunological and serological tests
- Operate routine and sophisticated instruments in the laboratory.
- Develop microteaching skills and Pedagogy.
- Successfully implement the chosen research methodology

## III. TEACHING AND TRAINING ACTIVITIES

The fundamental components of the teaching programme should include:

- Case presentations & discussion- once a week
- Seminar – Once a week
- Journal club- Once a week
- Grand round presentation (by rotation departments and subspecialties)- once a week
- Faculty lecture teaching- once a month
- Clinical Audit-Once a Month
- A poster and have one oral presentation at least once during their training period in a recognized conference.

The rounds should include bedside sessions, file rounds & documentation of case history and examination, progress notes, round discussions, investigations and management plan) interesting and difficult case unit discussions.
The training program would focus on knowledge, skills and attitudes (behavior), all essential components of education. It is being divided into theoretical, clinical and practical in all aspects of the delivery of the rehabilitative care, including methodology of research and teaching.

**1. Theoretical**: The theoretical knowledge would be imparted to the candidates through discussions, journal clubs, symposia and seminars. The students are exposed to recent advances through discussions in journal clubs. These are considered necessary in view of an inadequate exposure to the subject in the undergraduate curriculum.

**2. Symposia:** Trainees would be required to present a minimum of 20 topics based on the curriculum in a period of three years to the combined class of teachers and students. A

free discussion would be encouraged in these symposia. The topics of the symposia would be given to the trainees with the dates for presentation.

**3. Clinical:** The trainee would be attached to a faculty member to be able to pick up methods of history taking, examination, prescription writing and management in rehabilitation practice.

**4. Bedside:** The trainee would work up cases, learn management of cases by discussion with faculty of the department.

**5. Journal Clubs:** This would be a weekly academic exercise. A list of suggested Journals is given towards the end of this document. The candidate would summarize and discuss the scientific article critically. A faculty member will suggest the article and moderate the discussion, with participation by other faculty members and resident doctors. The contributions made by the article in furtherance of the scientific knowledge and limitations, if any, will be highlighted.

**6. Research:** The student would carry out the research project and write a thesis/ dissertation in accordance with NBE guidelines. He/ she would also be given exposure to partake in the research projects going on in the departments to learn their planning, methodology and execution so as to learn various aspects of research.

## IV. SYLLABUS

### 1. Theory

**MEDICAL MICROBIOLOGY**

- General
    - History of microbiology Microscopy
    - Bio-safety including universal precautions
    - Physical and biological containment
    - Sterilization and disinfection
    - Morphology of bacteria and other microorganisms
    - Nomenclature and classification of microorganisms
    - Microbiomes & Normal flora of human body
    - Growth & nutrition of bacteria Bacterial metabolism
    - Host-parasite relationship and virulence factors
    - Antibacterial substances and drug resistance
    - Bacterial genetics & bacteriophages
    - Molecular genetics relevant for medical microbiology

- Immunology
    - Immunology Components of the immune system
    - Innate and acquired immunity
    - Cells involved in immune response
    - Antigens
    - Immunoglobulins
    - Mucosal immunity
    - Complement Antigen & antibody reactions
    - Hypersensitivity Humoral & Cell mediated immunity
    - Cytokines
    - Immunodeficiency
    - Auto-immunity
    - Immune tolerance
    - MHC complex
    - Transplantation immunity
    - Tumor immunity
    - Vaccines and immunotherapy
    - Measurement of immunological parameters
    - Immunological techniques
    - Immunopotentiation & immunomodulation
- Systematic bacteriology
    - Staphylococcus, Micrococcus
    - Streptococcus & Enterococcus
    - Neisseria, Branhamella, Moraxella etc.
    - Coryneform organisms
    - Enterobacteriaceae
    - Vibrios, Aeromonas, Plesiomonas
    - Haemophilus
    - Bordetella
    - Brucella
    - Pseudomonas, Acinetobacter & other non-fermenters
    - Spirochaetes
    - Chlamydiae
    - Mycoplasma
    - Rickettsiae
    - Helicobacter, Campylobacter & Spirillium
    - Actinomyces, Nocardia, Actinobacillus and other actinomycetales,

- Miscellaneous Bacteria like Gardnerella, Pasturela, Francisella, Erysipelothrix, Listeria, Coxiella, Bartonella, etc.
- Gram positive bacilli of medical importance including Lactobacillus, Bacillus

- Mycobacteriology
  - History
  - Classification
  - Identification
    - Conventional
    - Molecular
  - Culture techniques
  - Anti-mycobacterial susceptibility testing
  - Mycobacterial Immunology & mycobacterial antigens
  - Latent Tuberculosis-Diagnosis & Interpretation
  - Histopathology in Tuberculosis
  - NTM
  - M. leprae
  - Molecular applications in mycobacteriology
  - Recent advances in Mycobacteriology
- Anaerobic bacteriology
  - Anaerobic Methods
  - Anaerobic cocci & Bacilli including Clostridia, Bacteroides, Fusobacterium,etc.
- Medical Virolology
  - General properties of viruses
    - Classification of viruses
    - Morphology: Virus structure, Virus replication, Isolation & identification of viruses
    - Pathogenesis of viral infections
  - Bacteriophage
  - DNA viruses
    - Poxviridae
    - Herpesviridae
    - Adenoviridiae
    - Papova
    - Parvo viruses

        - Other DNA viruses
    - RNA viruses
        - Picorna virus
        - Enteroviruses
        - Arboviruses
        - Orthomyxoviruses
        - Paramyxoviruses
        - Reoviridiae
        - Rhabdoviridae
        - Retroviridae
        - Filoviruses
        - Coronaviridae
        - Calciviruses
        - Other RNA viruses
    - Hepatitis Viruses
    - Miscellanous Viruses
    - Oncogenic Viruses
    - Slow viruses including prions, Viriods
    - Vaccines & anti-viral drugs
- Medical Parasitology
    - General characters & classification of parasites
    - Methods of identification of parasites
    - Protozoan parasites
        - Entamoeba,
        - Free living amoebae,
        - Giardia
        - Trichomonas,
        - Balantidium
        - Leishmania,
        - Trypanosoma,
        - Plasmodium, Babesia
        - Toxoplasma,

- Sarcocystis,
- Cryptosporidium, Microsporidium, Cyclospora. Isospora,

- Helminthology
  - Intestinal Nematodes (Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius,
  - Tissue Nematodes (Filarial worms, Dracunculus etc.)
  - Cestodes (Diphyllobothrium,Taenia, Echinococcus, Hymenolepis, Dipyllidium, Multiceps etc.),
  - Trematodes (Schistosomes, Fasciola, Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc.)

- Medical Entomology:
  - Common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
  - Vector control agents
- Medical Mycology
  - General characteristics & classification of fungi
  - Morphology & reproduction of fungi Isolation & identification of fungi
  - Pathogenesis
  - Tissue reactions to fungi
  - Yeasts and yeast like fungi
    - Candida.
    - Cryptococcus,
    - Malassezia, Piedra,
    - Trichosporon, Geotrichum, Saccharomyces etc.
  - Mycelial fungi
    - Dermatophytes
    - Aspergillus,
    - Hyalohyphomycetes
    - Zygomycetes,
    - Dematiaceous hyphomycetes
  - Opportunistic Fungi & Common laboratory contaminants
  - Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, ,Penicillium marneffei etc.
  - Fungi causing subcutaneous mycosis & mycetoma

- Pneumocystis carinii infection
- Mycetismus & mycotoxicosis

- Antifungal agents & in vitro antifungal susceptibility tests.
- Applied Medical Microbiology
  - Epidemiology of infectious diseases
  - Approaches to diagnosis and management of infectious disease syndromes
    - Fevers & Pyrexia of unknown origin (PUO)
    - Respiratory tract infections
    - Urinary tract infection
    - Sepsis
    - Intra-abdominal infections
    - Cardio-vascular infections
    - Central Nervous Infections
    - Skin & soft tissue infections
    - Gastrointestinal infections & Food poisoning
    - Bone & Joint infections
    - STIs & RTIs
    - Eye infections
    - Hepatitis
    - AIDS
  - Traveler's Diseases
  - Emerging and re-emerging infections.
  - Biological warfare (Bioterrorism)
  - Probiotics
  - Microbiology of air, milk and water
  - Microbiology of hospital environment
  - Hospital acquired infections
  - Hospital infection control and management
  - Antimicrobial susceptibility testing & therapy
  - Rational use of antibiotics and its stewardship
  - Biomedical waste management
  - Safety and risk management
  - Environment management and Engineering controls
  - Investigation of an infectious outbreak and epidemiological typing

- Recent advances in diagnostic techniques in infectious diseases
- Infection control in special situations- Blood transfusion, solid organ transplantation and implants.
- Molecular genetics as applicable to Microbiology
- Quality Assurance and Accreditation of laboratories
- Vaccinology: principle, methods of preparation, administration of vaccines and testing
- Information technology (Computers) in microbiology, Bioinformatics, research methodologies
- Automation in Clinical Microbiology
- Statistical analysis of microbiological data and research methodology and ethics
- Care & handling of animals preferably by simulation and ethical considerations
- National infectious disease control, eradication programmes
- Recent Advances in Medical Microbiology

**2. Practical**

- Bacteriology
  - Aseptic practices in laboratory and safety precautions
  - Preparation of stains viz. Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN), Silver impregnation stain etc.
  - Preparation of media like Nutrient agar, Blood Agar, Mac-conkey agar, Sugars, Serum sugars, Kligler iron agar, Robertson's cooked meat broth, Lowenstein Jensens medium, Sabouraud's dextrose agar etc.
  - Preparation of reagents -oxidase, Kovac etc.
  - Quality control of media, reagents etc.
  - Preparation of antibiotic discs
  - Operation of autoclave, hot air oven, distillation plant, filters like Sietz and membrane filters Care and operation of microscopes
  - Washing and sterilisation of glassware (plugging and packing)
  - Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
  - Sterility tests Identification of bacteria of medical importance upto species level (except anaerobes which could be upto generic level).
  - Appropriate and aseptic sample collection techniques specially blood culture
  - Collection/transport of representative specimens for microbiological investigations

- Preparation, examination & interpretation of direct smears from clinical specimens after clinical correlation
- Plating of clinical specimens on media for isolation, purification, identification and interpretation after clinical correlation.
- Techniques of incubation for aerobic, microaerophilic and anaerobic organisms
- Tests for Motility: hanging drop, Cragie's tube, dark ground microscopy for spirochaetes
- Special tests-Bile solubility, sheep cell haemolysis, CAMP test, satellitism, catalase, oxidase and serotyping, etc.
- In-vitro toxigenicity tests- Elek's test, Negler's reaction
- Performance of antimicrobial susceptibility testing, eg. Kirby-Bauer, Stoke's method
- Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/ plate dilution methods
- Tests for Beta-lactamase production
- Antimicrobial susceptibility tests for Mycobacteria
- Special staining techniques for Mycoplasma, Treponemes, Gardenerella.
- Knowledge of Inoculation of lab animals by different routes, Bleeding techniques of animals including mice, guinea pig, rabbit and sheep Animal pathogenicity/toxigenicity tests for C.diphtheriae, C.tetani, S.pneumoniae, S.typhimurium, K.pneumoniae etc.
- Care and breeding of laboratory animals viz. mice, rats, guinea pigs, rabbits etc.
- Testing of disinfectants
- Disposal of contaminanted materials like cultures & infectious waste
- Bacteriological tests for water, air and milk
- Maintenance & preservation of bacterial cultures

- Mycobacteriology
  - Lab Diagnosis & Interpretations
  - Sample collection, skin slit smears
  - Microscopy
    - Z-N Staining
    - Direct Fluorescence Staining
  - Culture techniques & Automations
  - Anti-mycobacterial susceptibility testing
  - Histopathology techniques in Tuberculosis & Leprosy

- Molecular applications in mycobacteriology
- Latent Tuberculosis- Diagnosis & Interpretations
- Mantoux testing & Gamma Interferon Assay

Skills which are desirable to acquire

- Isolation of plasmids and Conjugation experiments for transfer of drug resistance.
- Serum antibiotic assays eg. Gentamicin.
- Phage typing for staphylococci, S.typhi etc.
- Bacteriocine typing eg. Pyocine, Proteocin etc
- Disinfectant testing
- Microbial Immunology
- Separation of serum and preservation of serum for short and long periods
- Performance of serological tests viz. Widal, Brucella tube agglutination, indirect hemagglutination,VDRL/RPR, ASO, Rose Waaler test, IFA and others
- Enzyme linked immunosorbent assay
- Latex agglutination tests
- Radial immunodiffusion for estimation of serum Immunoglobulins
- Immunoelectrophoresis
- Crossed immunoelectrophoresis
- Immunoblotting
- Radial immunodiffusion.

Skills which are desirable to acquire

- Leucocyte migration inhibition test.
- T-cell rosetting.
- Flow Cytometry
- Immunoelectrophoresis.
- Immunodiffusion in gels, counter immunoelectrophoresis visualization and interpretation of bands.

- Mycology
  - Collection and transport of specimens
  - Processing of samples for microscopy and culture
  - Direct examination of specimens by KOH, Gram's, Acid fast, Giemsa, Lactophenol cotton blue, direct fluorescence staining (Calcofluor staining), indirect fluorescence staining (Pneumocystis jirovecii) & special fungal stains
  - Examination of histopathology slides for fungal infections

- Isolation and identification of medically important fungi & common laboratory contaminants
- Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture
- Anti-fungal susceptibility testing (MICs)
- Maintenance of stock cultures
- Antigen and Antibody detection in candidiasis, aspergillosis, histoplasmosis, blastomycosis, Cryptococcosis, zygomycosis, coccidioidomycosis, cryptococcosis, aspergillosis, candidiasis, etc.

- Parasitology
  - Collection and transport of specimens for diagnosis of parasitic diseases
  - Examination of faeces for parasite ova and cysts etc. by direct and concentration methods (salt floatation, formol-ether methods and others)
  - Egg counting techniques for helminthes, micrometry and mounting of slides
  - Preparation & performance of stains -Leishman, Giemsa, Lugol's iodine, modified acid fast stain, etc.
  - Examination of blood for protozoa by thick and thin stained smears, QBC and microfilariae including concentration techniques
  - Examination of other specimens eg. Urine, CSF, Bone marrow etc. for parasites
  - Micrometry Identification of medically important adult worms
  - Immuno & molecular assays in parasitic infections (malaria, cryptosporidium, etc.)
  - Identificationof common arthropods and other vectors viz. mosquito, sandfly, ticks, mites, Cyclops, etc.
  - Preservation of parasites-mounting, fixing, staining etc.

Skills which are desirable to acquire

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

- Virology
  - Preparation of glassware for tissue cultures (washing, sterilisation).

- Preparation of buffers like PBS, Hank's Preparation of clinical specimens for isolation of viruses
- Collection & transport of specimens
- Staining for inclusion bodies
- Serological tests –ELISA & Immunofluoresence for HIV & HBsAg etc
- Molecular techniques in virology
- Chick Embryo techniques-inoculation and harvesting
- Handling of mice, rats and guinea pigs for collection of blood and other samples.

Skills which are desirable to acquire

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

Other areas in which knowledge is to be acquired:

- Pyrogen testing
- Biostatistics and clinical epidemiology
- Ethics & Medico legal aspects
- Economics of management of diseases

**Posting Sections/ departments**

| **Section/ Department** | **Duration** |
|---|---|
| 1. Orientation posting | 1 month |
| 2. Media room & Sterlization | 2 months |
| 3. Bacteriology* | |
| Pus & Body fluids seat | 3 months |
| Blood seat | 3 months |
| Urine seat | 3 months |
| Enterobactericeae | 3 months |
| 4. Parasitology* | 3 months |
| 5. Microbial Immunology* | 3 months |
| 6. Mycology* | 3 months |
| 7. Virology* | 3 months |
| 8. Mycobacteriology* | 2 months |

| | |
|---|---|
| 9. Molecular Laboratory* | 2 months |
| 10. Infection Control & Antibiotic Stewardship* | 2 months |
| 11. Histopathology/ Cytology | 1 month |
| 12. Revision & External posting | 2 months |
| **TOTAL** | **36 months** |

* : 12-15 positive cases per year per Post graduate at his/her posting need to be logged in (as a separate log book) with clinical details under supervision of the faculty incharge of the posting.

Note: Case series thus obtained are encouraged for publication. Such case series along with the log book will be part of the internal assessment at the end of the postings.

## V. COMPETENCIES TO BE ACQUIRED BY THE CANDIDATES

**Job Responsibilities**

- Assessment of adequacy of samples for microbiological processing
- During 1st year the resident will work under direct supervision of the consultants /Sr. Resident / 2nd yr & 3rd yr residents and will be responsible for handling and processing of the specimens in their respective sections with an aim of carrying bench to bedside.
- During 2nd yr, they will be responsible for reporting in their respective sections under the supervision.
- During 3rd yr, they should be able to handle all the emergencies in the evening and night.
- All the junior residents should be able to take practical demonstrations of undergraduates.
- Communication of positive samples from critical specimens to the treating units is mandatory.

Time frame for minimum skill acquisition by PG residents of Microbiology Department General Microbiology and Bacteriology

**First year**

- Operation of autoclave, hot air oven
- Washing and sterilization of glass wares for routine & tissue cultures
- Media and reagent preparation
- Laboratory waste management

- Aseptic practices in laboratory and safety precautions
- Care and maintenance of common laboratory equipments
- Care and breeding of laboratory animals
- Bleeding techniques from animals
- Preparation and performance of common bacterial stains
- Collection of specimens for microbiological investigations
- Care and operation of microscopes
- Preparation, examination and interpretation of direct smears from clinical specimens
- Direct examination of specimens by KOH, Gram's, Kinyoun's, Giemsa, Lactophenol cotton blue stains
- Motility testing of bacteria
- Identification of bacteria
- Biochemical tests & agglutination tests
- Serological tests-ELISA for HIV, RPHA for HBsAg, etc.

**Second & Third year**

- Quality control of media and reagents
- Quantitative and semi-quantitative analysis of urine
- Tests for identification of bacteria of medical importance up to species level
- Isolation and identification of common laboratory contaminants, dermatophytes and other fungi of medical importance (yeast, dematiacious fungi)
- Techniques of anaerobiosis
- Skin tests
- Preparation of antibiotic discs
- Detection of drug resistance mechanisms (beta lactamases, MRSA, NDM etc.)
- Estimation of MIC, MBC, etc.
- Separation of serum and preservation of serum for short and long periods
- Preparation of antigens from bacteria or tissues like Widal, VDRL, etc and them
- Standardization Latex and Staphylococcal Co-agglutination tests
- Performance of serological tests viz. Widal, Brucella tube agglutination, WeilFelix, Cold agglutination, VDRL, Paul-Bunnel, Rose-Waaler, IF, etc.
- Raising of antisera in laboratory animals
- Radial immunodiffusion for estimation of serum immunoglobulins

- Immuno & molecular assays
- Maintenance of stock cultures
- Maintenance of continuous cell lines by subcultures.
- Handling of mice, rat, guinea pigs for collection of blood, pathogenicity tests, etc.
- Inoculation of infective material
- by different routes in the animals
- Immunoelectrophoresis
- Histopathology sections-examination and identification of parasites
- Identification of common arthropods and other vectors viz., mosquito, sandfly, tick, mite, Cyclops
- Permanent staining techniques like iron haematoxylin
- Recognition of CPE producing viruses
- Identification tests on tissue cultures and supernatants by performance of viz. haemadsorption, Haemagglutination, Immunofluorescence, Neutralization, etc.
- General acquaintance
- Light microscopy
- Fluorescent microscopy
- Dark ground microscopy
- Tissue culture
- Microslide culture for fungus
- Immuno and molecular assays
- CD4 count estimation
- Medical statistics
- Quality control
- Waste disposal
- Molecular biology
- Information retrieval, computer, internet in medicine

## VI. LOG BOOK

A candidate shall maintain a log book of operations (assisted / performed) during the training period, certified by the concerned post graduate teacher / Head of the department / senior consultant.

This log book shall be made available to the board of examiners for their perusal at the time of the final examination.

The log book should show evidence that the before mentioned subjects were covered (with dates and the name of teacher(s) The candidate will maintain the record of all academic activities undertaken by him/her in log book.

1. Personal profile of the candidate
2. Educational qualification/Professional data
3. Record of case histories
4. Procedures learnt
5. Record of case Demonstration/Presentations
6. Every candidate, at the time of practical examination, will be required to produce performance record (log book) containing details of the work done by him/her during the entire period of training as per requirements of the log book. It should be duly certified by the supervisor as work done by the candidate and countersigned by the administrative Head of the Institution.
7. In the absence of production of log book, the result will not be declared.

## VII. RECOMMENDED TEXT BOOKS AND JOURNALS


1. Ananthanarayan & Paniker's Textbook of Microbiology, Orient Longsman,
2. Anaissie Elias J. Clinical Mycology, Churchill livingstone
3. Bailey and Scott's Diagnostic Microbiology. CV Mosby, St. Louis, Brooks, Geo F Jawetz
4. Medical Microbiology McGraw Hill Coller, Leslie Topley and Wilsons
5. Microbiology and microbial infections Vol 1, 2, 3, 4, 5, 6, Collee J G Mackie and Mc cartney
6. Practical Medical Microbiology, Koneman EW, Allen SD, Schreckenberg PC, Winn WC (Eds):
7. Atlas and Textbook of Diagnostic Microbiology. JB Lippincott, Philadelphia,
8. Manual of Clinical Microbiology. 6th ed. American Society for Microbiology, Washington, DC
9. Parija SC. Textbook of Medical Parasitology
10. Parija SC. Textbook of Practical Microbiology
11. Roitt Ivan M, Immunology Blackwell Science
12. Stites Immunolgy Mc Graw Hill
13. Woods GL, Washington JA: The Clinician and the Microbiology Laboratory.
14. Mandell GL, Bennett JE, Dolin R (Eds): Principles and Practice of Infectious Diseases.

15. Bailey and Scott's Diagnostic Microbiology.
16. Textbook of Parasitology. Chatterjee K.D.
17. Mycology – Rippons.
18. Essentials of Immunology- Roitt.
19. Gradwohl's Clinical Laboratory Methods and Diagnosis.
20. Biochemical tests for the Identification of Medical Bacteria- MacFaddin JF.
21. Manual of Clinical Microbiology- ASM press

**Reference books (Please refer the most recent edition)**

1. Topley and Wilson's Microbiology and Microbial infections.
2. Color Atlas and Textbook of Diagnostic Microbiology: Elmer W Koneman
3. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases
4. Microbiology and Clinical Practice: Shanson
5. Immunology: Janis Kuby
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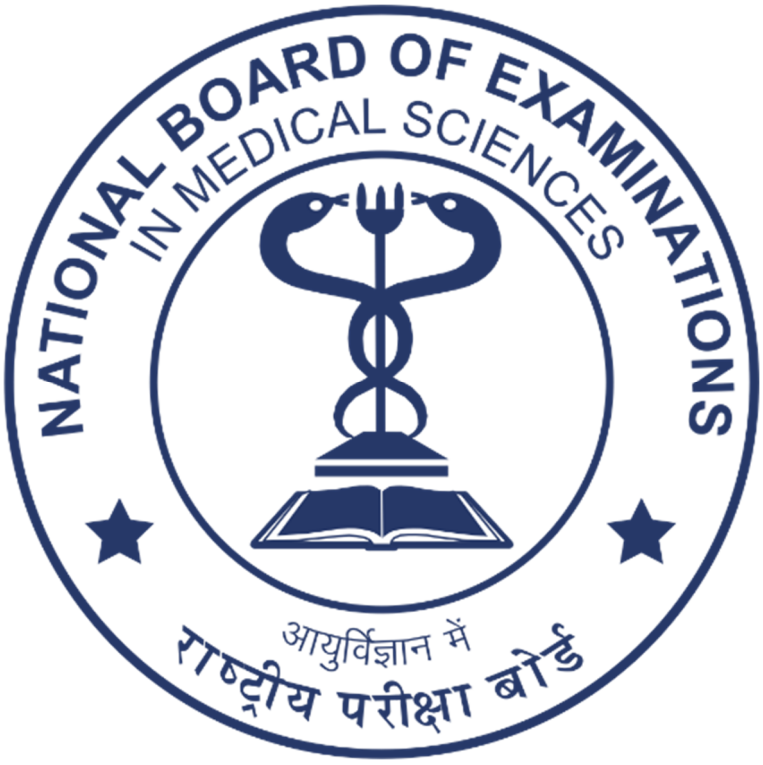


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