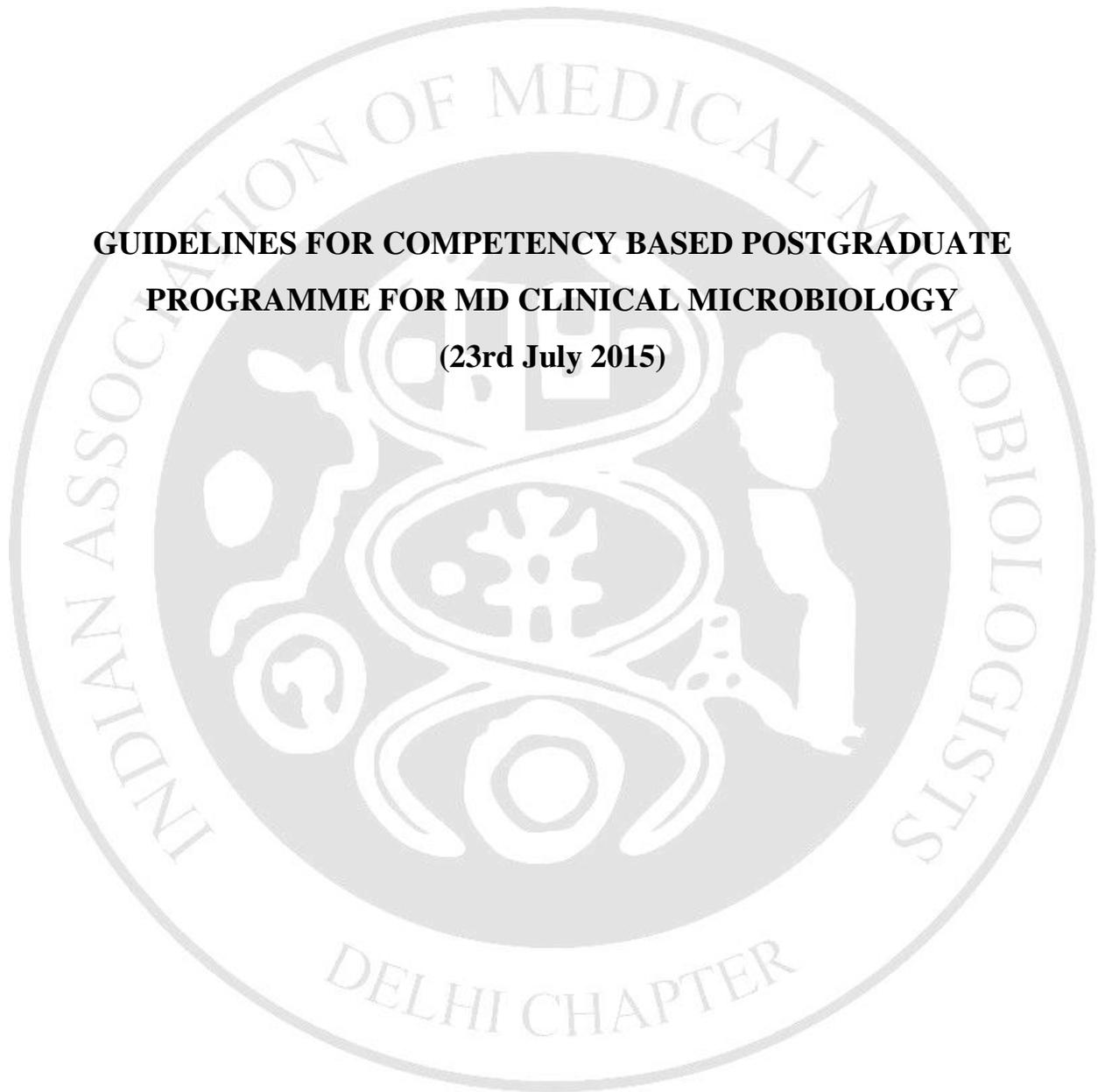


**GUIDELINES FOR COMPETENCY BASED POSTGRADUATE
PROGRAMME FOR MD CLINICAL MICROBIOLOGY
(23rd July 2015)**



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Background

Nelson Mandela said, quote “Vision without action is just a dream; action without vision just waste of time and vision with action can change the world, unquote”. The specialty of Clinical Microbiology needs the vision with action.

In 1967 US Surgeon General William H Stewart reflected the mood of the time and wanted to write an epitaph to the infectious diseases. But as the things evolved and re- emerged his inference could not have been farther from the truth.

Preamble

WHY THIS CHANGE IS NEEDED?

Infectious diseases (ID) are a major component of the current day medicine. Most of the developed countries have infectious diseases division managed by ID physicians and clinical microbiologists. It is an irony that the country that needs it the most does not have it except a few institutes. Infectious diseases are being recognised more in modern medicine (cancer treatment, transplants, innovative surgeries & procedures, AIDS, MDR TB etc.). Emergences of susceptible population, advent of many new microbial species as pathogens, reemergence of old infectious agents and antimicrobial drug resistance have made the situation more complicated.

Developing countries like India are trailing behind due to lack of adequate clinical expertise associated with the training of the clinical microbiologists in various medical schools of our country. The knowledge of the diagnostics exists but they fail to translate it into action.¹

The face of Clinical Microbiology has changed a lot in the past few years with the arrival of automated devices, rapid and point of care tests. It has been observed that the clinical microbiology syllabus has not undergone any drastic change over the past 40 years. The curriculum that exists aims to provide training only in the bench work once the patient's sample has reached the laboratory.² As a result the patient is rendered JUST A CLINICAL SAMPLE! This does not create a real time situation in the minds of the medical microbiologists working on the bench.¹ In the absence of interaction with the clinician and the patient the clinical correlation becomes impossible and remains limited to a few conscientious clinicians and medical microbiologists. Although the revised curriculum does advise the inclusion of clinical rounds, case discussions etc. but no road map is laid down in it (ref: Delhi University MD Microbiology curriculum).^{2, 3} The examination style of the students appearing for MD in Microbiology desires a lot to be changed.⁴

In wake of the above, it is important that we incorporate the clinical interactions more clearly in the curriculum and give a road map for the same to be a clinical branch of medicine.¹ This is only possible if MCI implements it to ensure compliance.

The foremost reason for seeking change in the syllabus is that we need to pay back to the very society & the exchequer who has spent millions in training us for our

MBBS & then for our M.D. With changing times information that was relevant earlier became redundant. This requires changing emphasis on acquiring new skills and knowledge in place of old. Current training programme lacks continuum in clinical training, leading to a waste in their talent as fully trained doctors by confining them to the laboratory alone. It renders a fully MBBS trained individual to have limited clinical skills once the MD Microbiology training is over.

Unfortunately, current scenario has failed this budding specialty in our country by condemning it, to begin with, to be an offshoot of Pathology, a postmortem science.⁵ When, to the contrary, it always was an ante mortem science and did not deserve to be condemned to be a non-clinical branch of medicine. The whole course needs to be put on a clinical platform. AIIMS, an autonomous body, has taken upon itself to start DM in ID for which a candidate with MD Microbiology is recommended to be eligible. This change in syllabus at MD Microbiology level will be a foundation course for one who wants to pursue ID DM subsequently.

I. SUBJECT SPECIFIC LEARNING OBJECTIVES:

The burden of ID in India requires an integrated approach as in US or Europe and elsewhere in the world. Unfortunately this important specialty does not exist in our country which needs it the most. This can be achieved by modification and advancement of the existing training module of the M.D. Microbiology curriculum for the benefit of the patients and preventive infectious disease programs. The literature also supports that integrated team effort towards patient care has better treatment outcomes rather than different specialties doing it alone (CID; 2007). Healthcare Acquired Infections exist

no matter how sophisticated a health care facility might be and its control is essentially the responsibility of this specialty. Various deliverables of this specialty can be envisaged to make it a state of the art course.

Objective 1: Acquire clinical competence in the assessment, investigation, diagnosis and management of any case suspect of infection including tropical infections/ sepsis / community acquired and emerging infections.

- Ability to perform appropriate investigation and specific skills e.g. lumbar puncture and interpret results.
- Ability to achieve an appropriate specific or differential diagnosis and suggest / initiate investigations and subsequently appropriate antimicrobial treatment.
- Ability to identify and respond appropriately to the epidemiological consequences of the diagnosis.

Objective 2: To acquire skills necessary to recognize and manage hospital acquired infections, and institute control systems, including operative, postoperative and intensive care related illness and health engineering.

- The development of and execution of infection control policies in the hospital setting through the infection control committee and monitoring of safe hospital engineering practices.
- Ability to diagnose and manage cases in the context of healthcare acquired infection.

- Recognition and treatment of specific infections related to post operative sepsis.
- Identification and management of infection and colonization by multi resistant organisms in the hospital setting.
- The development of and execution of infection control policies in the hospital setting through the infection control committee and monitoring of safe hospital engineering practices.
- The recognition and management of specific infection or tropical medicine problems related to the Intensive Care Unit (ICU) / Critical Care / HDUs
- Ability to recognize and manage the consequences of infection including sepsis syndrome and DIC in an ICU and ward setting.
- Help administration in regulating cost containment by identifying and suggesting appropriate infection control measures including procurement policies of antibiotics and disinfectants.
- Play an active role in monitoring Central Sterile Supplies Department of hospitals to ensure maintenance of strict aseptic protocols.

Objective 3: Acquire competence in diagnosis, investigation and management of imported infections with the knowledge to advise in relation to infections acquired through travel

- Recognize, diagnose and manage imported fevers and other imported diseases.
- Provide health advice for traveler.
- Infection related problems of immigrants.

- Interaction with community infection team.

Objective 4. Acquire competence in all aspects of the management of antibiotic use.

- Competence in antimicrobial prescription and dispensation
- Ability to define issues relating to antimicrobial pharmacology and toxicology including its side-effects
- Ability to develop rational antibiotic usage policies
- Competence in the economics of antimicrobial drug prescribing
- Competence in the use of pre-operative antibiotic prophylaxis

Objective 5: To obtain an understanding of the role of the microbiologist and the importance of microbiological techniques in ID and tropical medicine and to understand the process and constraints around the microbiological assays

- Basic microbiological bench work including critical interpretation of laboratory procedures in relation to laboratory diagnosis
- Histopathology of infectious diseases especially in mycobacteriology, mycology and virology.
- Ability to communicate with colleagues and other doctors in different disciplines and enable them to appreciate the relevance of microbiology data in the context of clinical information.
- Ability to give advice on the repertoire, the appropriate use and the limitation of tests in the microbiology laboratory.
- Management including health and safety procedures.

- Ability to recognize, manage and limit the presence of resistant organisms in clinical infectious diseases

Objective 6: To have an understanding of research methodology and the practical implementation of research projects

- Competence in research methodology including basic statistics.
- Involvement in detailed clinical or preclinical research.
- Epidemiological and public health research.

Objective 7: To create a facility for additional enhanced training in specific areas related to Infectious Diseases including:

- Emphasis on Quality control and Quality Assurance measures in laboratory investigations, required to lend credibility and reliability to the results.
- Barrier protection measures and Personal Protective Equipment (PPE).
- Infections related to Blood transfusion, solid organ transplantation & implants
- Occupational hazards
- Vaccinology
- National and Global response to outbreak / disaster situations
- Hospital Waste Management
- Disinfection , Sterilization and CSSD QC
- Epidemiology of infectious diseases (control at national and global level)

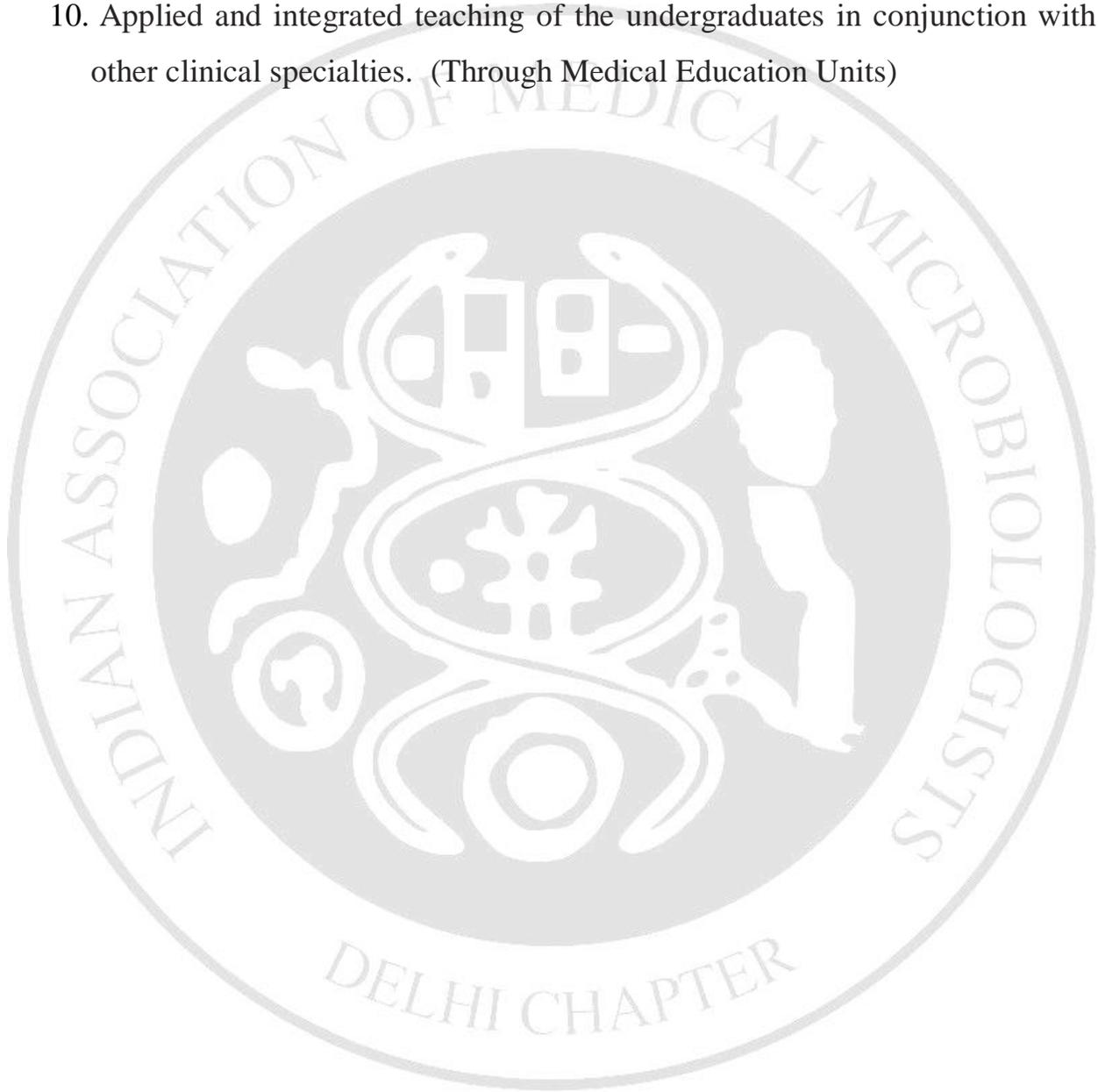
Objective 8: To be able to understand the applied immunological body reactions and molecular applications in various infections including tropical medicine

- Should develop understanding of basic immunology.
- In depth knowledge of applied immunology in infections and tropical medicine.
- Ability to utilize the diagnostic techniques based on immunological methods.

At the end of the training in M.D. Clinical Microbiology, the candidate will develop competence to:

1. Discuss epidemiology, natural history, pathological abnormalities, clinical manifestations, diagnostic modalities, principles of management and prevention of a common variety of infectious diseases affecting children and adults.
2. Make rational and relevant selection of laboratory tests with selection of appropriate, relevant & representative specimens.
3. Perform the specified important tests in microbial immunology with a high order of precision and interpretation.
4. Develop hospital policies on antimicrobial use & hospital infection control.
5. To discuss epidemiology, detection and prevention of infectious diseases in the community.
6. To detect and prevent of nosocomial infections.
7. Discuss vaccines and immunization programs, emerging & re-emerging pathogens and development of multi drug resistant organisms.

8. Have the adequate knowledge of other subspecialties so that they can treat the infections they encounter.
9. Supervise and train technical staff of the laboratory & maintain QA.
10. Applied and integrated teaching of the undergraduates in conjunction with other clinical specialties. (Through Medical Education Units)



II. SYLLABUS (Course Content):

The syllabus adopted allows the student to approach an infected patient in a composite way comprising of specific etiologic organisms, major clinical syndromes and host characteristics for the patients who are compromised.

1. Basic Principles in the pathogenesis of infectious diseases

- Microbial virulence factors
- Host defense mechanisms
- Epidemiology of Infectious diseases
- Clinical Microbiology as an interface with other specialties
- Anti-infective therapies

2. Major Clinical Syndromes

- Fevers
- 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
- Sexually transmitted infections (STIs) & reproductive tract infections (RTIs)

- Eye infections
 - Hepatitis
 - Immunodeficiency disorders & AIDS
3. Infectious diseases & their causative agents
 4. Immunisation
 5. Traveler's infectious diseases
 6. Bioterrorism
 7. Clinical Microbiologists & digital resource
 8. Zoonosis
 9. Microbiology as applied to public health and epidemiology

II.1 COURSE DETAILS

II.1.1: Theory

There should be 4 theory papers

Paper –I General Microbiology and Microbial Immunology

Paper – II Bacteriology and Mycology (Syndrome & investigation based)

Paper – III Virology and Parasitology (Syndrome & investigation based)

Paper – IV Applied Microbiology & Recent advances

See further course details for each paper as below:

Paper I

General Microbiology

1. History of microbiology
2. Microbial virulence factors

3. Epidemiology of Infectious diseases
4. Emerging & Reemerging infectious diseases threats
5. Hospital preparedness for emerging & highly contagious infectious diseases
6. Clinical Microbiology as an interphase with other specialties
7. Biosafety including universal containment
8. Morphology of bacteria and other microorganisms
9. Nomenclature and classification of microorganisms
10. Normal flora of human body
11. Bacterial toxins
12. Microbiology of hospital environment
13. Molecular genetics relevant to Clinical Microbiology
14. Quality assurance & quality control in Clinical Microbiology
15. Role of Clinical Microbiology in a hospital
16. Epidemiology and basic biostatistics
17. Antibiotics, PK PD and resistance mechanisms, CLSI / EUCAST guidelines
18. Antibiotic policy and guidelines

Microbial Immunology

1. Host defense mechanisms: Innate and acquired immunity
2. Cells involved in immune response
3. Antigens
4. Immunoglobulins
5. Mucosal immunity
6. Complement system

7. Hypersensitivity
8. Cell mediated immunity
9. Cytokines
10. Evaluation of the patient with suspected Immunodeficiency
11. Auto-immunity
12. Transplantation immunity & HLA
13. Tumor immunity
14. Vaccines and immunotherapy
15. Measurement of immunological parameters
16. Immunopotiation & immunomodulation
17. Hybridoma Technology
18. Applied Molecular biology
19. Immunological techniques
20. Recent advances in immunology

Paper II

Systemic bacteriology

1. Isolation, identification & susceptibility testing of bacteria
2. Gram positive cocci of medical importance including *Staphylococcus*, *Micrococcus*, *Streptococcus*, Anaerobic cocci
3. Gram negative cocci of medical importance including *Neisseria*, *Branhamella*, *Moraxella* etc. Anaerobic cocci
4. Gram positive bacilli of medical importance including *Lactobacillus*, anaerobic bacilli, *Coryneform* organisms, *Bacillus* & aerobic bacilli,

Actinomyces, Nocardia, Actinobacillus and other actinomycetales,
Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.

5. Gram negative bacilli of medical importance including *Vibrios, Aeromonas, Plesiomonas, Haemophius, Bordetella, Brucella, Gardnerella, Pseudomonas* & other non-fermenters, *Pasturella, Francisella, Bacteriodes, Fusobacterium, Leptotrichia* and other anaerobic gram negative bacilli etc.
6. Enterobacteriaceae
7. Mycobacteria & tissue reactions
8. Spirochaetes
9. Chlamydiae
10. Mycoplasmatales, *Mycoplasma, Ureaplasma, Acholeplasma* and other
11. Mycoplasmas
12. *Rickettsia, Coxiella, Bartonella* etc.
13. Anaerobic Bacteriology
14. Emerging and re-emerging bacterial species
15. Antimicrobial susceptibility testing - methods and clinical significance

Mycology

1. General characteristics & classification of fungi
2. Morphology & reproduction of fungi
3. Isolation and identification of fungi
4. Tissue reactions to fungi
5. Yeasts and yeast like fungi of medical importance including *Candida, Cryptococcus, Malassezia Trichosporon, Geotrichum Saccharomyces* etc.

6. Mycelial fungi of medical importance including *Aspergillus*, *Zygomycetes*, *Pseudoallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
7. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffei* etc.
8. Dermatophytes
9. Fungi causing mycetoma, keratomycosis & otomycosis
10. Algae causing disease in humans
11. *Pneumocystis jirovecii* infection
12. *Rhinosporidium seeberi* & *Loboa lobo*
13. *Actinomycetes* & *Nocardia*
14. Common laboratory contaminant fungi
15. Mycetismus & mycotoxicosis
16. Antifungal agents & in-vitro antifungal susceptibility testing and its clinical relevance.
17. Serological and molecular methods of diagnosis
18. Emerging fungal species
19. Molecular diagnosis of fungal infections - techniques and clinical significance

Paper III

Virology

1. General properties of viruses
2. Classification of viruses
3. Morphology: Virus structure

4. Virus replication
5. Isolation & identification of viruses
6. Pathogenesis and tissue reactions of viral infections
7. Genetics of viruses
8. DNA viruses of medical importance including Poxviridae, Herpesviridae, Adenoviridae, Hepadna virus, Papova and Parvo viruses etc.
9. RNA viruses of medical importance including Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Retroviridae, Filoviruses, Human immunodeficiency virus, Arboviruses, Coronaviridae, Calciviruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepatitis viruses
13. Virioids
14. Vaccines, anti-viral drugs & antiviral testing
15. Oncogenic viruses
16. Newer emerging viruses
17. Molecular diagnosis of viral infections - techniques and clinical significance

Parasitology

1. General characters & classification of parasites
2. Methods of identification of parasites & tissue reactions.

3. Protozoan parasites of medical importance including Entamoeba, Free living amoebae, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora*, *Isospora*, *Babesia*, *Balantidium* etc.
4. Helminthology 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 (*Trichiuris*, *Trichinella*, *Strongyloides*, *Ancylostoma*, *Necator*, *Ascaris*, *Toxocara*, *Enterobius*, Filarial worms, *Dracunculus* etc.)
5. Entomology: Common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, Cyclops, louse, myasis.
6. Antiparasitic agents
7. Antiparasitic susceptibility testing
8. Molecular diagnosis of parasitic infections - techniques and clinical significance
9. Emerging parasites

Paper IV

Applied Microbiology

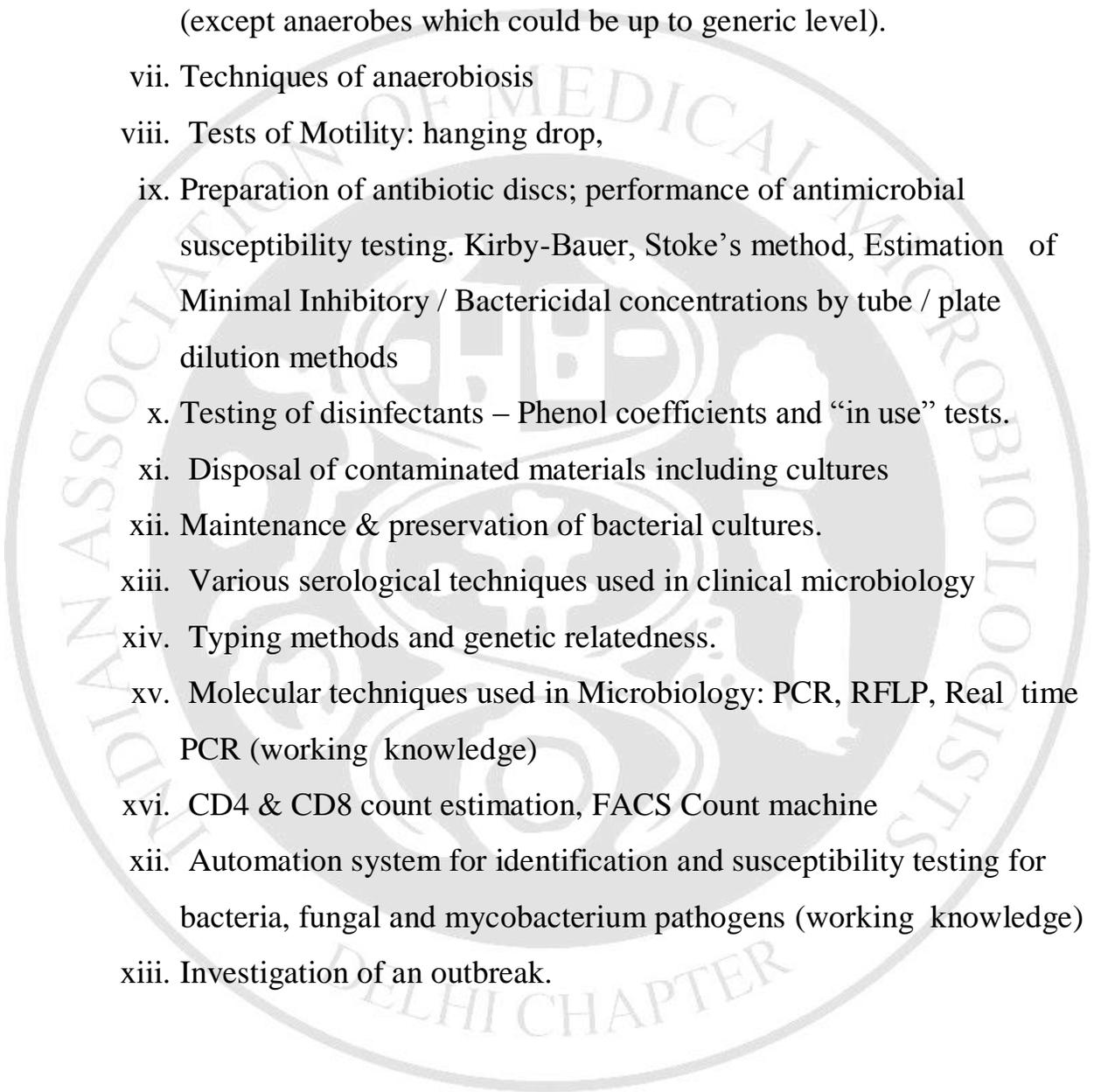
1. Fevers & Pyrexia of unknown origin (PUO)
2. Respiratory tract infections
3. Urinary tract infection
4. Sepsis
5. Intra-abdominal infections

6. Cardio-vascular infections
7. Central Nervous Infections
8. Skin & soft tissue infections
9. Gastrointestinal infections & Food poisoning
10. Bone & Joint infections
11. STIs & RTIs
12. Eye infections
13. Hepatitis
14. AIDS
15. Hospital acquired infections
16. Biomedical waste management
17. Investigation of an infectious outbreak including microbes that can be used for biological warfare (Bioterrorism)
18. Opportunistic infections
19. Vaccinology : principle, methods of preparation, administration of vaccines
20. Study of Traveler's diseases
21. Information technology (Computers) in microbiology, Bioinformatics , research methodologies
22. Automation in Clinical Microbiology
23. Statistical analysis of microbiological data and research methodology
24. Probiotics
25. National infectious disease prevention, control eradication programmes
26. Recent advances in diagnostic techniques in infectious diseases
27. Rational use of antibiotics and its stewardship
28. Quality Assurance and Accreditation

29. Safety and risk management
30. Concept of Barrier protection and Personal protective equipment.
31. Environment management and Engineering controls
32. Infection control in special situations- Blood transfusion, solid organ transplantation and implants.
33. Hierarchy of controls and occupational hazards

II.1.2: Skills (Practical):

1. **Clinical skills:** History taking, physical examination and assessment of the patients with suspected infectious diseases, formulation of diagnostic algorithms, patient care plan. The patient may be in the OPD, emergency services, general or private wards, intensive care units, and operation theatre of different specialties of the health care facility. Clinico-microbiological correlation of laboratory results.
2. **Laboratory Skills :**
 - i. Collection / transport of specimens for microbiological investigations
 - ii. Preparation, examination & interpretation of direct smears from clinical specimens
 - iii. Plating of clinical specimens on media for isolation, purification,
 - iv. Identification and quantification of pathogens.
 - v. Preparation of stains viz. Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN) stain.
 - vi. Silver impregnation stain and special stains for capsule and spore etc.
 - vii. Acclimatization to various culture media
 - viii. Quality control of media, reagents etc.

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- ix. Care and operation of microscopes
 - x. Aseptic practices in Laboratory and safety precautions
 - xi. Identification of bacteria of medical importance up to species levels (except anaerobes which could be up to generic level).
 - vii. Techniques of anaerobiosis
 - viii. Tests of Motility: hanging drop,
 - ix. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing. Kirby-Bauer, Stoke's method, Estimation of Minimal Inhibitory / Bactericidal concentrations by tube / plate dilution methods
 - x. Testing of disinfectants – Phenol coefficients and “in use” tests.
 - xi. Disposal of contaminated materials including cultures
 - xii. Maintenance & preservation of bacterial cultures.
 - xiii. Various serological techniques used in clinical microbiology
 - xiv. Typing methods and genetic relatedness.
 - xv. Molecular techniques used in Microbiology: PCR, RFLP, Real time PCR (working knowledge)
 - xvi. CD4 & CD8 count estimation, FACS Count machine
 - xii. Automation system for identification and susceptibility testing for bacteria, fungal and mycobacterium pathogens (working knowledge)
 - xiii. Investigation of an outbreak.

III. Thesis / Dissertation

Objectives:

By carrying out a research project and presenting his work in the form of thesis, the postgraduate will be able to:

- a. Identify a relevant research question
- b. Conduct a critical review of literature
- c. Formulate a hypothesis
- d. Determine the most suitable study design
- e. State the objectives of the study
- f. Prepare a study protocol
- g. Undertake a study according to the protocol
- h. Analyze and interpret research data and draw conclusions
- i. Write a research paper

Guidelines

A post graduate must undergo training in research methodology and basic statistics before embarking on the dissertation (MCI requirement)

While selecting thesis topics, following should be kept in mind:

- a. The scope of study should be limited so that it is possible to conduct it within the resources and time available to the student.
- b. The emphasis should be on research methodology rather than the results
- c. The research, study must be ethically appropriate .

- d. The protocol interim progress as well as final presentation must be made formally to the entire department.
- e. Two students per postgraduate teacher/thesis guide. A PG teacher must have a total of at least 8 years of experience out of which at least 5 years should be after acquiring PG degree.
- f. There should be periodic departmental review of the thesis work as per following schedule:

End of 6 month - Submission of protocol

End of 1st year - Mid-term presentation

6 months prior to examination – Final presentation and submission.

Dissertation protocol must be submitted to the Institute Research and Ethics Committees or an IRB for approval, before submission to the University

IV. SUBJECT SPECIFIC THEORETICAL COMPETENCIES:

A. COGNITIVE DOMAIN

1. Should have thorough knowledge, skill and competence to diagnose and manage routine and complex clinical problems in the field of bacteriology, parasitology, mycology, virology, microbial immunology, using traditional methods of recording an accurate and thorough history and performing a detailed physical examination.
2. Skill and competence to choose the various laboratory investigations necessary for proper management of the patient. A resident must be able to

understand the sensitivity, specificity and the predictive value of the proposed investigation, as well as its cost-effectiveness in the management of the patient.

3. Should be able to identify problems within and outside the laboratory pertaining to reliable test result and offer solutions thereof so that a high order of quality control is maintained.
4. Interpret laboratory data in relation to clinical findings with reasonable accuracy.
5. Proficiency in selecting correct antimicrobial drugs with thorough knowledge of their pharmacological effects, PK-PDs, side effects, interactions with the other drugs and alteration of their metabolism in different clinical situations.
6. Advice on the nature of appropriate specimens and the tests necessary to arrive at a diagnosis in a difficult and problematic case using group approach
7. Maintain accurate records of tests and their results for reasonable periods of time so that these may be retrieved as and when necessary
8. Subject himself / herself to continuing education and constantly update his/her knowledge of recent advances in clinical microbiology and infectious diseases.
9. Have a thorough knowledge of the practical aspects and methods of prevention and protection against nosocomial infections from (i) patient-to-patient (ii) patient-to-health care worker (HCW) (iii) HCW-to-patient; in any health care setting.

10. To carry out clinical research and make and record observations systematically that is of use for archival purposes and for furthering the knowledge of infectious diseases.
11. Able to systematically write a paper and publish in a relevant journal.
12. Should be able to teach about infectious diseases to undergraduates, postgraduates, nurses and paramedical staff including laboratory personnel.
13. Care of laboratory glassware & media.
14. Should have knowledge of Ethical Laboratory Practices.

B. AFFECTIVE DOMAIN

1. Should be able to function as a part of a team that is essential for the diagnosis and management of a patient. He/she should therefore develop an attitude of cooperation with his/her colleagues so necessary for this purpose.
2. Always adopt ethical principles and maintain positive attitude, compassion and proper etiquette in his/her dealings with patients, relatives and other health personnel.
3. Respect the rights, autonomy and confidentiality of data related to the patient including the right to information and second opinion.
4. Provide leadership and inspire members of the team with whom he/she is involved with in the fields of diagnostic, teaching and research.
5. Develop communication skills not only to word reports and professional opinions but also to interact with patients, relatives, peers and paramedical staff.

C. SUBJECT SPECIFIC PSYCHOMOTOR DOMAIN

1. Able to develop and demonstrate correct methodologies for collecting specimens like throat swab, blood, FNAC, CSF after lumbar puncture, bone marrow aspiration, purulent fluids, nasopharyngeal swab, urine, nail clippings etc. by routinely performing non- invasive out-patient or invasive indoor procedures. It is implied that the complications of these procedures and its handling be part of the training.
2. Skill and competence to function effectively in varied clinical settings, namely, ambulatory care, out-patient clinic, in-patient wards, or emergency/critical care.
3. Able to perform & interpret most of the routine tests in microbiology laboratory including specimen processing like staining, biochemical investigation, antibiotics susceptibility testing, serotyping, serological tests, at least working knowledge of molecular techniques like PCR, etc.
4. Active participation in infection control activity of the institute
5. Practical training in identification of infectious agents (bacterial, parasitic, viral and fungal)
6. Should be familiar with the operation, function and routine maintenance of equipments in the laboratory
7. Should be proficient in laboratory management and show team spirit and leadership quality while dealing with laboratory staff.
8. Should be capable of effectively disposing laboratory waste to ensure minimization of risk to infection and accidents to laboratory personnel.

Though for the PGs, everything above in cognitive and psychomotor domain is necessary to know, however the same can be divided into the following categories²:

- a. Must know category: Serial number 1-6 and 13 in Cognitive, Affective domain Serial number 1-5 & Serial number 1,3,5,6,7 in Psychomotor domain above
- b. Desirable to know: Serial number 7-10 in Cognitive & Serial number 2,4 in Psychomotor domain
- c. Nice to know: Serial number 11-12 in Cognitive domain

V. TEACHING AND LEARNING METHODS

It will be whole time in service on the residency pattern with clinical responsibility. Candidate will take part in the activities of the department including bench work in the Clinical Microbiology laboratory, and bed side assessments and management of patients in , OPD, in-patient care units and management of emergencies in infectious diseases. Training will be through lectures, interdepartmental seminars, clinical meetings, group discussions and bedside case discussions. Clinical Microbiology laboratory training will be through lectures and hands on experience in the lab.

He/She will participate in all academic activities of the hospital. He/She will be on call for infectious disease consultations. He/she will be observer in the hospital

infection control committee to understand infection control policies and its implementation. Methods of teaching are broadly as below:

1. **Journal Club:** 1 hour duration - Paper presentation/discussion - once per week.
2. **Seminar:** One seminar every week of one hour duration.
3. **Lecture/Group discussion:** as per syllabus by the faculty, to alternate with seminars.
4. **Syndrome Based Learning**
 - i. **Case presentation** in the clinical department of posting. Residents will present a clinical case for discussion before a faculty and discussion made pertaining to its management.
 - ii. **Case conference:** Residents are expected to work up one long case and three short cases and present the same to a faculty member and discuss the management. Ward round of the resident should begin with the round of cases with blood culture positive results, significant pyuria and bacteriuria or any other significant positive findings in the parent department. This will bring bench to bedside.
 - iii. **Radiology Classes:** Held twice weekly in which the radiological features of various problems are discussed.
5. **Clinico-microbiological Conference:** Special emphasis is laid on the causative, micro-organism, microbial pathology and diagnostic methodologies with management of the case in the Clinical Microbiology department.
6. **Combined Round/Grand Round:** These exercises are to be done for the hospital once a week or twice a month involving presentation of unusual

or difficult cases. Presentation of cases in clinical combined / grand rounds and clinical series/research data for the benefit of all clinicians and other related disciplines once in week or fortnightly.

7. **Emergency situation:** Casualty duty to be arranged by rotation among the PGs with a faculty cover daily by rotation.
8. Bedside clinical training for patient care management. Daily for ½ to one hour during ward round with faculty with bed side patient care discussions.
9. Clinical teaching: In OPD, ward rounds (in main specialties, i.e. medicine/ surgery/ obs & gynae/ pediatrics), emergency and ICU.
10. Daily attendance in department of Clinical Microbiology as per posting schedule to carry bench to bedside.
11. Thesis work.
- 12..Undergraduate teaching through taking practical classes.
13. Should have attended two conferences/CMEs/Workshops during his tenure.

VI. POSTINGS: Recommended schedule for three years training:

Residents will trace all microbiology positive especially blood culture and urine culture with pyuria findings to the patients on the floor and discuss the findings with the consultant on duty. This will carry bench to the bedside as a matter of routine. ⁶

The posting details are as mentioned below:

First four months

- Orientation programme including exposure to casualty/Emergency ward. (Full time posting as recommended by MCI)
- Learns bedside history taking in ward, casualty, ICU requirement.
- Assist ward round and visits other wards with senior colleagues to attend call/consultation from other departments.
- Participates in the teaching sessions in wards for bedside clinical teaching in the seminar/journal club and case conferences.
- Microbiology desk work after finishing daily rounds for hands on experience with Clinical Microbiology and microbial immunology procedures.
- Observer in Hospital Infection Control Committee.

NEXT 32 months: The resident is required to work both in the clinical specialty where he/she is posted as well as in the department of Clinical Microbiology, participate in the patient care and academic and research activities. Observer in Hospital Infection Control Committee.

VI. a) CLINICAL POSTINGS:

Rotational postings in medical patient care units (14 months) and surgical patient care units (6 months) , high risk areas (e.g. critical care units) (6 months) and hospital infection control and prevention units (6 months).

Thus Total duration = 32 months.

VI. b) SIMULTANEOUS LABORATORY POSTING:

After having finished his/her morning rounds, the resident will start his/her laboratory work as per their schedule below, absence due to emergency or evening postings will be accepted:

Laboratory Duration in months

Routine bacteriology- as specimen processing (including blood, CSF, stool, urine and other body fluids) identification and susceptibility testing for pyogenic

cultures: 12 months

Parasitology 3 months

Anaerobic lab 1 month

Serology 3 months

Mycology 3 months

Virology 3 months

Molecular microbiology 2 months

Mycobacteriology 2 months

Histopathology 3 months

Total 32 months

Need to be flexible as many of the above depts. may not be present in every institute (e.g. Molecular, anaerobic, virology)

VII): ASSESSMENT

VII. a) FORMATIVE ASSESSMENT during the training includes:

Internal assessment

However a formal assessment is recorded at the end of every posting with regard to knowledge and skills and reviewed regularly.

For evaluation of presentations, evaluation sheets may be incorporated for the purpose of assessment.

Log Book

During his/her training, the candidate should maintain a Log Book indicating the duration of the postings/work done in laboratory and clinical areas . It should indicate the clinics assisted and performed by the candidate, and the teaching sessions, symposia, journal club meeting etc. attended.

The purpose of the Log Book is to:

- (a) Help to maintain a record of the work done during training.
- (b) Enable the consultant to have first hand information about the work done and to intervene whenever necessary.
- (c) Use it to assess the clinical experience gained periodically.

The entries in the Log Book should be made on a daily basis and should be signed by the consultant every month. Candidates should prepare case notes along with relevant discussion regarding the case, i.e. 20 different types of cases, in whose management they were involved.

At least four months prior to the final examination, the Head of the Department and Head of the Institution should sign the Log Book, before submitting .

During the Viva, the candidate may be asked questions based on the cases or procedures entered in the Log Book.

Personal Details:

1. Name (in full)
2. Date of Birth
3. Date of joining
4. Permanent Address
5. Address for Communication
6. Name of the College/Institute in which training is imparted
7. Name of the Guide/Teacher
8. Duration of the Course
9. Signature of Candidate

General Principles

It is also usual that the candidates are assessed on the AFFECTIVE aspect of the training particularly with regard to the following:

1. Ability to get along with colleagues
2. To conduct with patients and nursing staff in a dignified way

Assessment

- Personal attributes Ongoing after each clinical posting
- Clinical skills and performance -do-
- Academic activities -do-
- Theory assessment End of 1-yr, 2-yr and at 2-yr 9 months
- Practical assessment -do-

During Formative Assessment Grading are done in one of the following ways:

(i) Awarding actual marks

(ii) Awarding scores: 0 = Poor

1 = Below average

2 = Average

3 = Above average

4 = Good

(iii) Awarding grades: A+ = 90% – 100%

A = 80% – 89%

A- = 75% – 79%

B+ = 70% – 74%

B = 60% – 69%

B- = 50% – 59%

C = < 50%

Candidates obtaining $\geq 35\%$ marks in their internal assessment will only be recommended to appear in the final examination.

VII. b) Summative Assessment:

The Post Graduate examination shall be in three parts: -

1. **Thesis**, to be submitted by each candidate at least 6 months before the date of commencement of the theory 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 practical; on the acceptance of the thesis by two examiners, the candidate shall appear for the final examination.

2. **Theory:** There shall be four theory papers as follows:

Paper I: General Microbiology and Microbial Immunology

Paper II: Bacteriology and Mycology (Syndrome & investigation based)

Paper III: Virology and Parasitology (syndrome & investigation based)

Paper IV: Applied Clinical Microbiology & Recent advances

It is recommended that the candidate should independently pass in the theory examination to be eligible to appear in the practical examination.

3. **Practical:** The practical examination should consist of the following and should be spread over two days. If the number of candidates appearing is more than five, additional day could be added.

- **Clinical ID related** one long case: History taking, physical examination, interpretation of clinical findings, differential diagnosis, microbiology investigations & perform the same in the Clinical Microbiology laboratory, interpret the results and suggest treatment and prognosis.
- **Microbiology Lab based:** Identify a pure bacterial culture till species level and perform antibiotic sensitivity testing
- **ID related Short cases** from various sections of the specialty with Point of Care (POC) testing/ rapid testing to be performed.
- **Spots Clinical Microbiology related:** Clinical problems with Microscopic slides /cultures/tissue cultures from virology, mycology, entomology and parasitology.

4. **Viva-voce Examination**

- Basic Microbiology & epidemiology
- Radiology: clinical problems for interpretation
- Etiopathogenesis
- Recent advances
- Emerging & re-emerging infections
- Component of presentation of thesis done by the student

VIII. Recommended Reading:

Principles and practices of infectious diseases by G.L.Mandell, J.E.Bannett and R.Dolin.

Manual of Clinical Microbiology, ASM press by A. Balows et al.

Clinical Microbiology Procedures, ASM press by Isenberg.

Microbiology and microbial infections, *Topley & Wilson's*.

Diagnostic Microbiology, *Bailey & Scott's*.

Current Protocol in Immunology by Coligan et al.

Bacterial Pathogenesis, Molecular Approach ASM press by Salyers.

Harrison's Principles of internal medicine.

Text book of Pediatric Infectious Diseases by Feign & Cherry

Medically important fungi – a guide to identification – Davis H Larone ASM press

Hospital epidemiology and infection control Glen C Mayhall. Lippincott Williams and Wilkins

IX. List of Journals

- Indian J Medical Microbiology
- Indian J Medical Research
- New England J. Medicine
- Lancet Infections Disease
- Infectious Diseases Clinics of North America
- Clinical Infectious Disease
- Journal of Infectious Diseases
- Review Clinical Microbiology
- J of Clinical Virology
- Int. J. of Parasitology
- Infection and Immunity
- Bulletin WHO
- MMWR Weekly
- Nature medicine
- British Medical Journal
- Paediatric Infectious Disease
- Annals of Internal Medicine

X. Duration of course

The course of Doctor of Medicine (Clinical Microbiology) will be of three years duration in the form of residency programme that is full time.

XI. Eligibility

- i. The essential qualification will be MBBS degree of any Indian University/ Deemed university/ Autonomous institution etc. as recognized by the Medical Council of India
- ii. Any other qualification of a foreign university that is recognized by the MCI and the concerned university as equivalent to the MBBS degree

XII. Selection

- i. The selection will be made on the basis of an entrance examination conducted by the concerned University or autonomous bodies with multiple choice questions of the level of MBBS, including all subjects of the MCI recognized MBBS course.

XIII. Dedicated beds for Clinical Microbiology in various specialties: A minimum of 20 beds (Medicine, Surgery, Pediatrics and Obstetrics & Gynecology) will be mandatorily dedicated for infections related admissions. These beds will be directly under the supervision of the faculty of the respective specialty (physician/surgeon).

XIV. Faculty under one roof:

1. **HOD, Clinical Microbiology department** will conduct the rotations & the course . The department will own the responsibility of the investigative work up of the patients admitted under the category of infections or fever occupying Clinical Microbiology beds. Whole faculty of the department of Clinical Microbiology will be on the roster prepared by the HOD for the clinical services, on turn-key basis.

Qualifications: MD Clinical Microbiology. Currently MD Microbiology qualified faculty will be eligible to teach with at least three years teaching experience as Senior Resident or more as a faculty in the speciality. Three years after running the MD Clinical Microbiology course such faculty will be considered as the faculty qualified as MD Clinical Microbiology.

2. Adjunct Faculty: HODs of Clinical departments (Medicine, Surgery, Gynae/Obs., Peds.) where the resident is posted will be the nodal persons who will function in tandem with the Clinical Microbiology department in providing the clinical services to the allocated 20 infection related beds. Whole faculty of the concerned departments will be involved on rotational basis.

Qualifications: MD/MS: Medicine/ Surgery/ Obstetrics & Gynecology/ Pediatrics/ Critical care

3. Visiting faculty: Eminent national and international faculty in the field of Clinical Microbiology and other medical specialties can be invited for guest lectures both didactic or bed side training. However, this faculty will not be considered as part of the minimum strength required for running the course. This faculty will be over and above the minimum requirement of the faculty.

Note: Since the above programme is being made for the first time subsequent learning should guide further modifications but not before the first batch has gone for final exams after completion of three years.

References:

1. Bhattacharya S. Laboratory microbiology to clinical microbiology: Are we ready for a transition? *Indian J Med Microbiol* 2009;27:97-99.
2. Rao RS, Lalitha MK, Narang P. Curriculum designing for post graduates in medical microbiology. *Indian J Med Microbiol* 1999;17:116-24.
3. Kanungo R. Microbiology curriculum for MBBS: Is there a need for change? *Indian J Med Microbiol* 2003;21:5.
4. The Royal College of Pathologist. Curriculum for specialty training in medical microbiology and virology. January 2007.
5. The Royal College of Pathologist. Specimen job description: Consultant medical microbiologist. April 2005.
6. Bhattacharya S. ESBL - from petri dish to the patient. *Indian J Med Microbiol* 2006;24:20-4.