



**ALL INDIA INSTITUTE OF MEDICAL SCIENCES, BIBINAGAR,  
Hyderabad Metropolitan Region, TELANGANA – 508126**

अखिलभारतीयआयुर्विज्ञानसंस्थान (एम्स),बीबीनगर,  
हैदराबादमेट्रोपोलिटनक्षेत्र, तेलंगाना – 508126, भारत

**MD MICROBIOLOGY  
AIIMS, Bibinagar**

**GENERAL INFORMATION ABOUT THE COURSE**

Title of Degree	MD Microbiology (Doctor of Medicine in Microbiology)
Duration of Course	3 completed calendar years
Eligibility	MBBS with NMC/MCI or State Medical Council Registration
Selection	On merit basis, following INI CET (Institute of National Importance Combined Entrance Examination)
Nature of work	It is a 3 years full time residency course. It is a round the clock learning programme.
Remuneration	As per the rules prevailing in AIIMS, New Delhi and Govt. of India rules
Proposed Number of candidates	2 per session (January and July sessions)
Institute of affiliation	AIIMS, Bibinagar
Pattern of Examination	Final Exam will be held in 3rd year near completion of term. If exams are held earlier candidate will continue to work till term is completed. Candidates will be examined in Theory and Practical after approval of Thesis by examiners. Examinations will not be held more than twice in a year. A gap of 4-6 months will be kept between exams.
Awarding Degree	Degree will be awarded by the AIIMS Bibinagar on successful completion of training and passing examination.
Examiners	Total Four-2 Internal and 2 External. Out of the two internal examiner one will be Head of the Department and 2nd Internal examiner by rotation after two examinations.
P. G. Teacher	Teachers having a total of eight years teaching experience out of which at least five years teaching experience Asst. Professor gained



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after obtaining postgraduate degree shall be recognized as postgraduate teachers in Microbiology.

Change of Teacher & Topic	Once candidate is allotted to a P.G. teacher and the thesis topic is also finalized he/she will not be allowed to change both, except in certain exceptional circumstance. For this approval of Executive Director AIIMS, Bibinagar will be required.
Attendance	Minimum 80% every year



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**DRAFT CURRICULUM FOR POSTGRADUATE COURSE**

**M.D. (MICROBIOLOGY)**

**ALL INDIA INSTITUTE OF MEDICAL SCIENCES, BIBINAGAR**

**Appendix**

<b>Topics</b>	<b>Page Number</b>
1. Preamble & Goal	4
2. Educational Objectives	5
3. Course overview	6
4. Course content (Syllabus)	9
Cognitive skills	
Psychomotor skills	
5. Time frame of training in various sections	19
6. Monitoring the progress of PG students	23
7. MD Microbiology Final examination format	25
8. Suggested Reading	31



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## **1. PREAMBLE**

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

## **GOAL**

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

1. Establish good “laboratory practices” in hospital and community in the field of Bacteriology, Mycobacteriology, Serology & Immunology, Virology, Parasitology, Mycology and Infection control including Molecular biology & its applications to various division.
2. Plan, execute and evaluate teaching assignments of Microbiology in Medical College.
3. Undergo specialization in any of the above subspecialties.
4. Plan, execute and analyse applied and fundamental research in various branches of Microbiology involving other related disciplines for health care.
5. Interpret laboratory results and actively participate in management of patients in terms of infectious diseases.



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## **2. EDUCATIONAL OBJECTIVES:**

### **(A) KNOWLEDGE:**

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

1. State and explain the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of infectious diseases and apply that knowledge in the treatment, prevention and control of communicable diseases caused by micro-organisms.
2. State and explain the principles of immunity and immunological phenomenon which would help in understanding the pathogenesis & laboratory diagnosis of infectious and non-infectious diseases.
3. Establish and practice diagnosis of infectious diseases in hospitals and community in the field of Bacteriology, Mycobacteriology, Serology & Immunology, Virology, Parasitology, Mycology and Infection control in the light of clinical findings.
4. Organize the prevention and control of communicable diseases in the community.
5. Understand and practice the principle of prevention and control of health care associated infections and rational antibiotic policy.
6. State the recent advances in the field of Medical Microbiology and apply this knowledge in understanding etiopathogenesis and diagnosis of diseases caused by micro-organisms.
7. Carry out fundamental or applied research in the branches of medicine involving microbiological work.
8. Develop specialization in any of the above sub-specialties.
9. Undertake teaching assignments in the subject of Medical Microbiology.

### **(B) SKILLS**

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

1. Set up a Microbiology Lab for the diagnosis of infectious diseases.
2. Perform laboratory procedures to arrive at the etiological diagnosis of infectious diseases caused by bacteria, fungi, viruses and parasite including the drug sensitivity profile.
3. Perform and interpret immunological and serological tests.
4. Operate routine and sophisticated instruments in the laboratory.
5. Develop microteaching skills and Pedagogy
6. Successfully implement the chosen research methodology.



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### **3. COURSE OVERVIEW**

#### **Cognitive domain:**

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

#### **Duration of course:**

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

#### **Training program:**

The candidates joining the course must work as full time residents during the whole period of their postgraduate training. They will be required to attend a minimum of 80% of training period. Candidates shall be given full time responsibility and assignments and their participation in all facets of the educational process assured.

Postgraduate students must maintain a log book of the work carried out by them and the training undergone by them during the period of training. These log book shall be checked and assessed by the faculty periodically.

Post graduate students will be allotted a dissertation topic and a Supervisor for guiding them. The student is expected to do all the clinical and laboratory work related to thesis himself / herself. He/she is expected to write the dissertation and submit it to the examination cell. The PG student will be allowed to appear in the final exam only after approval of the dissertation by the experts.



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**TEACHING /LEARNING METHODS:**

Learning in M. D. (Microbiology) will essentially be self-learning.

Following teaching-learning methods shall be followed-

**Group teaching sessions:**

1. Journal review
2. Subject seminar presentation
3. Group discussion
4. Technique and Slides seminars
5. Clinical case presentations pertaining to infectious diseases
6. Presentation of the findings of an exercise on any of the sub-specialities
7. Participation in CME programs and conferences.

**Hands on experience (Practical training)**

Practical training shall be imparted by posting the students in various sub-specialities (sections) as detailed in the intrinsic and extrinsic rotation.

Student shall be actively involved in day to day working of all the sections. He/ She will be trained under the guidance of teachers in all the aspects of Microbiology including Clinical Microbiology and applied aspects of laboratory medicine including collection and transport of specimen, receiving of samples, preparation of requisite reagents, chemicals, media and glassware, processing of specimens, performing required antimicrobial susceptibility testing and reporting on the specimens, interpretation of results, sterilization procedures, bio-safety precautions, infection control practices, maintenance of equipment, record keeping and quality control in Microbiology.

**Suggested schedule of rotation:**

**Intrinsic rotation:**

- |    |   |          |
|----|---|----------|
| 1. | Sample collection and Media preparation, Bio medical waste management | 3 months |
| 2. | Bacteriology (Aerobic and anaerobic)                                  | 6 months |
| 2. | Mycobacteriology  | 3 months |
| 3. | Serology/Immunology   | 3 months |
| 4. | Mycology  | 3 months |
| 5. | Virology  | 3 months |



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6.	Parasitology	3 months
7.	Dissertation / Elective Posting	3 months
8.	Hospital infection Control	2 months
9.	Final Rotation Posting Bacteriology, Serology & Immunology, Mycology, Parasitology, Virology	5 months

**Extrinsic rotation:**

	Lab Medicine	1 month
<b>Exam</b>		1 month
	<b>Total</b>	36 months

**Emergency duty:**

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

**Training in research methodology:**

Training in research methodology shall be imparted by planning of a research project by the student under the guidance of a recognized guide to be executed and submitted in the form of a dissertation/ thesis.

The dissertation is aimed at training the candidate in research methods and techniques. It will include identification of a research question, formulation of a hypothesis, search and review of relevant literature, getting acquainted with recent advances, designing of research study, collection of data, critical analysis of the results and drawing conclusions.

The topic shall be communicated to the Academic cell within six months of registration and at least 12 months should be spent on the research project.

The dissertation shall be completed and submitted by the student six months before appearing for the final examination.

**Teaching experience:**

Student shall be actively involved in the teaching of undergraduate students. He/she will be trained in teaching methods and use of audiovisual aids

**Training in Public Health/one Health:**

This training will expose the student to work in collaboration with department of CMFM & Veterinary Institute as well as institute working on environment to learn public health/one health microbiology.





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#### **4. COURSE CONTENTS (SYLLABUS)**

##### **Broad areas of study:**

1. General microbiology
2. Immunology
3. Systematic bacteriology
4. Mycology
5. Virology
6. Parasitology
7. Applied microbiology

##### **(A) COGNITIVE SKILL**

###### **GENERAL MICROBIOLOGY**

1. History of microbiology
2. Microscopy
3. Physical and biological containment
4. Sterilization and disinfection
5. Morphology of bacteria and other microorganisms
6. Nomenclature and classification of microorganisms
7. Normal flora of human body
8. Growth & nutrition of bacteria
9. Bacterial metabolism
10. Bacterial toxins
11. Bacteriocins
12. Host-parasite relationship
13. Antibacterial substances and drug resistance
14. Bacterial genetics
15. Molecular genetics relevant for medical microbiology

###### **IMMUNOLOGY**

1. Components of the immune system
2. Innate and acquired immunity
3. Cells involved in immune response
4. Antigens
5. Immunoglobulins
6. Mucosal immunity
7. Complement
8. Antigen & antibody reactions
9. Hypersensitivity
10. Cell mediated immunity
11. Cytokines
12. Immunodeficiency
13. Auto-immunity
14. Immune tolerance



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15. MHC complex
16. Transplantation immunology
17. Tumor immunity
18. Vaccines and immunotherapy
19. Measurement of immunological parameters
20. Immunological techniques
21. Immunopotentiality & immunomodulation

### **SYSTEMATIC BACTERIOLOGY**

1. Isolation & identification of bacteria
2. Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
3. Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella etc.
4. Gram positive bacilli of medical importance including Lactobacillus, Corynebacteria, Bacillus, Actinomyces, Nocardia, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.
5. Gram negative bacilli of medical importance including Enterobacteriaceae, Proteus, Vibrio, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas & other non-fermenters, Pasturella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
6. Helicobacter, Campylobacter & Spirillum
7. Mycobacteria
8. Spirochaetes
9. Chlamydiae
10. Mycoplasmales: Mycoplasma, Ureaplasma and other Mycoplasmas.
11. Rickettsiae, Coxiella, Bartonella etc.

### **VIROLOGY**

1. General properties of viruses
2. Classification of viruses
3. Morphology: Virus structure & bacteriophages
4. Virus replication
5. Isolation & identification of viruses
6. Pathogenesis of viral infections
7. Genetics of viruses



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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, Calci viruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepatitis viruses.
13. Viroids
14. Vaccines & anti-viral drugs.

## **PARASITOLOGY**

1. General characters & classification of parasites
2. Host- parasite relationship
3. Pathogenesis of parasitic infections
4. Methods of identification of parasites
5. Protozoan parasites of medical importance including Entamoeba, Free living amoebae, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Microsporidium, Cyclospora, Isospora, Babesia, Balantidium etc.
6. Helminthology of medical importance including those belonging to Cestoda (Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps etc.), Trematoda (Schistosomes, Fasciola, Fasciolopsis, Paragonimus, Clonorchis, Opisthorchis etc.) and Nematoda (Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus etc.)
7. Entomology: common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
8. Antiparasitic agents.

## **MYCOLOGY**

1. General characteristics & classification of fungi
2. Morphology & reproduction of fungi
3. Pathogenesis of fungal infections
4. Isolation & identification of fungi



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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 marneffeii etc.
8. Dermatophytes
9. Fungi causing mycetoma, keratomycosis & otomycosis.
10. Pneumocystis jirovecii infection
11. Rhinosporidium seeberi & Loboaloboi
12. Actinomycetes & Nocardia.
13. Common laboratory fungal contaminants
14. Mycetism & mycotoxicosis
15. Antifungal agents & in vitro antifungal susceptibility tests.
16. Hypersensitivity to fungi

### **APPLIED MICROBIOLOGY**

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Management of hospital waste
4. Investigation of an infectious outbreak
5. Bio-safety including universal precautions
6. Microbiology of hospital environment
7. Microbiology of air, milk and water
8. Quality assurance & quality control in microbiology
9. Accreditation of laboratories
10. Infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear & nose, septicaemia, endocarditis, haemorrhagic fever etc.
11. Opportunistic infections.
12. Sexually transmitted diseases
13. Vaccinology
14. Computers in microbiology
15. Gene cloning
16. Molecular techniques as applicable to microbiology



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17. Automation in Microbiology
18. Animal & human ethics involved in microbiological work.
19. Antimicrobial stewardship

**(B) PSYCHOMOTOR SKILLS**

**BACTERIOLOGY – MUST ACQUIRE**

1. Collection/transport of specimens for microbiological investigations
2. Preparation, examination & interpretation of direct smears from clinical specimens
3. Plating of clinical specimens on media for isolation, purification, identification and quantitation purposes.
4. Preparation of stains viz. Gram's, Albert's, Ziehl Neelsen's (ZN), Silver impregnation stain and special stains for capsule and spore etc.
5. Preparation and pouring of media like Nutrient agar, Blood Agar, Macconkey agar, Sugars, Serum sugars, Krigler iron agar, Robertson's cooked meat broth, Lowenstein Jensen's medium, Sabouraud's dextrose agar etc.
6. Preparation of reagents -oxidase, Kovac etc.
7. Quality control of media, reagents etc.
8. Operation of autoclave, hot air oven, distillation plant and filters.
9. Care and operation of microscopes
10. Washing and sterilisation of glassware (plugging and packing)
11. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
12. Aseptic practices in laboratory and safety precautions
13. Sterility tests
14. Identification of bacteria of medical importance up to species level (except anaerobes which could be up to generic level).
15. Techniques of anaerobiosis
16. Tests for Motility: Hanging drop method, Cragie's tube, dark ground microscopy for spirochaetes
17. In-vitro toxigenicity tests- Elek test, Naegler's reaction
18. Special tests-Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for Mycobacterium, satellitism, CAMP test, catalase, slide & tube agglutination tests and various other biochemical tests for identification of bacteria.



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19. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing, eg. Kirby- Bauer, Stoke's method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/ plate dilution methods
20. Tests for Beta-lactamase production
21. Testing of disinfectants -Phenol coefficient and "in use" tests
22. Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria
23. Disposal of contaminated materials like cultures
24. Disposal of infectious waste
25. Bacteriological tests for water, air and milk
26. Maintenance & preservation of bacterial cultures.
27. Operation and maintenance of all routine and automated instruments/ equipments of the laboratory:  
Microscope, Autoclave, Hot air oven, Incubators, Centrifuges, Automated bacterial culture system, Automated bacterial identification system, Automated Anaerobic culture system etc.

**BACTERIOLOGY – DESIRABLE TO ACQUIRE**

1. Conjugation experiments for drug resistance
2. Serum antibiotic assays e.g. gentamicin
3. Phage typing for Staphylococci, S.typhi, etc.
4. Bacteriocin typing viz. Proteocin, etc.
5. Enterotoxigenicity tests like rabbit ileal loop, intragastric inoculation of infant mouse, Sereny's test.
6. Animal pathogenicity/toxicity test for *C.diphtheriae*, *Cl.tetani*, *St.pneumoniae*, *S.typhimurium*, *K.pneumoniae* etc.
7. Serologic grouping of Streptococci
8. Mouse foot pad test for M leprae
9. Antimicrobial susceptibility tests for Mycobacteria
10. Molecular typing methods
11. Special staining techniques for Mycoplasma, Treponemes, Gardnerella.



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**IMMUNOLOGY & SEROLOGY – MUST ACQUIRE**

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
2. Preparation of antigens from bacteria or tissues for Widal, VDRL, O Streptolysin and group polysaccharide of Streptococcus etc. and their standardisation. (Only theory pass)
3. Performance of serological tests viz. Widal, Brucella tube agglutination, indirect hemagglutination, VDRL, ASO, RoseWaler test etc.
4. Immunodiffusion in gel (Ouchterlony), counter-immunoelectrophoresis.
5. Enzyme linked immunosorbent assay (ELISA)
6. Latex agglutination tests
7. Immunochromatography tests
8. Various POC tests
9. Preparation & preservation of complement & complement titration
10. Immunofluorescence.
11. Flowcytometry

**IMMUNOLOGY & SEROLOGY – DESIRABLE TO ACQUIRE**

1. Radial immunodiffusion for estimation of serum Immunoglobulins
2. Immunoelectrophoresis
3. Crossed immunoelectrophoresis
4. Neutrophil phagocytosis
5. Immunoblotting
6. Performance of serological tests viz. Weil Felix, cold agglutination, Paul Bunnel test
7. Leukocyte migration test
8. T - cell rosetting
9. Separation of lymphocytes by centrifugation, gravity sedimentation etc.
10. MAT for Leptospire

**MYCOLOGY – MUST ACQUIRE**

1. Collection and transport of specimens
2. Processing of samples for microscopy and culture
3. Direct examination of specimens by KOH, Gram's, Acid fast, Giemsa, Lactophenol cotton blue & special fungal stains
4. Examination of histopathology slides for fungal infections
5. Isolation and identification of medically important fungi & common laboratory contaminants



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6. Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture
7. Maintenance of stock cultures.

**MYCOLOGY – DESIRABLE TO ACQUIRE**

1. Antigen preparation -viz. from Candida, Aspergillus, Histoplasma, Sporothrix
2. Antibody detection for candidiasis, aspergillosis, histoplasmosis, blastomycosis, Cryptococcosis, zygomycosis, coccidioidomycosis
3. Antigen detection in cryptococcosis, aspergillosis, candidiasis
4. Skin test using aspergillin, candidin, histoplasmin, sporotrichin
5. Isolation and identification of actinomycetes.
6. Calcofluor staining & examination under fluorescent microscope
7. Anti-fungal susceptibility test
8. Animal pathogenicity tests viz. intravenous, intracerebral and intra peritoneal inoculation of mice for fungal pathogenicity study.

**PARASITOLOGY – MUST ACQUIRE**

1. Collection and transport of specimens for diagnosis of parasitic diseases
2. Examination of faeces for parasite ova and cysts etc. by direct and concentration methods (salt floatation and formol-ether methods)
3. Egg counting techniques for helminths micrometry and mounting of slides
4. Examination of blood for protozoa and helminths by wet mount, thick and thin stained smears
5. Examination of blood for microfilariae including concentration techniques
6. Examination of other specimens eg. Urine, CSF, Bone marrow etc. for parasites
7. Histopathology sections -examination and identification of parasites
8. Preparation & performance of stains -Leishman, Giemsa, Lugol's iodine
9. Identification of medically important adult worms
10. Preparation of media -NIH, NNN etc.
11. Copro-culture for larvae of hook worms
12. Identification of common arthropods and other vectors viz. mosquito, sandfly, ticks, mites, cyclops
13. Preservation of parasites-mounting, fixing, staining etc.
14. Identification of Opportunistic parasitic infections- Cryptosporidium, Microsporidia, Cyclospora, Iadamoeba butschlii, Strongyloides etc.
15. Identification of free living amoeba like Acanthamoeba and Naegleria





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**PARASITOLOGY – DESIRABLE TO ACQUIRE**

1. Maintenance of parasites in laboratory by in-vitro cultures
2. Permanent staining techniques like iron hematoxylin
3. QBC for malaria & filaria .
4. In-vitro culture of parasites like Entamoeba, Leishmania, P. falciparum, Acanthamoeba etc.
5. Antigen preparation -viz. Entamoeba, filaria, Toxoplasma, hydatid for serological tests for IRA, ELISA and skin tests like Casoni.

**VIROLOGY – MUST ACQUIRE**

1. Preparation of glassware for tissue cultures (washing, sterilisation).
2. Preparation of buffers like PBS, Hank's
3. Preparation of clinical specimens for isolation of viruses
4. Collection & transport of specimens
5. Recognition of CPE producing viruses
6. Serological tests -ELISA for HIV & HBsAg, Haemagglutination Inhibition test for Influenza, Measles
7. Chick Embryo techniques-inoculation and harvesting
8. Handling of mice, rats and guinea pigs for collection of blood, pathogenicity tests, etc.
9. Special staining procedure for viruses.
10. Molecular tests like PCR and RT-PCR: Performing the test and interpreting the result.

**VIROLOGY – DESIRABLE TO ACQUIRE**

1. Electron microscopy of virus -TEM, SEM
2. Preservation of viruses
3. Preparation of viral antigens.
4. Molecular techniques in virology
5. Preparation of monkey kidney cells (primary) and maintenance of continuous cell lines by subculture.
6. Performing virus culture, observing cell lines for CPE under inverted microscope.
6. Preservation in -70°C and liquid nitrogen
7. Performance of haemadsorption for Parainfluenza, Haemagglutination of Influenza, Immunofluorescence, Neutralisation for Enteroviruses and Respiratory viruses. Identification tests on tissue cultures and supernatants etc.
11. Sequencing and Next Generation sequencing.



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**APPLIED MICROBIOLOGY**

1. Planning and execution of investigations during an epidemic
2. Segregation and disposal of biological and hospital wastes
3. Handling automated systems
4. Performance of molecular techniques
5. Computer applications
6. All activities related to prevention of various Hospital Acquired Infections (HAIs)



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## **Microbiology Department**

### **(A) General Microbiology and Bacteriology**

#### **First year:-**

- Media and reagent preparation
- Operation of autoclave, hot air oven
- Washing and sterilization of glass wares
- Laboratory waste management
- Aseptic practices in laboratory and safety precautions
- Care and maintenance of common laboratory equipment
- Preparation and performance of common bacterial stains
- Collection of specimens for microbiological investigations
- Care and operation of microscopes
- Preparation, examination and interpretation of direct smears from clinical specimens
- Motility testing of bacteria
- Plating of clinical specimens on media

#### **Second year:-**

- Quality control of media and reagents
- Quantitative and semi-quantitative analysis of urine
- Skin tests
- Preparation of antibiotic discs
- Estimation of MIC, MBC, and tests for  $\beta$ -lactamases
- Microscopic Examination-Light Microscopy and Fluorescent microscopy
- Identification of bacteria of medical importance up to species level
- Care and breeding of laboratory animals

#### **Third year:-**

- Techniques of anaerobiosis
- Bleeding techniques from animals
- Inoculation of infective material by different routes in the animals
- Performance of autopsy on the animals
- Animal pathogenicity / toxigenicity tests and in-vitro toxicity tests
- Special tests

### **(B) Immunology**

#### **First year:-**

- Collection of blood by venipuncture
- Separation of serum and preservation of serum for short and long periods
- Preparation of antigens from bacteria or tissues like Widal, VDRL, etc and their standardization



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- Latex and Staphylococcal Co-agglutination tests
- Preparation of adjuvants like Freund's adjuvant
- Immunochromatography test
- Different SOP development

**Second year:-**

- Performance of serological tests viz. Widal, Brucella tube agglutination, Weil-Felix, Cold agglutination, VDRL, Paul-Bunnell, Rose-Waaler
- Raising of antisera in laboratory animals
- Enzyme linked immunosorbent assay (ELISA)
- Separation of lymphocytes by centrifugation, gravity sedimentation

**Third year:-**

- Counter immunoelectrophoresis
- Haemolysin and complement titration
- Leukocyte migration test
- T-cell resetting
- Radial immunodiffusion for estimation of serum immunoglobulins
- Immuno-electrophoresis
- Crossed immunoelectrophoresis
- Neutrophil phagocytosis
- Immuno-fluorescence test

**(C) Mycology**

**First year:-**

- Collection of specimens
- Direct examination of specimens by KOH, Gram's, Kinyoun's, Giemsa, Lactophenol cotton blue stains

**Second year:-**

- Isolation and identification of common laboratory contaminants, dermatophytes and others of medical importance (yeast, dematiaceous fungi)
- Maintenance of stock cultures

**Third year:-**

- Examination of histopathology slides for fungal infections
- Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture



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- Animal pathogenicity tests viz. intracerebral and intraperitoneal inoculation of mice for *Cryptococcus*.
- Anti-fungal sensitivity testing

**(D) Parasitology**

**First year:-**

- Examination of feces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formal-ether methods)
- Examination of blood for protozoa and helminthes by wet mount and thin and thick stained smears
- Performance of stains- Leishman, Giemsa
- Preservation of parasites- mounting, fixing, staining, etc.
- Preparation of media-NIH, NNN, etc.

**Second year:-**

- Egg counting techniques for helminthes
- Examination of other specimens eg. urine, CSF, bone marrow etc. for parasites
- In-vitro culture of parasites like *Entamoeba*, *Leishmania*, etc.
- Copro-culture of larva of hookworms
- Antigen preparation-viz. *Entamoeba*, filarial, hydatid for serological tests like IHA and skin tests like Casoni's test.
- Serological tests like IHA, ELISA, Co-A
- Microscopy for Opportunistic parasites

**Third year:-**

- Histopathology sections-examination and identification of parasites
- Identification of common arthropods and other vectors viz., mosquito, sandfly, tick, mite, Cyclops
- Permanent staining techniques like iron haematoxylin
- Maintenance of *Toxoplasma gondii* in mice

**(E) Virology**

**First year:-**

- Preparation of glass wares for tissue cultures (washing, sterilization)
- Preparation of media like Hanks, Eagle's MEM
- Preparation of clinical specimens for isolation of viruses
- Serological tests-ELISA for HIV, RPHA for HBsAg

**Second year:-**

- Maintenance of continuous cell lines by subcultures.
- Preservation in -70°C and liquid nitrogen
- Handling of mice, rat, guinea pigs for collection of blood, pathogenicity tests, etc.
- DNA /RNA extraction from clinical samples
- Setting PCR reaction- both conventional and Real time
- Gel electrophoresis
- Interpretation of PCR-Gel picture and curves of RT-PCR.



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**Third year:-**

- Recognition of CPE producing viruses
- Performance of viz. haemadsorption for Parainfluenza
- Haemagglutination for Influenza
- Immunofluorescence
- Neutralization for Enteroviruses and Respiratory viruses
- Identification tests on tissue cultures and supernatants, etc.

**(F) Hospital Infection Control activities**

**First year:-**

- Knowing basics of Infection control
- Monitoring Bio medical waste Management of hospital

**Second year:-**

- Water testing
- Air sampling, culture and interpretation
- Passive surveillance
- Safety of health care workers-Immunisation

**Third year:-**

- Active surveillance of HAIs
- Safety of HCWs- Managing NSI, PEP etc.
- Resource person for training of HCW regarding various aspects of Infection Control Practices(ICPs)

**6. MONITORING THE PROGRESS OF POST GRADUATES**



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### **1. Maintenance of log book**

Each post graduate student shall maintain a record of skills acquired during the three years of training period.

The head of the department should scrutinize the log book once in three months. At the end of the course the student should summarize the contents and get the log book certified by the head of the department.

The log book is to be submitted at the time of practical examination for the scrutiny by the board of examiners.

It is mandatory that a post graduate student should present one poster and /or read one paper at a national /state level conference and /or to present one research paper which can be published/accepted for publication/sent for publication during the period of his/her postgraduate studies.

**2. Periodical assessment** through assignments, performance in symposia, culture-seminars,Slide and technique seminars and journal clubs.

### **3. Dissertation/Thesis**

Every student registered as post graduate shall carry out work on an assigned research project under the guidance of a recognized post graduate teacher, the result of which shall be written up and submitted in the form of a thesis.

Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. Thesis shall be submitted at least six months before the theoretical and clinical / practical examination.

The thesis shall be a bound volume of a minimum of 50 pages and not exceeding 100 pages of typed matter (Double line spacing and on one side only) excluding certification, acknowledgements, annexure and bibliography.

Ethical issues and consideration must be given priority.

#### **Thesis should consist of**

- (a) Introduction
- (b) Review of literature
- (c) Aims and objectives
- (d) Material and methods
- (e) Result
- (f) Discussion
- (g) Summary and conclusion
- (h) Tables



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- (i) Annexure
- (j) Bibliography

Four copies of thesis shall be submitted six months prior to the commencement of the theory examinations on the date prescribed by the Controller of Examinations of AIIMS Bibinagar. The thesis should be approved by the Chief supervisor of that branch and the same has to be forwarded to the Controller of Examinations, by the head of the department.

Two copies in addition are to be submitted as an electronic version of the entire thesis in a standard C.D. format.

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; and on the acceptance of the thesis by two examiners, the student shall be allowed to appear for the final examination.

**EVALUATION OF THESIS: ACCEPTED/ NOT ACCEPTED**

No marks will be given

**7. MD MICROBIOLOGY FINAL EXAMINATION FORMAT**

Final university examination shall be at the end of three years

**THEORY:**

**Duration Marks**





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PAPER-I General Microbiology, Immunology	3 Hours	100
PAPER-II Systematic Bacteriology & Mycology	3 Hours	100
PAPER-III Virology and Parasitology	3 Hours	100
PAPER-IV Applied Microbiology & Recent Advances	3 Hours	100

**PRACTICAL:**

Duration: 3 days

<b>Day 1:</b>	<b>Forenoon</b>	<b>Afternoon</b>
	Pure culture	Fungal culture
	Mixed culture	Immunology exercise
	Bacteriological techniques	Virology techniques
<b>Day 2:</b>	Reporting of pure culture	Discussion of fungal culture
	Continuation of mixed culture	Slide discussion
	Discussion of immunology exercise	Parasitology exercise
	Animal experiments/ Molecular Biology Techniques	
<b>Day 3:</b>	Reporting mixed culture	Viva voce
	Pedagogy	Discussion on thesis

**PRACTICAL EXERCISES:**

	<b>Marks</b>
Identification of pure culture	25
Processing of clinical sample and identification of mixed cultures	40
Identification of fungi and slide culture	20
Animal experiments/ Molecular Biology Techniques	15
Virology techniques (egg inoculation / tissue culture/ELISA)	20
Parasitology (stool examination, Examination of PBS)	20
Immunology –serology	20
Slide discussion	20
Bacteriological techniques (staining, media prep., M/E, QC)	20

Total 200

Practical	200
Viva Voce	60
Pedagogy	40
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Total	300
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Pattern of question paper: (same for all 4 papers)

Duration 3 hours

Essay Questions: 2 numbers

Short answers : 10 numbers

Total marks 100

marks 25 x 2                      50 marks

marks 5 x 10                      50 marks

**MODEL QUESTION PAPERS**

**PAPER I – GENERAL MICROBIOLOGY & IMMUNOLOGY**

**Time: 3 hours**

**Max. Marks: 100**



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Note: *Answer all questions*

1. Discuss the principle and methods of preparation of monoclonal antibodies.  
Describe the clinical applications of monoclonal antibodies. 25
2. Define the principle and application of western blot in microbiology. 25
3. Write short notes on: 5x10
  - a) Advances in culture of anaerobic bacteria
  - b) Transposable genetic elements
  - c) Virulence factors of a Bacteria
  - d) Gaseous agents and disinfectants
  - e) Application of electron microscopy in diagnostic microbiology

**PAPER II – SYSTEMATIC BACTERIOLOGY AND MYCOLOGY**

**Time: 3 hours**

**Max Marks: 100**

Note: *Answer all questions.*



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1. Describe the newer concepts in taxonomy and nomenclature of *Leptospira* species.  
Discuss the epidemiology and laboratory diagnosis of leptospirosis. 25
2. Describe the newer *Vibrio* species. Discuss the newer vaccines against cholera. 25
3. Write short notes on: 5x10
  - a) Melidiosis
  - b) Leprosy eradication in India
  - c) *Penicillium marneffi*
  - d) Non-*Candida albicans* spp.
  - e) Histoplasmosis in India

**PAPER III – VIROLOGY AND PARASITOLOGY**

**Time: 3 hours**

**Max. Marks: 100**

Note: Answer all questions.



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1. Describe recent concepts in understanding *Entamoeba histolytica*, *Entamoeba dispar* and other look- alike species. 25
2. Discuss the epidemiology and pathogenesis of arbovirus infections in India.  
Discuss newer methods in diagnosis of viral infections. 25
3. Write short notes on: 5x10
  - a) Pathogenesis and laboratory diagnosis of neurocysticercosis
  - b) Vaccine trial against Malaria
  - c) Pathogenesis and laboratory diagnosis of lymphatic filariasis
  - d) Avian Influenza
  - e) Prion mediated diseases

**PAPER IV - APPLIED MICROBIOLOGY AND RECENT ADVANCES**

**Time: 3 hours**

**Max Marks: 100**

Note: *Answer all questions.*



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1. Discuss automation methods in clinical microbiology. 25
2. Discuss recent concepts in application of Nano technology in microbial diseases. 25
3. Write short notes on: 5x10
  - a) Chimeric antibodies
  - b) Opportunistic infections in HIV
  - c) Antigen detection in non-blood specimens for diagnosis of infectious diseases
  - d) Newer concepts in the pathogenesis of urinary tract infection
  - e) Disposal of hospital wastes

## 8. SUGGESTED READING

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

1. Topley and Wilson's Microbiology and Microbial infections. 8 Volume Set
2. Color Atlas and Textbook of Diagnostic Microbiology: Elmer W Koneman



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3. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases
4. Bailey and Scott's Diagnostic Microbiology.
5. Monica Cheesbrough's-District Laboratory Practice in Tropical Countries, Part 1 & 2
6. Bergey's Manual of Systematic Bacteriology ( Vol 1 & 2)
7. Henry D.Isenberg Clinical Microbiology Procedures Handbook
8. J. Michael Mille A Guide to Specimen Management in Clinical Microbiology
9. Parick R. Murray Medical Microbiology
10. Microbiology and Clinical Practice: Shanson
11. Immunology: Janis Kuby.
12. Basic Clinical Immunology. Fudenburg, Stites, Caldwell, Weils.
13. Abul K. Abbas Cellular and Molecular Immunology
14. Prescott's Microbiology
15. Stanley A. Plotkin , Walter Orenstein , Paul A. Offit Vaccines
16. Jawetz, Melnick & Addbergs Medical Microbiology
17. Fields Virology Vol-1 & Vol-2
18. Lennettes Laboratory Diagnosis Of Viral Infections
19. Davise H. Larone; Medically Important Fungi: A Guide to Identification
20. Kauffmann, Mandell-Atlas Of Fungal Infections
21. Lynne S. Garcia- Diagnostic Medical Parasitology
22. Manual of infection control procedures N Damini

### **Further Reading**

1. Mycology - Rippons
2. Essentials of Immunology- Roitt
3. Virology- Clinical Virology by Rich
4. Gradwohl's Clinical Laboratory Methods and Diagnosis.
5. Biochemical tests for the Identification of Medical Bacteria-MacFaddin JF
6. Manual of Clinical Microbiology- ASM press

### **Journals**

1. Science
2. Nature
3. Lancet
4. Indian Journal of Medical Microbiology
5. Clinical Microbiology Reviews
6. Journal of Clinical Microbiology
7. Journal of Medical Microbiology
8. Journal of AIDS
9. Journal of Hospital Infection
10. Indian Journal of Tuberculosis and Lung Diseases.



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8. Indian Journal of Medical Research
9. JAAC
10. Parasitology Today
11. Journal of Infection
12. Infection Control and Hospital Epidemiology
13. Indian Journal of Tuberculosis
14. Journal of Associations of Physicians of India
15. Lancet-Infectious Diseases
16. Emerging Infectious Diseases-online
17. New England Journal of Medicine
18. British Medical Journal
19. Scandinavian Journal of Infectious Diseases
20. ICMR Bulletin
21. AIDS Research & Review
22. MMWR
23. Tubercle
24. WHO Bulletin
25. Journal of American Medical Association
26. Paediatric infectious diseases
27. Indian Journal of Leprosy
28. International Journal of Leprosy
29. Immunology
30. American journal of Epidemiology

**Important Websites:**

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