REGULATIONS AND CURRICULUM GOVERNING

MD MICROBIOLOGY PROGRAM

(2024-25)

Name of the Constituent Unit/Centre: Yenepoya Medical College



YENEPOYA

Deemed to be University

Deralakatte, Mangalore, Karnataka.

NOTIFICATION FROM THE UNIVERSITY

YENEPOYA
(DEEMED TO BE UNIVERSITY)
Recognized under Sec 3(A) of the UGC Act 1956
Accredited by NAAC with 'A' Grade

NOTIFICATION – 34-ACM/2019 dtd. 20.02.2019

Sub:- Implementation of Competency Based Medical Education PG Curriculum

Ref. : Resolution of the Academic Council at its 34th Meeting held on 08.02.2019 vide Agenda 33

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The Academic Council at its 34th Meeting held on 08.02.2019 and subsequently the 45th meetings of Board of Management held on 09.02.2019 have accepted the proposal for implementation of Competency Based Medical Education (CBME) for the PG Curricula of the following programs as per the MCI Norms.

1. MD in Pathology
2. MD in General Medicine
3. MD in Anaesthesiology
4. MD in Paediatrics
5. MD in Respiratory Medicine
6. MD in Radio-diagnosis
7. MD in Anatomy
8. MD in Physiology
9. MD in Biochemistry
10. MD in Microbiology
11. MD in Pharmacology
12. MD in Forensic Medicine
13. MD in Psychiatry
14. MD in Dermatology
15. MD in Community Medicine
16. MS in General Surgery
17. MS in OBG
18. MS in Otorhinolaryngology
19. MS in Ophthalmology
20. MS in Orthopaedics

This revised curriculum shall come into effect from the academic year 2019-2020 onwards.

REGISTRAR

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MD IN MICROBIOLOGY

Preamble:

The aim of postgraduate education in Microbiology is to impart requisite clinical, diagnostic, teaching and research skills with appropriate attitude and communication competencies required in the field of Medical Microbiology. Currently the postgraduate students of Microbiology are trained in the laboratory with minimal exposure to patient care, but with technological advances and automation in diagnostic microbiology and increasing threat of infections due to emerging & reemerging microbes, drug resistance and widening host range, a microbiologist needs to develop clinical expertise in addition to technical expertise and be available more at the bedside to develop partnership with clinician in diagnosis and management of infectious disease cases. To fulfill these expectations, the program of MD Microbiology needs to shift focus to clinical aspects of microbiology, where a student is trained in the clinical setting and is able to contribute in the clinical management along with diagnosis, prevention and control of infectious disease.

This document provides guidelines to standardize Microbiology teaching at the postgraduate level throughout the country and fulfill the expectations as a microbiologist. The new curriculum guide has given more emphasis on training in patient care setting with integration of concepts of microbiology in various clinical specialties through dedicated postings, ward rounds, case discussion etc.

Reference: Guidelines for competency based postgraduate training programme for MD in microbiology. NATIONAL MEDICAL COMMISSION Postgraduate Medical Education Board D 11011/1/22/AC/Guidelines/21 Date: 07-11-2022

Subject specific objectives (goals)

A postgraduate student upon successfully qualifying in the MD Microbiology examination should be able to:

1. Demonstrate competence in clinical aspects as a Microbiologist to improve patient care.
2. Demonstrate application of microbiology in different clinical settings to address diagnostic and therapeutic problems along with preventive measures.
3. Play an important role in hospital infection control by actively participating in activities of the Hospital Infection Control Committee as a team member.
4. Demonstrate competence in recording, advising and guiding use of antimicrobials judiciously for infectious diseases in routine and in special clinical situations and

population.

5. Demonstrate competence in developing guideline for antibiotic usage, including formulation of antibiotic policy in hospital.
6. Demonstrate communication skills required for safe & effective laboratory practice and teaching of microbiology
7. Demonstrate skills in conducting collaborative research in the field of Clinical Microbiology and allied sciences which has significant bearing on human health and patient care.
8. Demonstrate ability to plan, execute and evaluate teaching and training assignments efficiently and effectively in Microbiology for undergraduate students as per Competency Based Medical Education (CBME).
9. Identify public health epidemiology, global health patterns of infectious diseases and effectively participate in community outreach and public health programs for investigation, prevention and control of infectious diseases.
10. Demonstrate ability to work as a member of the rapid response team and contribute to investigations of outbreaks of infectious diseases in the hospital and outbreak/epidemic/pandemic in the community.
11. Demonstrate self-directed learning skills and keep updated with recent advances in the field of clinical microbiology.
12. Demonstrate administrative and organizational skills to establish good clinical microbiological services in a hospital and in the community in the field of clinical microbiology
13. Demonstrate effective leadership and teamwork skills while working with other members of the health care team in hospital, laboratory and community settings.
14. Demonstrate attributes of professional behavior and uphold the prestige of the discipline amongst the fraternity of doctors

Postgraduate training:

The postgraduate training should include the following components for a holistic approach-

1. Clinical Microbiology including Antimicrobial Resistance (AMR)
2. Laboratory skills in diagnostic Microbiology
3. Infection Prevention and Control Skills

4. Teaching and learning Skills
5. Research Skills
6. Attitude, Ethics and Communication skills

The postgraduate student should develop and demonstrate competence in the above components as follows:

1. Clinical Microbiology including Antimicrobial Resistance (AMR)

i. Should be able to elicit relevant history for optimum clinico-microbiological correlation with laboratory results.
ii. Should be able to perform basic physical examination and assess the patients with any suspected infection including community acquired/ tropical infection/ sepsis/ imported infection / hospital acquired infections and emerging and re-emerging infections.
iii. Should be able to formulate and critique diagnostic algorithms and patient care plans
iv. Should be able to choose, interpret and communicate the results of appropriate microbiological investigation in a suspected infection.
v. Should be able to suggest optimal antimicrobial therapy, based on results of antimicrobial susceptibility tests and other investigations.
vi. Should be able to advocate antibiotic stewardship for prevention and control of AMR (detailed competencies under AMR are given in Annexure I)
vii. Should be able to educate patients/ relatives/ community on various aspects of antimicrobial use, antimicrobial drug resistance, prevention and control of infections.

2. Laboratory skills in diagnostic Microbiology

i. Should be able to demonstrate acquisition of pre-analytical, analytical and post-analytical laboratory skills to ensure quality of test results.
ii. Should be able to perform tests pertaining to basic, diagnostic, clinical and applied Microbiology.

3. Infection Prevention and Control

i. Should be able to demonstrate knowledge, skills & attitude required to detect, prevent and control health care associated infections of all types.
ii. Should be able to set up and manage Central Sterile Services Department (CSSD) and

prepare effective sterilization and disinfection policy for the hospital.

iii. Should be able to demonstrate knowledge and skills about management of biomedical waste in health care setting as per recent guidelines and educate staff about risks, preventive measures and the management of occupational exposure to infectious agents

4. Teaching and Learning Skills

i. The Medical Education Department/Unit of the institution should be able to sensitize the postgraduate students in basic concepts of medical education technologies like domains of learning, teaching skills, teaching - learning methods, lesson planning, learning resource material, assessment techniques etc.

ii. Should be able to demonstrate good teaching skills while conducting teaching/training sessions like tutorials, demonstrations and practical for undergraduate students, laboratory technicians etc. and participate actively in the planning and conduct of assessment of students learning at various stages of formative / summative assessment.

iii. Should be able to learn by integrating with concerned subspecialty

5. Research Skills

i. Should be able to plan, design and conduct meaningful scientific research in microbiology in collaboration with allied subjects.

ii. Should acquire expertise to write research protocol, thesis and present a research paper in the scientific forum.

iii. Should follow guidelines on ethical conduct in research.

iv. Should acquire proficiency and demonstrate ability to use biostatistics, data management.

v. Should be able to critically appraise a scientific article and have knowledge of evidence-based practice.

vi. Should acquire expertise in writing proposals for research grants and know the various sources of research funding

6. Communication and attitudinal skills

i. Should demonstrate the right kind of attitude, communication and ethics while dealing with clinical material and reports.

ii. Should be able to work as an effective team member and leader

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SUBJECT SPECIFIC COMPETENCIES

The competencies will have a judicious mix of all domains of learning and may show predominance in one domain. The Post-Graduate student during the training programme should acquire the following predominant domain specific competencies to achieve the defined goals:

A) Predominant in Cognitive Domain (Knowledge):

At the end of the course, the student should have acquired knowledge in the following competencies:

Paper I: General Microbiology (GM) & Immunology (IG)

General Microbiology (GM):

i. Describe important historical events and developments in microbiology
ii. Describe nomenclature, classification, morphology, growth requirements, and pathogenesis and laboratory diagnosis of different bacteria, viruses, parasites and fungi.
iii. Explain the importance of normal flora microbes, including Microbiome in health and disease.
iv. Explain the factors influencing and significance of microbial environment in health care setup.
v. Describe the epidemiology of common infectious diseases, host-parasite relationship and their significance.
vi. Describe various types of microscopes and microscopic techniques used in diagnostic microbiology.
vii. Explain various methods of isolation, identification and preservation of microbes in laboratory.
viii. Explain the type, mechanism of action and applications of microbial toxins, other virulence factors & microbial products like Bacteriocins.
ix. Explain the concept & application of various biosafety and biosecurity issues in laboratory and patient care including physical, biological containment and standard precautions.

x. Discuss the various methods of sterilization and disinfection and apply them in the laboratory and in patient care

xi. Explain the basic principles of bacterial genetics and applications of molecular techniques in medical microbiology.

xii. Explain the concept of microbiological surveillance including patient screening methods, organism typing and genome sequencing methodologies.

xiii. Explain the concept and application of quality assurance, quality control and accreditation in diagnostic microbiology.

xiv. Describe the significance and causes/reasons regarding emerging infectious diseases with strategies for their identification and control.

xv. Explain the concept and application of molecular biology techniques in the laboratory diagnosis of infectious diseases.

xvi. Explain the concept and use of information technology (LIS, WHO NET etc.) in microbiology laboratory effectively.

xvii. Describe the principles & implementation of animal and human ethics involved in diagnostics and research in Microbiology

xviii. Explain the principles and application of recent technological advances, automation, and application of Artificial Intelligence, nanotechnology, biosensors, bioinformatics, etc. in diagnosis & research in Microbiology.

xix. Explain the importance and methods of testing microbiology of air, water and food in patient care both in community/ hospital setting.

xx. Explain in detail about types & mechanism of action of Antimicrobial agents, their pharmacokinetics & pharmacodynamics, along with mechanism of drug resistance.

xxi. Describe types and applications of Bacteriophages in diagnostic and therapeutic of infections

Immunology (IG)

i. Describe the structure and function of the immune system, immunological mechanisms in health and response of the host immune system to infections. (Innate and acquired immunity, Cells involved in immune response, Antigens, Immunoglobulins, Mucosal immunity, Cell mediated immunity, Cytokines, MHC complex, Immune tolerance etc)

ii. Explain the complement system and describe its role in health and disease.

iii. Describe the mechanism/s in immunological disorders (hypersensitivity, autoimmune disorders and immunodeficiency states) and discuss the laboratory methods used in their diagnosis including measurement of immunological parameters

iv. Describe the types & principles of antigen and antibody reactions and immunological techniques used in diagnostic microbiology as well as in research.

v. Describe the immunological mechanisms of transplantation and tumor immunity.

vi. Describe the mechanism/s and significance of immune-potentiation and immune-modulation.

vii. Describe various types, techniques and advances in the development and applications of vaccines including UIP and immunotherapy and reverse vaccinology.

viii. Explain the role of animals in immunology.

PAPER II Clinical / Systemic Microbiology –I (CM –I)

I. Discuss in depth about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines in the situations/ scenario given below:

- **Infections of various organs and systems of the human body**

Microbiological basis of infective syndromes of various organs and systems of human body viz. CVS and blood, Respiratory Tract Infections, Urinary Tract Infections, Central Nervous System infections, Reproductive Tract Infections, Gastrointestinal Tract infections, Hepatobiliary System, Skin and Soft tissue infections, Musculoskeletal system, infections of Eye, Ear and Nose etc)

PAPER III: Clinical / Systemic Microbiology – II (CM-II)

I. Discuss in depth about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines in the situations/ scenario given below:

- **Infectious diseases as per the source/risk**
- **Opportunistic Infections in special and high risk host**
- **Infections in special situations/ scenario.**

Microbiological basis of infective syndromes as per the source/risk e.g. Blood borne, sexually transmitted infections congenital, vector borne, food, air & water borne, zoonotic, laboratory acquired, occupational infections etc. Opportunistic Infections in special and high risk host eg Pregnancy, neonates, geriatrics, diabetics, immunocompromised host due to any reason, patients with Implants/Devices, dialysis etc, Infections in special situations/ scenario: Tropical, Travel related, Emerging/ Remerging Infectious diseases seen commonly, agents of bioterrorism etc

II. Elicit relevant history, interpret laboratory results with clinic-microbiological correlation and develop diagnostic and treatment algorithms

Following organisms (bacteria, fungi, virus and parasites) must be covered under clinical / systemic microbiology and the list must be updated to include newly identified microbes from time to time

Bacteria:

1. Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
2. Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella etc.
3. Gram positive bacilli of medical importance including Lactobacillus, Coryneform organisms, Bacillus and aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.
4. Gram negative bacilli of medical importance including Enterobacteriaceae, Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella,

Pseudomonas and other non-fermenters, Pasteurella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc

5. Helicobacter, Campylobacter, Calymmatobacterium, Streptobacillus, Spirillum and miscellaneous bacteria
6. Mycobacteria
7. Spirochaetes
8. Chlamydia
9. Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.
10. Rickettsiae, Coxiella, Bartonella etc.
11. Any newly emerging bacteria

Fungi:

1. Yeasts and yeast like fungi of medical importance including Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces etc.
2. Mycelial fungi of medical importance including Dermatophytes, Aspergillus, Zygomycetes, Pseudallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
3. Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Talaromyces marneffei etc.
4. Fungi causing Mycetoma, Chromoblatomycosis, Occulomycosis Otomycosis, Phaeohyphomycosis etc
5. Pythium insidiosum
6. Prototheca
7. Pneumocystis jirovecii
8. Lacazia loboi (Loboa loboi)
9. Laboratory contaminant fungi
10. Fungi causing Mycetism and mycotoxicosis
11. Any newly emerging fungi

Virus:

1. DNA viruses of medical importance including Pox viruses, Herpes viruses, Adeno viruses, Hepadna virus, Papova and Parvo viruses etc.

2. RNA viruses of medical importance including Picorna viruses, Toga viruses, Flaviviruses, Orthomyxo viruses, Paramyxo viruses, Reo viruses, Rhabdo viruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human immunodeficiency virus, Arbo viruses, Corona viruses, Calci viruses etc.
3. Oncogenic viruses
4. Bacteriophages
5. Slow viruses including prions
6. Unclassified viruses
7. Viriods
8. Any newly emerging virus

Parasite:

1. Protozoan parasites of medical importance including Entamoeba, Free living amoebae, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Cyclospora Isospora, Babesia, Balantidium, etc.

2. Helminths of medical importance including those belonging to Cestoda (Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps etc.), Trematoda (Schistosomes, Fasciola, Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc.) and Nematoda (Ascaris lumbrecoides, Ancylostoma duodenale, Enterobius vermicularis, Trichuris trichiura, Filariasis etc.)
3. Rhinosporidium seeberi
4. Entomology: common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops, louse, myasis etc.
5. Neglected tropical parasitic diseases
6. Any newly emerging parasite

Paper IV: Applied Microbiology (AM) & Recent Advances:

Student should be able to apply knowledge & comprehension about following applied aspects:

1. Prophylaxis - Basic Principles and applications of general, immune as well as chemo-prophylaxis of infections in various clinical situations / scenarios.
2. Vaccinology: types of vaccines, principles, methods of preparation of vaccines and administration of vaccines.
3. Health care associated Infections - types, pathogenesis, diagnosis, prevention, control and surveillance of health care associated infections.
4. Biomedical waste and its management.
5. Role of microbes in non-communicable diseases - infectious agents in origin and progression of non-communicable diseases like cancer, diabetes, musculoskeletal disorder and influence of these microbes on mental health.
6. Antimicrobial Resistance Detection and Prevention: classification, mechanism of action, detection and reporting drug resistance to antimicrobials (antibacterial, antiviral, antifungal, antimycobacterial and antiparasitic agents).
7. Investigation of an infectious disease outbreak in hospital and outbreak/epidemic/pandemic in community.
8. Information technology (computers) in microbiology.
9. Automation in Microbiology
10. Molecular techniques in the laboratory diagnosis of infectious diseases.
11. Statistical analysis of microbiological data and research methodology.
12. Animal and human ethics involved in microbiological work.
13. Laboratory safety and management

B. Predominant in Affective Domain

i. Communicate effectively & empathically with patients and their relatives during sample collection, history taking, counseling and reporting results.
ii. Acquire Consent taking and counseling skills and demonstrate these to undergraduates.
iii. Communicate effectively with peers, and consultants for better clinical correlation of laboratory findings as well as research.
iv. Demonstrate effective communication and attitudinal skill while teaching undergraduate students
v. Function as an effective team member and leader with good conflict management

skills.

vi. Adopt ethical principles, particularly maintenance of confidentiality when dealing with laboratory reports.

vii. Demonstrate ability to recognize and manage ethical and professional conflicts and abide by prescribed ethical and legal codes of conduct and practice.

viii. Demonstrate altruistic professional behavior with respect, discipline, responsibility, accountability, punctuality and integrity at all times while dealing with patients and their relatives.

C. Psychomotor Domain: (Skills)

C1. The postgraduate student should be able to *perform the following and/or interpret the results independently or as a part of a team*:

- **Laboratory skills:**
  - Collect, transport and store appropriate specimens for microbiological investigations
  - Receive and process clinical specimens after appropriate preparation of samples for the appropriate investigation (centrifugation, extraction, mincing concentration etc.)
  - Processing of samples by various methods like:
    - Macroscopic / gross examination of samples.
    - Choose the most appropriate microscopic method for demonstration of pathogens.
    - Prepare, examine, and demonstrate microbes in direct smears for diagnosis of infectious disease/s.
    - Isolate and identify pathogenic microbe from clinical specimens (by conventional & automated methods).
    - Perform, interpret & record antimicrobial susceptibility testing of the isolate.
    - Perform rapid, conventional and automated serological techniques for diagnosis of infectious diseases and immunological diseases
  - Maintain records and ensure quality control in microbiology
  - Maintain and preserve microbial cultures.
  - Operate and maintain instruments used in the laboratory for sterilization and disinfection and patient care with quality control.

- Operate and maintain common laboratory equipment like microscopes, water bath, centrifuge, incubator, automated culture system, micro-centrifuge, ELISA washer and reader etc.
- Perform and assess significance of microbial contamination of food, water and air
- Biosafety measures - biosafety cabinets, chemical material safety data sheet (MSDS), fire safety, needle stick injury management.

Organisms (Bacteria, Fungi, Virus and Parasites) based Laboratory skills:

- **Direct microscopic methods for demonstration of infectious agents:**

a. Wet mount examination for - looking for cells and organisms (bacteria, fungi, parasite)
   - Saline mount stool sample - parasitic morphology
   - Iodine mount-parasitic morphology
   - KOH for fungi
   - Negative staining

b. Staining methods
   - Preparation of stains & quality check
   - Preparation of peripheral blood smears from various samples
   - Staining techniques - simple, differential, special staining methods - capsule, spore, flagella etc.
   - Gram Staining
   - Acid Fast staining (with modifications).
   - Leishman & Giemsa for demonstration of intracellular pathogen bacteria, parasite, fungi etc.
   - Albert staining.

c. Fluorescent staining
   - Auramine staining - Mycobacterium tuberculosis.
   - QBC – for malaria.
   - Calcoflor white staining for fungus

d. Isolation of pathogens
   - Preparation of glass wares
   - Sterilisation procedures

- Media preparation-required for isolation & identification
- Quality check of all media - functional as well as sterility check and maintenance of the record
- Inoculation methods of various samples – surface, streak, stab etc depending on sample
- Incubation methods - aerobic, anaerobic, microaerophilic, capnophilic depending on the pathogens.

e. Identification of pathogen

- Colony characters – various characters to be noted in different media.
- Staining to identify – Gram's / Alberts / Acid Fast/ Lactophenol cotton blue depending on pathogen.
- Motility by hanging drop preparation and other methods.
- Biochemical reactions - phenotypic-enzymatic, oxidative fermentative, sugar fermentation, other special tests helping to identify up to species level.
- Serotyping.

- **Immunological tests**
  - Collection, preparation and storage of samples
  - Perform Rapid tests / /Latex agglutination/ ICT/ELISA etc
- **Molecular tests**
  - PCR/RTPCR – all steps till interpretation
  - CBNAAT
- **Biomedical waste management skills.**
- **Quality control skills in all areas.**

➢ Clinical Microbiology Skills

(Infectious Disease Case Based Skill)

i. Demonstrate ability to take and interpret the history of infectious disease case.
ii. Be able to clinically examine the case and diagnose.
iii. Take decision for choice of samples to be collected for diagnosis
iv. Suggest optimum choice of antimicrobial agent to be prescribed with reasons.

- **Infection Prevention and Control Skills-**
  i. Hand hygiene skills
  ii. Donning and doffing of PPE
  iii. Transmission based precautions in patient care
  iv. Segregation and disposal of biomedical waste in laboratory and hospital
  v. Handling of sharps
  vi. Post-exposure prophylaxis when exposed to blood and body fluids
  vii. Spillage management
  viii. Sterilization policy of environment and devices in the hospital as per the latest guidelines.
  ix. Calculation of HAI infection rates.
  x. Plan & conduct HAI surveillance & infection control audits

C2. Should be able to perform under supervision and/or interpret the results of *the following desirable procedures independently or as a part of a team*:

- **Demonstration of microbe by**
  i. IF – autoimmune diseases
  ii. IF – antigen demonstration in fungi/viral infection /cellular changes
- **Isolation & Identification using newer automated systems for bacterial i**dentification, Mycobacterial culture and Mycobacterial susceptibility
- Immunological test
  i. Nephelometry/ turbidometry method for quantitative CRP/ASO/RA test
  ii. Chemi-Luminiscence Immuno Assay
- Perform molecular & newer diagnostic tests for diagnosis of infectious disease.

C3. Should observe the following procedures independently or as a part of a team and/or interpret the results of* : (optional)

- Demonstration of microbes by Electron microscope
- Viral culture & identification of growth of viruses
- Immunological test
  iii. Quantiferon
  iv. Flowcytometry

- Molecular tests
    i. Genome sequencing methods
    ii. Molecular typing.

Note: If any of the above facilities are not available in the institute effort to collaborate and post the students in nearby laboratory to acquire the skills shall be made.

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used. **The suggested examples of teaching-learning methods are given below but are not limited to these. The frequency of various below mentioned teaching-learning methods can vary based on the subject's requirements, competencies, work load and overall working schedule in the concerned subject.**

A. Lectures: Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per requirements of the subject. All postgraduate trainees will be required to attend these lectures. Lectures can cover

topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. Salient features of Postgraduate medical curriculum
5. Teaching and assessment methodology.

Topic numbers 3, 4 & 5 can be done during research methodology/biostatistics and medical education workshops in the institute

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work / Bedside clinics: Minimum- once every 1-2 weeks

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department where a student is posted should participate in moderating the teaching-learning sessions during clinical rounds

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other

department/s on topics of current/common interest or clinical cases.

G. a. Rotational clinical / community / institutional postings (As per Table I)

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines. Few examples are listed below:

- Broad specialty departments
- Emergency/Casualty department
- Super specialty departments e.g. Cardiology / Endocrinology / Nephrology / Medical Oncology etc.
- Laboratory-based specialty units/departments e.g. Biochemistry / Microbiology/ Infection control unit/Laboratory Medicine etc.
- Medical Education Unit (MEU) or Department of Medical Education (DOME)

Clinical / Practical Training Schedule in Microbiology

The three-year training programme in microbiology is arranged in the form of rotational postings to different sections/laboratories/departments/disciplines for specified periods. Providing a suitable learning environment to develop clinical insight and achieve the outcomes of a medical microbiologist must be the driving force while planning posting schedules, which may be modified depending on needs, feasibility and exigencies. Student must be posted for various duration in different sections of Microbiology (like Bacteriology, Serology, Virology, Parasitology, Immunology, Mycobacteriology, Mycology and Hospital infection control), patient care areas in hospital (like emergency, OPDs, critical care areas, surgical and medical wards etc) as well as in community outreach programs, so that they can learn specific requirements of each section and participate in patient care and prevention of infectious diseases in the hospital as well as community. These postings are meant to provide hands-on training and develop required skills in clinical and laboratory medicine of microbiology.

Table 1. Following is the suggested plan of Rotation for Postgraduate students

Postings to Diagnostic Laboratories/Hospital/ Community-

Sl. no	Schedule of Rotation	Duration	Suggested Specific Learning Objectives
1	Microbiology laboratory Different sections of Bacteriology • Media preparation • Mycobacteriology • Serology/Immunology • Mycology • Virology • Parasitology • Molecular lab • Hospital Infection • Control including • BMW management	Distributed in various section depending upon training & departmental needs	As per the specific objectives in each section, a student is expected to acquire skills from basic to the most recent ones in diagnostic microbiology.
2	**Sample Collection area**	**Two weeks**	• To learn pre-analytical parameters & procedures at sample collection area • To communicate effectively with patients at sample collection area. • Learn to demonstrate respect, empathy & confidentiality when dealing with patients, samples and reports. • Demonstrate leadership skills in managing the functioning of the lab (staff management, preparing duty roster)
3	**Clinical Pathology** i. Hematology ii. Histopathology iii. Blood Bank	**Two weeks**	• Basic knowledge of clinical pathology (as applied to Microbiology) • Inflammation and repair • Intercellular substances and reaction • Pathological changes in the body in bacterial, viral, mycotic and parasitic infections **Clinical Pathology skills:**

			• Peripheral smear examination • CBC interpretation • Urine examination • Pathological investigations and their significance in infectious disease diagnosis **Blood Bank skills:** • Transfusion transmitted infection • Blood grouping • Screening of blood & blood donors • Counseling skills **Histopathology skills:** • Various stains and staining techniques used in histopathological examination of infectious agents • Identification of pathogen and/or pathological changes in tissue sections in infectious diseases
4	**Clinical Biochemistry**	**One week**	• Basic understanding of biochemistry as applied to immunological/ molecular methods for study of microbial diseases and pathogenesis of infections. • Significance of biochemical markers/profile in diagnosis, prognosis and monitoring of infective syndromes like sepsis
5	**ICTC /PPTCT/ART**	**Two weeks**	• HIV counseling skills • HIV Testing strategies • HIV Surveillance strategies • Treatment regimens in HIV positive case, management of drug resistance, and prophylaxis PEP, prevention & management of opportunistic infection
6	**Tuberculosis and RNTCP**	**Two weeks**	• Diagnosis of Pulmonary and extra pulmonary TB • Fluorescent Microscopy for TB • Molecular diagnosis • National Tuberculosis Elimination

			Program • Treatment regimens in susceptible and drug resistant TB cases
7	**District hospital postings** (mandatory) 3rd or 4th semester for 3 months	**Three months***	• Identify types of infections seen in community • Identify lacuna in KAP in community that promote development of infections • Choice of antimicrobials and treatment plan for infections in community • Infection control in community • Should contribute to strengthen the services of the district health system, the diagnostic laboratory services. • Participate in public health programs & research activities
8	**Clinical locations –** • **Medicine & allied** (General Medicine, Respiratory Disease, Skin & Venereal Disease) • **Pediatrics** • **Surgery & allied** (General Surgery, Orthopedic) • **Obstetrics and Gynecology**	**Two months Posting to be done for morning half of the day**	• Depending on the area of posting- • History taking and physical examination skills • Sample collection and transportation skills • Identification of common infections and make a differential diagnosis • Choose the appropriate laboratory investigations required for confirmation of diagnosis • Interpret the laboratory results and correlate them clinically. • Learn common treatment plan, particularly choice of antimicrobials and identify factors that influence choice of antimicrobials. • Acquire reasoning and critical thinking required in decision making when dealing with an infectious disease case • Infection control practices
9	**Critical care units-** i. Medical ICU	**Three weeks (in morning**	• All above in a critical setting along with

	ii. Surgical ICU ii. Neonatal/Pediatric ICU	**half day)**	• Availability and choice of specialized investigations necessary for optimum management of a critical patient with ID. • Significance and adherence to antibiotic policy and antibiotic stewardship program Infection control in ICU
10	**Institutional Super specialty wing** if available Dialysis, Oncology, Cardiology etc	**One week (morning half day)**	• To study infections seen in special situations along with their management & prevention approach
	Total duration of posting outside microbiology laboratory	**33 weeks**	

***Posting under "District Residency Programme"**

- Depending upon the objectives to be achieved, feasibility and availability of resources, the rotational postings can be within the hospital or outside the hospital.
- During the clinical posting, opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with clinicians in different hospital setting must be scheduled.
- The PG student must be tagged along with the resident of the clinical department for bedside case discussion, under the guidance of an assigned faculty. A minimum of five case histories shall be recorded by a student during course of study. The case history must be representative of different type of Infectious Disease (ID) cases likely to be encountered eg., those caused by different microbes in community and hospital setting, HAI, infections in critical care/ ward setting, infection in different age groups, infections in special host like Immunocompromised host, traveler, specific occupations etc.
- The process of recording case histories can begin in first half of 2nd year of PG program, after students have learnt about various infective syndromes. The severity and complexity of cases must progress gradually, with simple community-based

infection to begin with. At least one fourth of the cases recorded must have been discussed with the ID specialist or a clinician and their feedback/remarks documented in log book/ portfolio with their signatures.

- Documentation of students learning at the end of each posting is required.

Emergency duty

The student should also be posted for managing emergency laboratory services in Microbiology. He/she should deal with all emergency investigations in Microbiology.

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Time frame to acquire knowledge & skills Knowledge:

End of 1st year	End of 2nd year	End of 3rd year
General Microbiology: 1. History and Pioneers in Microbiology 2. Microscopy 3. Nomenclature and classification of microbes 4. Morphology of bacteria and other micro-organisms 5. Growth and Nutrition of bacteria 6. Bacterial metabolism 7. Sterilization and disinfection 8. Culture media and culture methods 9. Identification of bacteria 10. Bacterial toxins 11. Bacterial antagonism : Bacteriocins 12. Bacterial genetics 13. Gene cloning 14. Antibacterial substances used in the treatment of infections and drug resistance in bacteria 15. Bacterial ecology 16. Normal flora of human body, Hospital environment, Air, Water and Milk 17. Host-parasite relationship	**Immunology :Clinical** 1. Hypersensitivity 2. Immunodeficiency 3. Auto-immunity 4. Immune tolerance 5. Transplantation immunity 6. Tumour immunity 7. Immunoprophylaxis and immunotherapy **8.** Measurement of immunity	**General microbiology & Immunology** **All**

Immunology : 1. Innate and acquired immunity 2. Antigens 3. Immunoglobulins 4. Antigen and antibody Reactions 5. Complement System 6. The normal immune system: structure and function 7. Immune Response	**Systematic bacteriology** 1. Streptococcus and Lactobacillus 2. Staphylococcus and micrococcus 3. Pseudomonas 4. The Enterobacteriaceae 5. Mycobacteria 6. Corynebacterium and other Coryneform bacteria 7. Vibrios, Aeromonas, Plesiomonas, Campylobacter & Spirillum 8. Neisseria, Branhamella & Moraxella 9. Haemophilus & Bordetella 10. Bacillus: the aerobic spore bearing bacilli 11. Clostridium: the spore-bearing anaerobic bacilli 12. Non-sporing anaerobe 13. The Spirochaetes	**Systematic bacteriology (2nd year) plus:** 1. Actinomycetes, Nocardia and Actinobacillus 2. Erysipelothrix and Listeria 3. The Bacteroidaceae: Bacteroides, fusobacterium and Leptotrichia 4. Chromobacterium, flavobacterium 5. Acinetobacter and Alkaligenes 6. Pasteurella, Francisella 7. Brucella 8. Chlamydia, Rickettsiae 9. Mycoplasmatales: Mycoplasma, Ureaplasma and Acholeplasma 10. Miscellaneous bacteria
Microbiology applied to Tropical medicine and Recent advances 1. Normal Microbial flora 2. Epidemiology of infectious diseases 3. Hospital acquired infections & Hospital waste disposal 4. Bacteriology of water milk and air	**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 & lab diagnosis of viruses 7. Epidemiology of viral infections 8. Anti-viral drugs 9. Bacteriophages 10. Herpes viruses 11. Paramyxoviruses 12. Influenza virus 13. Hepatitis viruses 14. Rabies virus 15. HIV	**VIROLOGY (2nd year): plus** 1. Vaccines 2. Pox viruses 3. Vesicular viruses 4. Toga viruses 5. Bunya viruses 6. Arena viruses 7. Marburg and Ebola viruses 8. Rubella virus 9. Orbi viruses 10. Respiratory diseases : Rhinoviruses, adenoviruses and corona viruses 11. Enteroviruses;

	PARASITOLOGY: 1. General Parasitology *2.* Protozoan parasites of medical importance: *Entamoeba, Giardia,Trichomonas, Leishmania, Trypanosoma, Plasmodium*	**PARASITOLOGY (2nd year): plus** **1. Protozoan parasites of medical importance:** *Toxoplasma, Sarcocystis, Cryptosporidium, Babesia, Balantidium* etc. **2. Helminthology:** All those medically important helminthes belonging to Cestoda, Trematoda and Nematoda **3. Cestodes:** Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipyllidium Multiceps etc. **4. Trematodes:** Schistosomes, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc. **5. Nematodes:** Trichuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus, 6.**Ecto-parasites:** Common arthropods and other vectors viz., Mosquito, Sand fly, Ticks, Mite, Cyclops

	MYCOLOGY 1. The morphology and reproduction in fungi 2. Classification of fungi *3. Dermatophytes, Candida* 4. *Aspergillus*	**MYCOLOGY (2nd year): plus** 1. Contaminant and opportunistic fungi 2. Fungi causing superficial mycoses 3. Fungi causing subcutaneous mycoses 4. Fungi causing systemic infections **5.** Anti-mycotic agents

3rd year

- **Microbiology applied to tropical medicine and recent advances**
  1. Infections of various organs and systems of human body
  2. Molecular genetics as applicable to microbiology
  3. Vaccinology: principle, methods of preparation, administration of vaccines.
  4. Bio-terrorism

Allied basic sciences

a) **Biochemistry:** Basic understanding of biochemistry as applied to immunological/ molecular methods for study of microbial diseases and pathogenesis of infections.

- Protein purification and estimation
- Protein estimation
- Nucleic acid purification and characterization
- Agarose and polyacrylamide gel electrophoresis: principles
- Ultracentrifugation – principles
- Column chromatography –principles

Skills

1st year residency-skills list					
Area	**Sl. no.**	**Procedure**	**Observed no.**	**Assisted no./ practice**	**Performed independently No.(under**
General microbiology	1.	Microscopy for unstained preparations/ wet mount	5	5	10
	2.	Microscopy for stained preparation	5	5	10

	3.	Preparation of direct smears from clinical specimens	5	5	10
	4.	Hanging drop preparation	5	5	10
	5.	Washing, sterilization and packing of glassware	10 sessions	-	-
	6.	Infection control activities- environmental	10	10	-
	7.	Identification of HAI	5	5	--
	8.	Calculation of HAI quality indicators	5	5	--
	9.	Bacteriology of water	5	5	-
	10.	Bacteriology of air	5	5	-
	11.	Antibiotic disc preparation	-	-	-
	12.	Handling of laboratory animal	-	-	-
	13.	Methods for preservation of bacteria	10	-	-
	14.	Maintenance of stock cultures	10	-	-
Staining	1.	Gram staining	10	20	30
	2.	Acid fast staining (Ziehl-Neelsen method)	10	20	30
	3.	Albert staining	5	10	10
	4.	Modified ZN staining for *M. leprae*	5	5	5
	5.	Modified ZN staining for *Nocardia*	5	5	5
	6.	IQC-staining	5	5	5
Media preparation	1.	Preparation of stains	4	4	4
	2.	Preparation of reagents	10	10	10

	3.	Preparation, plugging, pouring & Quality Control (QC) of culture media	20	20	30
	4.	Operation & maintenance of autoclave	10	10	20
Bacteriology	1.	Specimen collection for Blood Culture	5	5	5
	2.	Inoculation of liquid & solid media	20	20	30
	3.	Identification test	20	20	30
	4.	Antimicrobial sensitivity testing- modified Kirby-bauer technique	10	20	30
	5.	IQC- Antibiotic disc potency	5	5	-
	6.	Operation of BacT/ALERT	5	10	20
	7.	Operation of Vitek 2 compact	5	10	20
	8.	Petroff's concentration technique	10	10	20
	9.	AFB culture & sensitivity	5	10	20
Mycology	1	KOH Wet mount	5	10	20
	2	Germ tube test	5	10	20
	3	Slide culture	5	10	20
	4	Negative staining for fungus	5	5	5
	5	LPCB mount	10	10	10
Parasitology	1	Giemsa staining for thick & thin peripheral blood smear	5	-	-

	2	Stool wet mount for R/M	10	20	30
	3	Stool concentration techniques	5	10	5
	4	Modified ZN staining for C. parvum	2	2	2
Serology/ Immunology	1	Phlebotomy & separation of serum	10	10	5
	2	Operation & maintenance of mini-VIDAS	5	10	20
	3	Operation & maintenance of ELISA reader & washer	5	10	--
	Performance of serological tests				
	1.	Latex agglutination test(RA, ASO)	10	20	30
	2.	RPR card test	10	20	30
	3.	Tube agglutination test	10	20	30
	4.	Gold conjugate Rapid card test	10	20	30
	5.	ANA by IF	5	5	--
	6.	ANA by Immunoblot	5	5	--
	7.	IQC-serology	5	5	5

2nd year residency-skill list

Area	Sl. no.	Procedure	Observed no.	Assisted no./	Performed Independently
General microbiology	1.	Microscopy for unstained preparations/ wet mount	---	- -	- -
	2.	Microscopy for stained preparation	--	- -	- -
	3.	Preparation of direct smears from clinical specimens	--	- -	- -

	4.	Preparation of slit skin smear for lepra bacilli	5	5	5
	5.	Hanging drop preparation	--	- -	1 0
	6.	Washing, sterilization and packing of glassware	05 sessions	-	-
	7.	Infection control activities- environmental sampling	--	1 0	1 0
	8.	Identification of HAI	--	5	5
	9.	Calculation of HAI quality indicators	--	5	5
	10.	Bacteriology of water	--	5	5
	11.	Bacteriology of air	--	5	5
	12.	Antibiotic disc preparation	05 lots	-	-
	13.	Handling of laboratory animal	-	-	-
	14.	Methods for preservation of bacteria	--	0 5	1 0
	15.	Maintenance of stock cultures	--	0 5	1 0
Staining	1	Gram staining	--	-	3 0
	2	Acid fast staining (Ziehl-Neelsen method)	--	- -	3 0
	3	Albert staining	--	-	0 5
	4	Modified ZN staining for *M. leprae*	--	- -	5
	5	Modified ZN staining for *Nocardia*	--	- -	5

	6	IQC-staining	--	-	5
Media preparation	1	Preparation of stains	--	-	5
	2	Preparation of reagents	--	-	15
	3	Preparation, plugging, pouring & Quality Control	--	-	50
	4	Operation & maintenance of autoclave	--	-	20
Bacteriology	1	Specimen collection for Blood Culture	--	-	5
	2	Inoculation of liquid & solid media	--	-	30
	3	Identification test	--	-	3
	4	Antimicrobial sensitivity testing- modified Kirby- bauer technique	--	-	30
	5	IQC- Antibiotic disc potency	--	5	5
	6	Operation of BacT/ALERT	--	-	20
	7	Operation of Vitek 2 compact	--	-	20
	8	Petroff's concentration technique	--	-	20
	9	AFB culture & sensitivity	--	-	20
Mycology	1	KOH Wet mount	--	-	2
	2	Germ tube test	--	-	2
	3	Slide culture	--	-	2
	4	Negative staining for fungus	--	-	5
	5	LPCB mount	--	-	1

Parasitology	1	Giemsa staining for thick & thin peripheral blood smear	-	10	-
	2	Stool wet mount for R/M	--	--	30
	3	Stool concentration techniques	--	--	5
	4	Modified ZN staining for C.parvum	--	--	2
Serology/ Immunology	1	Phlebotomy & separation of serum	--	--	5
	2	Operation & maintenance of mini-VIDAS	--	--	20
	3	Operation & maintenance of ELISA reader & washer	--	--	20
	Performance of serological tests				
	1	Latex agglutination test(RA, ASO, CRP)	--	--	30
	2	RPR card test	--	-	3
	3	Tube agglutination test	--	--	30
	4	Gold conjugate rapid card test	--	--	30
	5	ANA by IF	--	-	1
	6	ANA by Immunoblot	--	-	1
	7	IQC-serology	--	-	5

3rd year residency-skill list

Area	Sl. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed independently no. (under

General microbiology	1.	Microscopy for unstained preparations/ wet mount	---	- -	--
	2.	Microscopy for stained preparation	--	- -	--
	3.	Preparation of slit skin smear for lepra bacilli	--	- -	--
	4.	Hanging drop preparation	--	- -	--
	5.	Washing, sterilization and packing of glassware	05 sessions	-	-
	6.	Infection control activities- environmental sampling	--	- -	10
	7.	Identification of HAI	--	- -	5
	8.	Calculation of HAI quality indicators	--	- -	5
	9.	Bacteriology of water	-	-	5
	10	Bacteriology of air	-	-	5
	11	Antibiotic disc preparation	-	5 lots	2 lots
	12	Handling of laboratory animals	-	-	10
	13	Methods for preservation of bacteria	-	-	10
	14	Maintenance of stock cultures	-	-	10
Staining	1.	Gram staining	--	-	30
	2.	Acid fast staining (Ziehl-Neelsen method)	--	- -	30
	3.	Albert staining	--	-	05

	4.	Modified ZN staining for *M. leprae*	--	- -	5
	5.	Modified ZN staining for *Nocardia*	--	- -	5
	6.	IQC-staining	--	-	5
Media preparation	1.	Preparation of stains	--	- -	10
	2.	Preparation of reagents	--	-	1
	3.	Preparation, pouring & QC of culture media	--	- -	50
	4.	Operation & maintenance of autoclave	--	- -	20
Bacteriology	1.	Specimen collection for Blood Culture	--	- -	5
	2.	Inoculation of liquid & solid media	--	- -	30
	3.	Identification test	--	- -	30
	4.	Antimicrobial sensitivity testing- modified Kirby-bauer technique	--	- -	30
	5.	IQC- Antibiotic disc potency	--	- -	5
	6.	Operation of BacT/ALERT	--	- -	20
	7.	Operation of Vitek 2 compact	--	- -	20
	8.	Petroff's concentration technique	--	- -	20
	9.	AFB culture & sensitivity	--	- -	20
Mycology	1	KOH Wet mount	--	-	2
	2	Germ tube test	--	-	2
	3	Slide culture	---	-	2

	4	Negative staining for fungus	--	- -	5
	5	LPCB mount	--	-	1
Parasitology	1	Giemsa staining for thick & thin peripheral blood smear	--	- -	-
	2	Stool wet mount for R/M	--	-	3 0
	3	Stool concentration techniques	--	-	5
	4	Modified ZN staining for *C. parvum*	--	- -	2
Serology/ Immnology	1	Phlebotomy & separation of serum	--	- -	5
	2	Operation & maintenance of mini-VIDAS	--	- -	2 0
	3	Operation & maintenance of ELISA reader & washer	--	- -	2 0
	Performance of serological tests				
	1	Latex agglutination test(RA, ASO, CRP)	--	- -	3 0
	2	RPR card test	--	-	3
	3	Tube agglutination test	--	- -	3 0
	4	Gold conjugate rapid card test	--	- -	3 0
	5	ANA by IF	--	-	1
	6	ANA by Immunoblot	--	-	1
	7	IQC-serology	--	-	5

G b. *Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MD/MS in broad specialties in all Medical colleges/ Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education

(Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation shall be termed as "District Residency Programme" and the PG medical student undergoing training shall be termed as "District Resident".

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.}

Opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with specialists / clinicians in different hospital settings must be scheduled to address antimicrobial resistance issues and strategies to deal with it.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced

I. Training in teaching & learning skills

MEU/DOME should train PG students in education methodologies and assessment

techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

J. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The logbook is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the Log Book is to:

a) Help maintain a record of the work done during training.
b) Enable Faculty/Consultants to have direct information about the work done and intervene, if necessary.
c) Provide feedback and assess the progress of learning with experience gained periodically.

The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination

The PG students shall be trained to reflect and record their reflections in logbook particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty shall refer to the MCI Logbook Guidelines uploaded on the Website.

K. Course in Research Methodology: All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and

generate the online certificate on successful completion of the course.

Other aspects

- The Postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The Postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS).
- The Postgraduate trainees must undergo training in information technology and use of computers.

During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learnt initially on the models, later to be performed under supervision followed by independent performance. For this purpose, provision of skills laboratories in medical colleges is mandatory.

Skills & performance

The student should be given graded responsibility to enable learning by apprenticeship. The faculty throughout the year should assess competence of the student in skills. Feedback must be given and area of improvement/remarks should be mentioned for the skill and student should be re-assessed for the skills which are not acquired. To go to the next level, it should be mandatory for the student to acquire lower level skills satisfactorily, i.e only on satisfactory completion of assisted/performed with assistance skills should the student be permitted to perform the skill independently

ASSESSMENT

I. FORMATIVE ASSESSMENT, ie., assessment to improve learning

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide

feedback to improve learning; it should also cover professionalism and communication skills. The Internal Assessment should be conducted in theory and practical/clinical examination, should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. At least five clinical cases shall be assessed through discussion of case histories recorded by the students while posted in clinical setting and recorded along with feedback (preferably by ID specialist if available /clinician).

Quarterly assessment during the MD training should be based on:

- Case presentation, case work up, case handling/management
- Journal club- Paper presentation & discussion
- Seminar/Lecture/ group discussion
- Case based /Laboratory or Skill based discussions
- Interdepartmental case or seminars, clinical microbiology round/ grand round/ seminar-
- discussion

Note: These sessions may be organized and recorded as an institutional activity for all postgraduates.

- Attendance at Scientific meetings, CME programmes

The student is to be assessed periodically as per categories listed in the postgraduate student appraisal form (Annexure I1).

II. SUMMATIVE ASSESSMENT, i.e., assessment at the end of training

Essential pre-requisites for appearing for examination include:

1) **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.

2) At least **two presentations** at national level conference. One research paper should be published /accepted in an indexed journal. **(It is suggested that the local or University Review committee assess the work sent for publication).**

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and

Oral examination

The postgraduate examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory examination

The examinations shall be organized on the basis of 'Grading 'or 'Marking system' to evaluate and to certify postgraduate student's level of knowledge, skill and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D shall be held at the end of 3rd academic year

There will be four theory papers (as per PG Regulations).

Paper I: General Microbiology and Immunology (GM & IG).

Paper II: Clinical / Systemic Microbiology (CM I).

Paper III: Clinical / Systemic Microbiology (CM II).

Paper IV- Recent Advances & Applied Microbiology (AM).

Universities shall prepare a blueprint for assessment of competencies and ensure 60-70% weightage is given to higher levels in Blooms taxonomy (application and above) in theory with more number of clinical scenario based questions. **In Paper II/III (CM – II/III) – distribution of Clinical Scenarios testing the ability of a student to deal with infections caused by various etiological agents is suggested to be 40-50% Bacterial, 20-30% Viral, 10-20 % each for Mycobacterial, Parasitic & Fungal pathogens**

Practical/Clinical and Oral/Viva Voce examination

Practical examination

- Practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor & affective domain.
- Type of Exercises for Practical Examination should include cases (actual or paper based

depending on the feasibility) of infectious diseases for workup and evaluation of clinical microbiology competence along with exercises to test ability to perform bacteriology, virology, parasitology, mycology, mycobacteriology, immunology, serology with microscopic examination and antimicrobial susceptibility report,.

Oral/Viva voce examination:

The simultaneous viva-voce on the clinical case & lab based practical exercise should be taken along with main viva by each examiner separately. Oral examination shall be comprehensive enough to test the postgraduate student's overall ability to apply knowledge of the subject to hospital/community/research areas focusing on psychomotor and affective domain skills.

Table 2. Suggested Day wise distribution of practical exercises:

Ex. No	Day -1	Ex.No	Day-2
1	**Clinical Microbiology exercise** (Give a real clinical case /paper based scenario addressing commonly seen cases in bacteriology/mycobacteriology/virology/mycology/parasitology/HAI /AMR/out break /national project based etc of infectious diseases to the PG for workup and evaluation with respect to case history, basic physical examination, required investigations, interpretation of diagnostic test results, and therapeutic management decisions including prescription of antibiotics, along with IC practices)	**1 cont**	Clinical Microbiology exercise - Conclusion
2	**Long Exercise- Bacteriology** (Mixed culture given with a	**2 cont**	Long Exercise - Bacteriology conclusion

	clinical history representing any specimen collected from respective systemic infection)		
3	**Short Exercise – Bacteriology** (Identification of a pure culture)	**3 cont**	Short Exercise - Bacteriology conclusion
4	**Serology Exercise** (In a clinical case, choice of test & technique with interpretation of test results)	**4 cont**	Serology cont. if required
5	**Virology techniques** (In a clinical case, choice of test & technique with interpretation of test results. Viral serology/ Molecular techniques depending upon availability)	**5 cont**	Virology cont. if required
6	**Mycology** (Identification of fungi in a clinical case)	**6 cont**	Mycology cont. if required
7	**Parasitology** (In a clinical case, choice of test & technique with interpretation of test results Stool examination, Examination of Peripheral blood smear etc	9	**Pedagogy** (10-15minutes)
8	**Slides** (Slides including histopathology for microscopic identification & discussion	10	**Log book, Dissertation Viva, Grand-Viva**

Criteria for evaluation

Sl.No	Description	Details
1	**Theory**	
	No. of theory papers	4

	Marks for each theory paper	100
	Total Marks for theory paper	400
	Passing minimum for theory	200/400 (40% minimum in each paper)
2	Practical	300
3	Viva Voce including pedagogy	100
	Passing minimum for practical including viva voce	200/400
	The candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory – aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%) (2) Practical/Clinical and Viva voce - aggregate 50% (3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination. (4) Five per cent of mark of total marks of Clinical/Practical and Viva Voce marks (20 marks) will be of dissertation/thesis and it will be part of clinical/practical examination marks. External examiner outside the state will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce. (5) No grace mark is permitted in post-graduate examination either for theory or for practical	

PRACTICAL EXAMINATION PATTERN

Sl.No	Exercise	Marks allotted
1	**Long Exercise- Bacteriology:** (Mixed culture given with a clinical history representing any specimen collected from respective systemic infection)	50
2	**Short Exercise- Bacteriology:** (Identification of a	30

	pure culture)	
3	**OSPE:** a) **Clinical Microbiology exercise** (A real clinical case /paper based scenario addressing commonly seen cases in bacteriology/ mycobacteriology/ virology/ mycology/ parasitology/ HAI/AMR/out break /national project based etc of infectious diseases to the PG for workup and evaluation with respect to case history, basic physical examination, required investigations, interpretation of diagnostic test results, and therapeutic management decisions including prescription of antibiotics, along with IC practices) b) **Special stain**	60
4	**Virology**	30
5	**Serology / Immunology**	30
6	**Parasitology:** (In a clinical case, choice of test & technique with interpretation of test results Stool examination, Examination of Peripheral blood smear etc	30
7	**Mycology**	30
8	**Slides**	20
9	**Dissertation viva**	20
	Total	**300**
1	Pedagogy	20

2	Grand Viva	80
	Total	**100**

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Recommended Reading Books (latest edition)

1. Forbes B, Sahm D, Weissfeld A. Bailey and Scott's Diagnostic Microbiology, Mosby, St.Louis.
2. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. Color Atlas and Textbook of Diagnostic Microbiology, J.B. Lippincott, Philadelphia.
3. Murray PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH. Manual of Clinical Microbiology, American Society for Microbiology.
4. Garcia LS, Bruckner DA. Diagnostic Medical Parasitology, American Society for Microbiology.
5. Mackie & Mccartney Practical Medical Microbiology by J.G. Collee, A.G. Fraser
6. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases: by John E. Bennett, Raphael Dolin, Martin J. Blaser
7. Manson's Tropical Diseases by Jeremy Farrar; Peter J. Hotez; Thomas Junghanss; Gagandeep Kang; David Lalloo; Nicholas J. Wh
8. Harrison's Infectious Diseases, by Dennis L. Kasper; Anthony S. Fauci
9. Hunter's Tropical Medicine and emerging infectious disease by Edward T. Ryan, David R. Hill, Timothy P. Endy
10. Clinical Immunology Principles and Practices by Robert Rich
11. Anaerobic Bacteriology, Clinical and Laboratory practice by A. Trevorwillis
12. Topley & Wilson, Principles of Bacteriology, Virology and Immunity by M.T. Parker and L.H. Collier
13. Topley and Wilson's Microbiology and Microbial infection by Brian W. J. Mahy, Graham Selby Wilson, and William Whiteman Carlton Topley
14. Text book of Medical Mycology by Jagadish Chandra
15. Atlas of Fungal infection by Carol A. Kauffman
16. Bennett and Brachman's Hospital Infection, 6th edition, William R Jarvis.

Journals

03-05 international Journals and 02 national (all indexed) journals

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BLUE PRINT

MD Microbiology Theory Examination

Weightage should be given to higher levels in Blooms taxonomy (application and above)

All short essays should be structured.

In Paper II/III the questions should be 40-50% Bacterial, 20-30% Viral , 10-20% each for Mycobacterial ,Parasitic and Fungal pathogens. There should be at least 6 clinical scenario based questions out of a total 10.

Summative Theory Examination – 4x 100 =400 marks

Marks distribution for theory question papers

Theory	Topics		Question Pattern	Marks allotment
PAPER I	General Microbiology & Immunology			
	1.	General Microbiology	Short essay	50
	2.	Immunology	Short essay	50
			Total	100
PAPER II	Clinical/Systemic Microbiology (CM I)			
	1.	Blood & CVS infections	Short essay	30
	2.	Gastrointestinal & Hepatobiliary system infections	Short essay	30
	3.	Skin & soft tissue infections	Short essay	20
	4.	Musculoskeletal infections	Short essay	20
			Total	100
PAPER III	Clinical/Systemic Microbiology (CM II)			
	1.	Respiratory System infections	Short essay	20
	2.	Central Nervous system infections	Short essay	20
	3.	Genitourinary tract infections	Short essay	20
	4.	Infection control	Short	10

		practices	essay	
	5.	Zoonotic infections	Short essay	10
	6.	Congenital infections and Miscellaneous	Short essay	20
			Total	100
Paper IV	Recent advances & Applied Microbiology			100
	1.	General Microbiology and Immunology	Short essay	20
	2.	Clinical Microbiology including Virology, Parasitology & Mycology	Short essay	30
	3.	Recent advances in laboratory testing	Short essay	20
	4.	Infection control practices	Short essay	30

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MODEL QUESTION PAPER

PAPER-I

General Microbiology & Immunology

Date: **Time: 3 hrs** **Max marks: 100**

Instructions: Answer all the questions

Draw neat labelled diagram wherever necessary

I. Short Essays: 10 x 10 marks

1. Enlist the general properties of cytokines. Enumerate those cytokines which play a role in acute phase response. Add a note on SIRS. (2+5+3)
2. Describe the mechanisms of innate immunity. Add a note on toll like receptors and their significance (7+3)
3. Enumerate steps in the investigation of an outbreak. Add a note on microbial typing mechanisms and its role in outbreak investigation (5+5)
4. Classify disinfectants. Write in brief about their mode of action and tests to determine their efficacy. (2+5+3)
5. What are super antigens? Enumerate 4 super antigens. Describe their role in immunity. (1+1+8)
6. Discuss the role of point of care testing in microbiology
7. Discuss the role of T-lymphocyes and their subsets in immune response. Add a note on evaluation of cell mediated immunity. (7+3)
8. What are biofilms? Describe their clinical significance and role in antibiotic resistance. Add a note on their detection in the laboratory. (2+4+4)
9. Classify mechanisms of antibiotic resistance. Explain acquired resistance mechanisms in detail with suitable examples. (3+7)
10. Describe Biosafety and its implications in medical microbiology laboratory.

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MODEL QUESTION PAPER
PAPER-II
Subject: Clinical Microbiology-I

Date: **Time: 3 hrs** **Max marks: 100**

Instructions: Answer all the questions
Draw neat labelled diagram wherever necessary

II. Short Essays: 10 x 10 marks

1. A 29 year old man was admitted to hospital with cellulitis of left foot following fever for two weeks. On examination he had multiple needle prick marks on his limbs. He had splinter hemmorhages and mild spleenomegaly. A systolic murmur was heard on CVS examination. Typical ECHO findings were also noted. Two sets of blood culturs were sent and grew Gram positive cocci.

   a. What are the provisional diagnosis & the likely causative agent?
   b. List the micro-organisms associated with this condition. Describe the pathogenesis of this condition.
   c. Describe the lab diagnosis of this condition.
   d. What are the criteria for diagnosing this condition? (2+3+3+2=10)

2. A 56 year woman who had received multiple blood transfusions in the past 6 months presented with persistent fatigue, loss of appetite, nausea, vomiting and abdominal pain for the last 10 days. She had a history of passing high coloured urine. Her Liver function tests showed elevated bilirubin and enzymes. A viral hepatitis panel was advised and the patient monitored according to its results. (2+3+3+2=10)

   a. What are the tests included in viral hepatitis panel for this patient?
   b. If found positive for HBs Ag, what is the course of this disease?
   c. How do you monitor a case of HBV infection on therapy?
   d. What is the specific prophylaxis available for HBV infection?

3. Enlist the parasites infecting GIT. Describe their larval forms. Add a note on Clonorchis sinensis. (2+5+3=10)

4. A 45-year-old female swimmer noticed a painful swelling of both her cheeks 3 months ago. Multiple erythematous nodules have been found since 2 months ago. Two weeks ago, a pus discharge from the nodule was noticed. The color of the pus was light yellowish while sticky in character. Pus culture was done but showed no

growth. The lesions were not improved even after an oral dicloxacillin use. The culture was repeated and yielded no growth.

a. What are the further investigations required to arrive at a diagnosis?
b. What is the most likely etiological agent in this case?
c. Describe the virulence mechanism & pathogenesis of this organism.
d. Briefly describe the other mycobactria causing skin infections. (3+1+3+3=10)

5. A young lady developed nodular lesions on his foot which gradually turned into ulcers and involved the entire foot and lower leg. She gave history of insect bite in that area a few weeks back. Culture of pus did not yield growth. A fungal etiology was suspected and pus was sent for fungal KOH mount and culture. Discuss the differential diagnosis of this case.
6. A 32 year old business executive complains of recurrent abdominal pain, feeling of fullness and bloating. On examination, the pain is localized to epigastric region. He also gives history of occasional vomiting.
    a. Identify this clinical condition.
    b. Name the etiological agent responsible for this.
    c. Describe its virulence factors and pathogenesis
    d. Describe the lab diagnosis of this condition. (1+1+4+4=10)
7. Weil's disease- Pathogenesis, Lab diagnosis and Epidemiology (4+4+2=10)
8. HIV- genes, antigens, subtypes and pathogenesis.
9. Coxsackieviruses and their infections
10. A 48 year-old male patient from Bihar, had been suffering from hypopigmented skin lesions on his face and limbs for 18 months. The patient gave a history that about 12 years ago he had an illness with fever, weakness and enlarged abdomen was treated for one month. Now he has a papulo-nodular lesion on his chin, cheeks and severely ulcerated lesions spread at the other parts of his body. The lesions are non-itching with intact sensitivity. Critically evaluate this case.

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MODEL QUESTION PAPER

PAPER-III

Subject: Clinical Microbiology-II

Date: **Time: 3 hrs** **Max marks: 100**

Instructions: Answer all the questions
Draw neat labelled diagram wherever necessary

III. Short Essays: 10 x 10 marks

1. During winter, 80-year-old man with COPD & diabetes was admitted to hospital for cough & fever of four days. He rapidly progressed in a day and was hypoxic and in respiratory distress. Chest X ray showed bilateral ground glass appearance with areas of consolidation.

   a. What is the provisional diagnosis & the likely causative agent?
   b. List two differential diagnosis of this condition.
   c. Describe the lab diagnosis of this condition.
   d. Describe the antigenic variations of this causative agent?
   e. Briefly describe its immunoprophylaxis. (1+1+4+2+2=10)

2. A 28-year-old lady presented to antenatal clinic in her 8 th week of pregnancy. This was her first pregnancy (G1P0) and she had no other past medical history. On examination she had non tender enlarged cervical and axillary lymph nodes and splenomegaly. Toxoplasma IgM was strongly positive and IgG was also positive. (1+2+5+2=10)

   a. What are the probable diagnosis?
   b. How do you directly demonstrate this parasite by laboratory methods?
   c. Describe in detail the serological tests in this condition?
   d. Describe in brief the life cycle of this parasite.

3. Describe the pathogenesis of Rabies. Describe in brief ARV. What are the prophylactic measures for a case of dog bite? (3+2+5=10)

4. A 56-year-old farmer from India presented with on and off fever and joint pains. He was closely associated with animals and gave history of consuming raw milk. He subsequently developed an abscess in the right iliac fossa. Both his blood & pus culture grew gram negative bacilli.

   a. What is the likely organism?

b. Describe the pathogenesis of this condition.
c. Describe in detail its laboratory diagnosis.
d. What precautions are recommended while handling this organism in laboratory? (1+3+4+2=10)

5. Define CAUTI. Describe in detail the diagnosis of CAUTI in a hospitalized patient.
6. A 26-year-old business executive complains of urethral discharge and dysuria for two weeks. The discharge was sent for investigations. Gram smear revealed many pus cells but no bacteria. Cultures were negative for bacteria.
    e. Identify this clinical condition.
    f. Name the etiological agents responsible for this.
    g. Describe the lab diagnosis of this condition. (1+3+6=10)
7. Describe antimicrobial stewardship in detail.
8. Describe viral oncogenesis.
9. List the flavi viruses. Describe the pathogenesis and lab diagnosis of Dengue virus infections.
10. A 48-year-old male patient of retroviral infection was admitted with features of pneumonia. His chest X ray showed interstitial lung infiltrates. He was tentatively given TMP-SMZ and showed some improvement. The sputum culture yielded only oropharyngeal flora.

a. What is the most probable etiological agent in this case?
b. Describe the life cycle of this agent.s
c. Describe the pathogenesis of this condition
d. Describe the lab diagnosis of this condition. (1+2+3+4=10)

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MODEL QUESTION PAPER
PAPER-IV
Subject: Recent Advances and Applied Microbiology

Date: **Time: 3 hrs** **Max marks: 100**

Instructions: Answer all the questions
Draw neat labelled diagram wherever necessary

I. Short Essays: 10 x 10 marks

1. Genome sequencing: Principles, Applications, Challenges
2. Chemiluminescent immunoassay
3. Discuss in brief role of faecal microbiota transplant.
4. Quality control in microbiology
5. Drug resistance in plasmodium species. Add note on recent updates in
6. malarial vaccines.
7. Newer disposal technology in Biomedical waste management.
8. Describe various steps involved in outbreak investigations of MRSA infection in NICU
9. Give an account of Newer antifungal drugs
10. Discuss in brief about automation in microbiology
11. Emerging and reemerging infection with a note on recent diagnostic methods

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Annexure I

Following are the competencies to be achieved under Antimicrobial Resistance Detection and Prevention:

1. Demonstrate in depth knowledge of classification, mechanism of action and drug resistance of antimicrobials (antibacterials, antiviral, antifungal, antimycobacterial and antiparasitic agents).
2. Explain various phenotypic and genotypic methods used in laboratory for detection of drug resistant strains and their implications in patient care.
3. Demonstrate skills in performing antimicrobial susceptibility testing with calculations of MIC/MBC by various phenotypic and genotypic methods and interpret results as per standard guidelines (CLSI, EUCAST etc).
4. Detect and report bacterial drug resistance by identification of the commonly isolated drug resistant strains (MRSA, VRSA, VRE, CRE, MBL, AMP-C etc) and choose the most appropriate agent for therapeutic use in a specific clinical scenario.
5. Explain the implications of AST result on antimicrobial therapy to clinicians/colleagues.
6. Communicate effectively with clinicians to guide and create an antimicrobial treatment plan based on organism identification and susceptibility test.
7. Explain the concept of narrow/broad spectrum of antimicrobials, PK/PD parameters and their significance on response to antimicrobial therapy.
8. Explain significance of monitoring of antimicrobial therapy in patient care.
9. Explain the concept of empiric, syndromic and culture-based treatment strategies for treating infections.
10. Explain the need to de-escalate from empirical broad-spectrum therapy to targeted narrow-spectrum therapy.
11. Explain the importance of appropriate use of antimicrobial agents, risk of antimicrobial resistance and spread of AMR in the health care environment and the community.
12. Explain the concept of normal microbial flora, colonization, contamination and infection with its role in deciding antimicrobial therapy.
13. Demonstrate knowledge about antimicrobial prophylaxis including peri-operative

surgical prophylaxis regimens.

14. Describe the concept of first-, second- and third-line antimicrobial therapy for infections
15. Explain the importance of restricted reporting of susceptibility data by the laboratory to control antimicrobial use.
16. Explain the concept and application of WHO tool for optimizing use of antimicrobial agents: Access, Watch and Reserve (AWaRe)
17. Explain the importance of antimicrobial formularies, consumption data and prescribing policies and processes to monitor use of antimicrobials in hospitals.
18. Effectively use information technology (LIS, WHO NET etc.) for data collection and surveillance of AMR in microbiology laboratory.
19. Explain significance of collecting local antimicrobial resistance data and its use in deciding direct empirical antimicrobial therapy.
20. Demonstrate knowledge and skills to develop antibiotic policy by using local AMR data in hospital.
21. Explain significance of adherence to antibiotic policy and antibiotic stewardship program.
22. Be a part of antimicrobial stewardship team for the institution.
23. Demonstrate knowledge about recent published guidelines that recommend antimicrobial treatment therapy in various clinical situations.
24. Effectively communicate with the patients/ relatives about the role of antimicrobial agents in their disease and advice on appropriate use.
25. Actively engage with patients, relatives and the community to advise on the role of antimicrobial agents in therapy and the threat of resistance.
26. Participate in clinical audit and quality improvement programmes relating to antimicrobial use.
27. Teach students, colleagues and other health professionals regarding antimicrobial use and resistance

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Annexure II

Student appraisal form for MD in Microbiology

	Elements	Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	**Scholastic aptitude and learning**										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned(e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self-directed Learning										
2	**Work related to training**										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										

2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee?	Yes	No								
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										