



King George's Medical University UP, Lucknow

POST GRADUATE DEPARTMENT OF MICROBIOLOGY



Ref. No. 1603/2021

Date 16/12/2021

सेवा में,

प्रो०उमा सिंह,
अधिष्ठाता-एकेडेमिक्स
किंग जार्ज चिकित्सा विश्वविद्यालय,
उ०प्र०, लखनऊ।

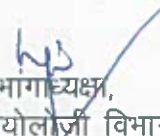
महोदय,

कृपया आपके कार्यालय के पत्र संख्या Dean-Academics/KGMU/2021/3765 dated 13.12.2021 का संदर्भ ग्रहण करने का कष्ट करें। उक्त के संदर्भ में आप द्वारा वांछित एम०डी० पाठ्यक्रम का curriculum आवश्यक कार्यवाही हेतु प्रेषित है।

धन्यवाद

संलग्नक : यथोक्त

भवदीय,


विभागाध्यक्ष,
माइक्रोबायोलॉजी विभाग,
किंग जार्ज चिकित्सा विश्वविद्यालय,
उ०प्र० लखनऊ।

CURRICULUM FOR MD MICROBIOLOGY- KGMU

GOAL

The purpose of MD in Microbiology is to create specialists in the field of Clinical Microbiology who would provide high quality health care and apply the latest advances in the field of Medical Microbiology for the accurate & timely diagnosis of the various infectious disease processes, do research & actively involved in the workshops/training so as to be updated with the latest trends in Medical Microbiology.

PROGRAM OUTCOMES

A post graduate student upon successfully qualifying in the MD (Microbiology) Examination should be able to:

1. Demonstrate competence as a Clinical Microbiologist
2. Exhibit effective communication skills with the allied departments by rendering services in basic as well as advanced laboratory investigations and in practice of clinical microbiology
3. Application of the knowledge of Clinical Microbiology in a variety of clinical settings to contribute in the diagnostic and therapeutic problems along with preventive measures.
4. Play a pivotal role in hospital infection control practices, including formulation of antibiotic policy and proper management of biomedical waste.
5. Acquire skills in conducting collaborative research in the field of Microbiology and allied sciences.
6. Actively involved in clinical/experimental research which will significantly improve the patient care outcome.
7. Demonstrate effective communication skills required for teaching undergraduate students
8. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.
9. Plan, execute and evaluate teaching assignments in Medical Microbiology.
10. Plan, execute, analyze and present the research work in Medical Microbiology.
11. To acquire various skills for collaborative research.
12. To participate in various workshops/seminars/journal clubs/demonstration in the allied departments.
13. Uphold the prestige of the discipline amongst the fraternity of doctors.

SYLLABUS

PAPER-I GENERAL MICROBIOLOGY AND IMMUNOLOGY
PAPER-II BACTERIOLOGY + MYCOLOGY
PAPER-III VIROLOGY AND PARASITOLOGY
PAPER-IV APPLIED MICROBIOLOGY & RECENT ADVANCES

A. COGNITIVE DOMAIN – At the end of the course, the student should have acquired knowledge in the following theoretical competencies –

General Microbiology

1. Introduction to microbiology
 - a. History of Microbiology
 - b. Role of Microbiology laboratory in diagnosis of infections
 - c. Guidelines for the Collection, Transport, Processing, Analysis and Reporting of Cultures
2. Microscopy – Types and principles
3. Bio-safety in laboratory
4. Quality control and Quality assurance
5. Sterilization and disinfection
6. Types and preparation of Culture media
7. Morphology of bacteria
8. Growth, Nutrition and requirement of bacteria
8. Normal flora of human body
9. Bacterial toxins and Bacteriocins and their role
10. Microbiology of air, milk and water
11. Host-parasite relationship including bacterial virulence factors and pathogenicity
12. Antibacterial substances and drug resistance
13. Bacterial genetics
14. Molecular diagnosis of microorganisms
15. Accreditation of laboratories
16. Bioterrorism
17. Risk management and Laboratory Safety practices
18. Laboratory diagnosis of bacteria
19. Syndromic approach
20. Hospital Acquired Infections – Types, Surveillance and prevention
21. Human Microbiome

Immunology

1. Structure and function of the immune system
2. Immunity – Types and features
3. Antigens
4. Immunoglobulins
5. Complement – Role in infections and diagnostics

6. Antigen & antibody reactions
7. Hypersensitivity reactions
8. Cytokines and their role
9. Immunodeficiency
10. Auto-immunity
11. MHC complex
12. Transplantation immunity
13. Tumor immunity
14. Vaccines and immunotherapy
15. Immunological techniques
16. Immunomodulation

Systematic bacteriology

1. Systemic classification of bacteria
2. Gram positive cocci - *Staphylococcus*, *Micrococcus*, *Streptococci*, *Enterococci*, anaerobic cocci etc.
3. Gram negative cocci - *Neisseria*, *Branhamella*, *Moraxella* etc.
4. Gram positive bacilli of medical importance including *Lactobacillus*, 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*, *Haemophilus*, *Bordetella*, *Brucella*, *Gardnerella*, *Pseudomonas*
6. Nil- fermenters
7. Miscellaneous bacteria - *Helicobacter*, *Campylobacter*, *Legionella* & *Spirillum*
8. Enterobacteriaceae
9. Mycobacteria
10. Spirochaetes
11. *Chlamydiae*
12. Mycoplasmales: *Mycoplasma*, *Ureaplasma*, *Acholeplasma* and other *Mycoplasmas*.
Rickettsiae, *Coxiella*, *Bartonella* etc.
13. Anaerobic bacteriology –
 - a. Introduction to Anaerobic bacteria
 - b. Human infections caused by anaerobic bacteria
 - c. Collection, transport and handling of anaerobic specimens and cultures
 - d. Isolation and identification of anaerobic bacteria
 - e. Anaerobic Gram negative bacilli – *Bacteroides*, *Fusobacterium* etc.
 - f. Anaerobic Gram positive bacilli – *Propionibacterium*, *Eubacterium*, *Lactobacillus*, *Mobiluncus*, etc
 - g. *Clostridium* species
 - h. Anaerobic Gram positive and negative cocci

Virology

1. General characteristics of viruses
 - a. Classification of viruses
 - b. Morphology of viruses
 - c. Replication of viruses
5. Pathogenesis and host response of viral infections
6. Laboratory diagnosis of viruses
7. DNA viruses - Poxviridae, Herpesviridae, Adenoviridae, Hepadna virus and Parvo viruses etc.
9. RNA viruses - Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Filoviruses, Arboviruses, Coronaviridae,
10. Retroviridae, Human immunodeficiency virus
10. Slow viruses including prions
11. Unclassified viruses
12. Carcinogenic viruses
13. Teratogenic viruses
14. Vaccines & anti-viral drugs
15. Recent advances in diagnosis of Viral infection

Parasitology

1. Introduction to parasitology
 - a. Taxonomical and systemic classification of parasites
 - b. General characteristics of parasites
2. Laboratory diagnosis of parasitic infections
3. Protozoan parasites - Entamoeba, Free living amoebae, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora*, *Isospora*, *Babesia*, *Balantidium* etc.
4. Helminthology –
 - a. Cestoda (*Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepis*, *Dipylidium*, *Multiceps* etc.)
 - b. Trematoda (*Schistosomes*, *Fasciola*, *Fasciolopsis*, *Gastrodiscoides*, *Paragonimus*, *Clonorchis*, *Opisthorchis* etc.)
 - c. Nematoda (*Trichiuris*, *Trichinella*, *Strongyloides*, *Ancylostoma*, *Necator*, *Ascaris*, *Toxocara*, *Enterobius*, *Filarial worms*, *Dracunculus* etc.)
5. Entomology: common arthropods & other vectors
6. Antiparasitic agents
7. Drug resistance in parasites
8. Recent advances in parasitology

Mycology

1. Introduction to Mycology including classification, morphology, nomenclature, reproduction and laboratory diagnosis of fungi
2. Host response to fungal infections
3. Superficial mycoses including Dermatophytes

4. Subcutaneous mycoses- Sporotrichosis, Chromomycosis, Mycetoma and all fungi causing these infections
5. Yeasts and yeast like fungi of medical importance including *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Saccharomyces* etc.
6. Systemic fungi of medical importance including *Aspergillus*, *Zygomycetes*, *Pseudoallescheria*, *Fusarium*, *Piedra*
7. Hyphomycetes and hyalohyphomycetes
8. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffeii*
9. Fungi causing mycetoma, keratomycosis, otomycosis and opportunistic infections.
10. *Pneumocystis carinii* infection
11. *Rhinosporidium seeberi* & *Loboa loboii*
12. Common laboratory contaminants
13. Mycetism & mycotoxicosis
14. Antifungal agents & invitro antifungal susceptibility tests
15. Newer fungi
16. Recent Advances in diagnosis of fungal infections

Applied Microbiology

1. Epidemiology of various infectious diseases
2. Hospital acquired infections – Types, Surveillance systems, prevention
3. Biomedical waste management in hospital
4. Outbreak investigation
5. 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.
6. Opportunistic infections.
7. Sexually transmitted diseases
8. Vaccinology: principle, methods of preparation, administration of vaccines information technology (Computers) in microbiology
9. Gene cloning
10. Molecular techniques as applicable to microbiology
11. Automation in Microbiology
12. Statistical analysis of microbiological data and research methodology
13. Animal & human ethics involved in microbiological work

B) AFFECTIVE DOMAIN

1. Should be able to develop inter- and intra-collaborative communication and work skills to provide the best possible diagnosis.
2. Should be epithetical, etiquette, respectful and ethical approach towards patients, relatives and other health personnel.

C) PSYCHOMOTOR SKILLS

1. Collection/transportation of microbiological specimens
2. Preparation, staining, examination and interpretation of direct smears from clinical specimens
3. Inoculation of clinical specimens on solid/liquid media for isolation, purification, identification.
4. Preparation of stains/reagents viz. Gram, Albert's, Ziehl-Neelsen (ZN), Silver impregnation stain and special stains for capsule and spore, KOH, oxidase, Kovac, catalase etc.
5. Preparation, pouring and Sterility tests of different solid/liquid medias and biochemicals like Sugars, Kligler iron agar/Triple sugar iron agar (TSI), Robertson's cooked meat broth, Lowenstein Jenson's medium, Sabouraud's dextrose agar etc.
6. Quality control of media and reagents
7. Operation, care and maintenance of various equipments like autoclave, hot air oven, incubators, centrifuge etc.
8. Maintenance and care of microscopes
9. Washing and sterilization of glassware (including plugging and packing)
10. Aseptic practices in laboratory and safety precautions.
11. Identification of bacteria up to species level by using morphotyping and biotyping
12. Preparation of anaerobic isolation and identification medias
13. Isolation and identification of anaerobic media atleast upto genus level
14. Motility demonstration techniques: hanging drop, Cragie's tube, dark ground microscopy for *spirochaetes*
15. Basic identification tests - Catalase test, Oxidase test, slide and tube coagulase tests, niacin and catalase tests for *Mycobacterium*, bile solubility, chick cell agglutination, sheep cell haemolysis, satellitism, CAMP test, and other biochemical tests.
16. Selection of proper drugs for putting up of AST for a particular organism from a particular site.
17. Performance of antimicrobial susceptibility testing eg. Kirby-Bauer, Stoke's method and by automated methods
18. Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/plate dilution methods.
19. Tests for β -lactamase production.
20. Screening and confirmatory tests of gram negative isolates for ESBL and MBL
21. Screening of *Staphylococci* for Methicillin Resistance.
22. Screening of *Enterococci* for Vancomycin resistance.
23. Interpretation and proper reporting of antimicrobial susceptibility testing.
23. Testing of disinfectants.
24. Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteruria
25. Bacteriological tests for water, air and milk
27. Maintenance and preservation of bacterial stock cultures
28. Maintenance and preservation of fungal stock cultures
29. Performing and reporting of bacterial, fungal, mycobacterial Quality control and proficiency testing samples

30. Performing and interpretation of basic serological reactions like –rapid ICT's, Widal(Slide and Tube), Latex agglutination tests, VDRL flocculation test etc.
31. Ethical approach towards animal handling and animal inoculation (in case applied)
32. Identification of viruses :Selection of egg of proper age, proper incubation of eggs, monitoring of eggs for development of embryo and egg inoculation and harvesting technique for virus isolation, Tissue culture, Hemagglutination inhibition, Viral load estimation, Polymerase chain reaction
33. Putting drug susceptibility testing for Mycobacterium tuberculosis on solid and liquid media.
34. Proper use, operation, maintenance of Automated systems in Microbiology
35. Interpretation of various tests by Automated systems.
36. Molecular testing of various organisms
37. Genotypic antimicrobial susceptibility testing of bacteria by molecular methods.

TIME FRAME TO ACQUIRE 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	IMMUNOLOGY :Clinical 1. Hypersensitivity 2. Immunodeficiency 3. Auto-immunity 4. Immune tolerance 5. Transplantation immunity 6. Tumor immunity 7. Immunoprophylaxis and immunotherapy 8. Measurement of immunity	GENERAL MICROBIOLOGY & IMMUNOLOGY: All

<p>13. Gene cloning 14. Antibacterial substances used in the treatment of infections and drug resistance in bacteria 15. Bacterial ecology - Normal flora of human body, Hospital environment, Air, Water and Milk 16. Host-parasite relationship</p>		
<p>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</p>	<p>SYSTEMATIC BACTERIOLOGY 1. <i>Streptococcus</i> and <i>Lactobacillus</i> 2. <i>Staphylococcus</i> and <i>Micrococcus</i> 3. <i>Pseudomonas</i> 4. The <i>Enterobacteriaceae</i> 5. <i>Mycobacteria</i> 6. <i>Corynebacterium</i> and other Coryneform bacteria 7. <i>Vibrios</i>, <i>Aeromonas</i>, <i>Plesiomonas</i>, <i>Campylobacter</i> & <i>Spirillum</i> 8. <i>Neisseria</i>, <i>Branhamella</i> & <i>Moraxella</i> 9. <i>Haemophilus</i> and <i>Bordetella</i> 10. <i>Bacillus</i>: the aerobic spore-bearing bacilli 11. <i>Clostridium</i>: the spore-bearing anaerobic bacilli 12. Non-</p>	<p>SYSTEMATIC BACTERIOLOGY (2nd year) :plus 1. <i>Actinomycetes</i>, <i>Nocardia</i> and <i>Actinobacillus</i> 2. <i>Erysipelothrix</i> and <i>Listeria</i> 3. The <i>Bacteroidaceae</i>: <i>Bacteroides</i>, <i>Fusobacterium</i> and <i>Leptotrichia</i> 4. <i>Chromobacterium</i>, <i>flavobacterium</i>, <i>Acinetobacter</i> and <i>Alkaligenes</i> 5. <i>Pasteurella</i>, <i>Francisella</i> 6. <i>Brucella</i> 7. <i>Chlamydia</i> 8. <i>Rickettsiae</i> 9. <i>Mycoplasmatales</i>: <i>Mycoplasma</i>, <i>Ureaplasma</i> and <i>Acholeplasma</i> 10. Miscellaneous bacteria</p>

	sporinganaerobe 13. The <i>Spirochaetes</i>	
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. <i>Herpes viruses</i> 11. <i>Paramyxoviruses</i> 12. <i>Influenza virus</i> 13. <i>Hepatitis viruses</i> 14. <i>Rabies virus</i> 15. <i>Human immunodeficiency viruses</i>	VIROLOGY (2nd year): plus 1. Vaccines 2. <i>Pox viruses</i> 3. <i>Vesicular viruses</i> 4. <i>Toga viruses</i> 5. <i>Bunya viruses</i> 6. <i>Arena viruses</i> 7. <i>Marburg and Ebola viruses</i> 8. <i>Rubella virus</i> 9. <i>Orbi viruses</i> 10. Respiratory diseases : <i>Rhinoviruses, adenoviruses and corona viruses</i> 11. Enteroviruses; <i>Polio, Echo, and Cocksackie viruses</i> 12. Other enteric viruses 13. Slow viruses 14. Oncogenic viruses 15. Teratogenic viruses
	PARASITOLOGY: 1. General Parasitology 2. Protozoan parasites of medical importance: <i>Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium</i>	PARASITOLOGY (2nd year): plus 1. Protozoan parasites of medical importance: <i>Toxoplasma, Sarcocystis, Cryptosporidium, Babesia, Balantidium</i> etc. 2. Helminthology: All those medically important helminthes belonging to Cestoda, Trematoda Nematoda. 3. Cestodes: <i>Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps</i> etc. 4. Trematodes: <i>Schistosomes, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis</i> etc. 5. Nematodes: <i>Trichuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus,</i> etc.

		<p>6. Ecto-parasites: Common arthropods and other vectors viz., Mosquito, Sand fly, Ticks, Mite, Cyclops</p>
	<p>MYCOLOGY 1. The morphology and reproduction in fungi 2. Classification of fungi 3. <i>Dermatophytes</i> 4. <i>Candida</i> 5. <i>Aspergillus</i></p>	<p>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</p>
		<p>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</p> <p>ALLIED BASIC SCIENCES (a) Biochemistry: Basic understanding of biochemistry as applied to immunological/ molecular methods for study of microbial diseases and pathogenesis of infections. 1. Protein purification and estimation 2. Protein estimation 3. Nucleic acid purification and characterization 4. Agarose and polyacrylamide gel electrophoresis - principles 5. Ultracentrifugation – principles 6. Column chromatography – principles</p> <p>(b) Molecular biology: Basic knowledge as applicable to molecular diagnostics & molecular epidemiology. 1. Recombinant DNA technology 2. Southern, northern and western blotting 3. DNA amplification techniques 4. Diagnostic PCR, different methods of PCR product detection (liquid hybridization,</p>

		ELISA). 5. Genotyping of microbes and viruses (c) Pathology: (as applied to Microbiology) Basic knowledge of 1. Inflammation and repair 2. Intercellular substances and reaction 3. Pathological changes in the body in bacterial, viral, mycotic and parasitic infections 4. Demonstration of pathogen in tissue section
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Skills:

IST YEAR RESIDENCY - SKILL LIST		
Sr No	Area	Procedure
1	General Microbiology	Microscopy for unstained preparations/ wet mount
		Microscopy for stained preparation
		Preparation of direct smears from clinical specimens
		Preparation of slit skin smear for lepra bacilli
		Hanging drop preparation
		Washing, sterilization and packing of glassware
		Infection control activities Environmental Sampling
		Identification of HAI
		Calculation of HAI quality indicators
		Bacteriology of water
		Bacteriology of air
		Antibiotic disc preparation
		Handling of laboratory animal
		Methods for preservation of bacteria
		Maintenance of stock cultures
2	Staining	Gram staining
		Acid fast staining (Ziehl-Neelsen method)

		Albert staining
		Modified ZN staining for <i>M. leprae</i>
		Modified ZN staining for <i>Nocardia</i>
		IQC-staining
3	Media preparation	Preparation of stains
		Preparation of reagents
		Preparation, plugging, pouring & Quality Control (QC) of culture media
		Operation & maintenance of autoclave
4	Bacteriology	Specimen collection for Blood Culture
		Inoculation of liquid & solid media
		Identification test
		Antimicrobial sensitivity testing- modified Kirby-bauer technique
		IQC- Antibiotic disc potency
		Operation of BacT/ALERT
		Operation of Vitek 2 compact
		Petroff's concentration technique
		AFB culture & sensitivity
5	Mycology	KOH Wet mount
		Germ tube test
		Slide culture
		Negative staining for fungus
		LPCB mount
6	Parasitology	Giemsa staining for thick & thin peripheral blood smear
		Stool wet mount for R/M
		Stool concentration techniques
		Modified ZN staining for <i>C. parvum</i>
7	Serology/ Immunology	Phlebotomy & separation of serum
		Operation & maintenance of mini-VIDAS
		Operation & maintenance of ELISA reader & washer
		Performance of serological tests
		Latex agglutination test (RA, ASO, CRP)

		RPR card test
		Tube agglutination test
		Gold conjugate Rapid card test
		ANA by IF
		ANA by Immunoblot
		IQC-serology
2ND YEAR RESIDENCY - SKILL LIST		
Sr No	Area	Procedure
1	General Microbiology	Microscopy for unstained preparations/ wet mount
		Microscopy for stained preparation
		Preparation of direct smears from clinical specimens
		Preparation of slit skin smear for lepra bacilli
		Hanging drop preparation
		Washing, sterilization and packing of glassware
		Infection control activities Environmental Sampling
		Identification of HAI
		Calculation of HAI quality indicators
		Bacteriology of water
		Bacteriology of air
		Antibiotic disc preparation
		Handling of laboratory animal
		Methods for preservation of bacteria
		Maintenance of stock cultures
2	Staining	Gram staining
		Acid fast staining (Ziehl- Neelsen method)
		Albert staining
		Modified ZN staining for <i>M. leprae</i>
		Modified ZN staining for <i>Nocardia</i>
		IQC-staining
3	Media preparation	Preparation of stains
		Preparation of reagents
		Preparation, plugging, pouring & Quality Control (QC) of

		culture media
		Operation & maintenance of autoclave
4	Bacteriology	Specimen collection for Blood Culture
		Inoculation of liquid & solid media
		Identification test
		Antimicrobial sensitivity testing- modified Kirby-bauer technique
		IQC- Antibiotic disc potency
		Operation of BacT/ALERT
		Operation of Vitek 2 compact
		Petroff's concentration technique
		AFB culture & sensitivity
5	Mycology	KOH Wet mount
		Germ tube test
		Slide culture
		Negative staining for fungus
		LPCB mount
6	Parasitology	Giemsa staining for thick & thin peripheral blood smear
		Stool wet mount for R/M
		Stool concentration techniques
		Modified ZN staining for <i>C. parvum</i>
7	Serology/ Immunology	Phlebotomy & separation of serum
		Operation & maintenance of mini-VIDAS
		Operation & maintenance of ELISA reader & washer
		Performance of serological tests
		Latex agglutination test(RA, ASO, CRP)
		RPR card test
		Tube agglutination test
		Gold conjugate Rapid card test
		ANA by IF
		ANA by Immunoblot

		IQC-serology

3 RD YEAR RESIDENCY-SKILL LIST		
Sr No	Area	Procedure
1	General Microbiology	Microscopy for unstained preparations/ wet mount
		Microscopy for stained preparation
		Preparation of slit skin smear for lepra bacilli
		Hanging drop preparation
		Washing, sterilization and packing of glassware
		Infection control activities, Environmental Sampling
		Identification of HAI
		Calculation of HAI quality indicators
		Bacteriology of water
		Bacteriology of air
		Antibiotic disc preparation
		Handling of laboratory animal
		Methods for preservation of bacteria
		Maintenance of stock cultures
2	Staining	Gram staining
		Acid fast staining (Ziehl- Neelsen method)
		Albert staining
		Modified ZN staining for <i>M. leprae</i>
		Modified ZN staining for <i>Nocardia</i>
		IQC-staining
3	Media preparation	Preparation of stains
		Preparation of reagents
		Preparation, pouring & Quality Control (QC) of culture media
		Operation & maintenance of autoclave
4	Bacteriology	Specimen collection for Blood Culture
		Inoculation of liquid & solid media
		Identification test
		Antimicrobial sensitivity testing- modified Kirby- bauer technique
		IQC- Antibiotic disc potency
		Operation of BacT/ALERT
		Operation of Vitek 2 compact

		Petroff's concentration technique
		AFB culture & sensitivity
5	Mycology	KOH Wet mount
		Germ tube test
		Slide culture
		Negative staining for fungus
		LPCB mount
6	Parasitology	Giemsa staining for thick & thin peripheral blood smear
		Stool wet mount for R/M
		Stool concentration techniques
		Modified ZN staining for <i>C. parvum</i>
7	Serology/ Immunology	Phlebotomy & separation of serum
		Operation & maintenance of mini-VIDAS
		Operation & maintenance of ELISA reader & washer
		Performance of serological tests
		Latex agglutination test(RA, ASO, CRP)
		RPR card test
		Tube agglutination test
		Gold conjugate Rapid card test
		ANA by IF
		ANA by Immunoblot
		IQC-serology

TEACHING –LEARNING METHOD

The following methods of Teaching and learning shall be implemented for MD students in Microbiology.

A. Group teaching sessions: (PG activity)

- Journal review
- Subject seminar presentation
- Group discussion
- Slides seminars
- Clinical case presentations pertaining to infectious diseases
- Presentation of the findings of an exercise on any of the sub-specialties
- Case study
- Problem-based learning
- Laboratory experiments
- Pedagogy

- Morbidity & Mortality Review Board

B. Promoting active participation and paper/poster presentation in CMEs, Workshops and conferences

C. Hands on experience (practical training)

Postgraduate students will be posted in various sections in rotation within the department and also in other departments as follows

Suggested schedule of rotation:

Departmental rotation:

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

Interdepartmental rotation:

Clinical Pathology	1 month
Transfusion Medicine	1 month
Clinical Biochemistry	1 month

Clinical Posting:

Trauma	1 Month
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Total 36 months

Emergency duty:

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

- Student shall be actively involved in day to day working of all the sections.
- He/she will be trained under the guidance of teachers in all the aspects of Clinical Microbiology and applied aspects of laboratory medicine including:
 - a. Collection and transport of specimens,
 - b. Receiving of samples,
 - c. Preparation of requisite reagents,
 - d. Chemicals, media and glassware, processing of specimens,
 - e. Performing required antimicrobial susceptibility testing and reporting on the specimens, Interpretation of results,
 - f. Sterilization procedures,

- g. Bio-safety precautions,
- h. Infection control practices,
- i. Maintenance of equipment,
- j. Record keeping and quality control in Microbiology.

Interdepartmental posting

Clinical Pathology:

- Peripheral smear examination
- CBC interpretation
- Urine examination
- Basic Coagulation tests

Blood Bank

- Blood grouping
- Coombs test

Clinical Biochemistry:

- Working of Biochemistry analyzers
- Principle and methodology of Lipid profile
- Plasma glucose estimation
- KFT, LFT
- Fluid biochemistry parameters
- Immunology markers
- CLIA based tests e.g. Thyroid profile

Skin & Venereal Disease

- Examination of leprosy patients and Collection of slit skin smear
- Examination of STD cases and sample collection
- Tzanck smear collection and examination
- Examination of fungal infections cases and sample collection

ICTC & ART for HIV

- HIV counseling and testing
- HIV Testing strategies
- CD4 estimation
- Plasma viral load
- Treatment regimens

Pulmonary medicine

- Fluorescent Microscopy for TB
- Diagnosis of Pulmonary and extra pulmonary TB

- CBNAAT
- National tuberculosis Elimination Program
- Treatment regimens

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:

PG student has to undergo research methodology workshop organized by the Institute in the first year itself.

This training will help the PG student in planning and execute his dissertation under the able guidance of PG teacher.

Teaching Responsibilities:

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

PG activity schedule

The Journal club, Seminar presentation and Practical exercise activity will be conducted once a week .

Evaluation

A. Timing of six-monthly progress report submission to Academic Section:

Report	July Session		January session	
	Period	To be submitted	Period	To be submitted
First	July to December	7 th January	January to June	7 th July
Second	January to June	7 th July	July to December	7 th January
Third	July to December	7 th January	January to June	7 th July
Fourth	January to June	7 th July	July to December	7 th January
Fifth	July to December	7 th January	January to June	7 th July
Sixth	January to June	10 th June	July to December	10 th December

Note: The first five reports will be taken into consideration to decide the eligibility of the student to appear for the Professional Examination.

B. Dissertation

Synopsis submission and approval:

Process to be completed within six months of admission to MS / MD program:

Activity	July admission	January admission
Selection of topic in consultation with PG Guide	September	/ March / April
Approval by Department PG Committee	October	
Institute Scientific Committee approval	November	/ May / June
Institute Ethics Committee approval	December	
Final approval letter by Academics Section	31 st December	30 th June

B. Submission of Dissertation:

The Dissertation will be submitted to Academic Section at least six months prior to the scheduled examination, i.e. by 31st December for June examination and by 30th June for December examination.

Formative

(A) Theory:

Schedule	Marks
At end of First year	100 (1 Paper)
At end of Second year	100 (1 Paper)
Pre-professional	400 (4 Papers of 100 marks each)
Total	600 Marks

(B) Practical:

Schedule	Marks
At end of First year	100
At end of Second year	100
Pre-professional	400 (Practical 300 + Viva 100)
Total	600 Marks

Candidate should secure a minimum of 50% marks in Theory and Practical separately, in order to be eligible to appear for Professional Examination.

Summative

A	Theory	4 Papers each of 100 Marks = 400 Marks
B	Practical	Practical 300 + Viva 100 = 400 Marks

Final Result

(A) Theory – 400 Marks (Minimum 40% marks in each paper and aggregate of 50% in order to be declared pass)

(B) Practical – 400 Marks

Minimum 50% marks required in Theory & Practical separately, in order to be declared successful at MD/MS Examination.

PATTERN OF THEORY EXAMINATION

Post Graduate Internal Examination I & II

Duration -3 hours

Q1 SAQs (Solve any Five)

Q2 LAQs

Total Marks :100

Marks 5x10

Marks 2x25

PATTERN FOR PRE PROFESSIONAL EXAMINATION : PAPER I-IV (FOR EACH PAPER)

Duration -3 hours

Q1 SAQs (Solve any Five)

Q2 LAQs

Total Marks :100

Marks 5x10

Marks 2x25

PATTERN FOR PRACTICAL EXAMINATION I : 100 MARKS

Exercise on Bacteriology: 25 marks

Exercise on Mycology: 25 marks

Viva: 50 marks

PATTERN FOR PRACTICAL EXAMINATION II : 100 MARKS

Exercise on Virology: 25 marks

Exercise on Parasitology: 25 marks

Viva : 50 marks

PATTERN FOR PRACTICAL PRE PROFESSIONAL EXAMINATION: Total 400 marks (Practical 300 + Viva 100)

Duration: Two days

Practical : Total 300 marks			Exercise in						
Long Exercise Bacteriology	Short Exercise Bacteriology	Mycobacteriology /Special staining	Virology	Immunology	Mycology	Parasitology	Serology	Identification of slides	Pedagogy
50 marks	30 marks	10 marks	30 marks	30 marks	30 marks	30 marks	30 marks	30 marks	30 marks
Viva :100 marks									

The examination will consist of the following exercises conjointly conducted and evaluated by four examiners, two internals and two externals.

1. Exercise in Clinical Bacteriology- 01 Long

- Isolation and identification of bacteria from clinical specimen

2. Exercise in Bacteriological Techniques- 01 short

- Isolation and identification of bacteria given in pure culture

3. Exercise in Virology-

- Egg inoculation, or identification of unknown virus
- Serological tests

4. Mycology Exercise

- Identification of fungi

5. Exercise in Parasitology-

- Examination of stool for ova and cysts by direct and concentration techniques

6. Identification of slides

7. Immunology / serology Exercise

- Any one of the serological techniques used in clinical medicine

8. Pedagogy

Oral/Viva-Voce Examination: The oral examination consists of questioning on the dissertation and overall subject matter. It will be conducted by all the four examiners as in the case of the practical examination.

Log book

Students have to maintain logbook throughout the postgraduate program duration and get it duly signed by the guide and Professor and Head of the Department. Continuous evaluation of the student will be maintained in the logbook. Participation in PG activities, Seminars, Journal presentations, attendance in the CMEs, Conferences, PG quiz and Workshops will be maintained in the logbook. Schedule and duty records of PG students will be maintained.

Publications

PG student should at least send 01 research paper for publication which should be either accepted or published during the residency tenure.

PG student must present at least one poster/ paper in the State/National/ International conference attended.

REFERENCE BOOKS:

1. Ananthanarayan & Paniker's Textbook of Microbiology, 7th edition. Orient Longman, India; 2007.
2. Anaissie Elias J. Clinical Mycology, Churchill livingstone 2003.
3. Bailey and Scott's Diagnostic Microbiology. 9th ed. CV Mosby, St. Louis, 2003.
4. Brooks, Geo F Jawetz Medical Microbiology 22nd ed McGraw Hill 2001. 52
5. Collier, Leslie Topley and Wilsons Microbiology and microbial infections Vol 1, 2, 3, 4, 5, 6 : 9th edition
6. Collee J G Mackie and Mc cartney Practical Medical Microbiology 14th ed 1999.
7. Koneman EW, Allen SD, Schreckenber PC, Winn WC (Eds): Atlas and Textbook of Diagnostic Microbiology. 4th ed. JB Lippincott, Philadelphia. 1992.
8. Murray PR, Baron EJ, Pfaller MA, Tenover PC, and Tenover RH (Eds): Manual of Clinical Microbiology. 6th ed. American Society for Microbiology, Washington, DC, 2005.
9. Parija SC. Textbook of Medical Parasitology .3rd Edition 2008. All India Publishers and Distributors, New Delhi. India
10. Parija SC. Textbook of Practical Microbiology, 1st Edition, 2007 Ahuja Publishing House , New Delhi , India .
11. Roitt Ivan M, Immunology 10th edition Blackwell Science 1994.
12. Baijainthimala Mishra. Textbook of Medical Virology, 1st Edition, 2018 CBS Publishers, New Delhi
13. Sites Immunology 10th edn, Mc Graw Hill 2001.

- 14 Woods GL, Washington JA: The Clinician and the Microbiology Laboratory. Mandell GL, Bennett JE, Dolin R (Eds): Principles and Practice of Infectious Diseases. 4th ed. Churchill Livingstone, New York, 2002.
- 15 Gradwohl's Clinical Laboratory Methods and Diagnosis
- 16 Biochemical tests for the Identification of Medical Bacteria MacFaddin JF 6. Manual of Clinical Microbiology- ASM press
- 17 Text book of Parasitology. Chatterjee K.D
- 18 Immunology: Janis Kuby- 2003.
- 19 Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases -2004, 6th edition
- 20 Control of Hospital Infection- A practical handbook (most recent edition)-2000, 4 th edition
- 21 Microbiology in Clinical Practice. Shanson D.C
- 22 Microbiology and Clinical Practice: Shanson-1999, 3rd edition
- 23 Topley and Wilson's Microbiology and Microbial infections. 8 volumes 2005, 10th edition
- 24 Color Atlas and Textbook of Diagnostic Microbiology: Elmer W Koneman -2006, 6 th edition.
- 25 Hospital infection control by Nizam Damani
- 26 Essentials of Hospital infection control by Apurba Sastry & Deepashri R
- 27 Mycology – Rippons
- 28 Virology- Clinical Virology by Rich

Reference Journals

1. Indian Journal of Medical Microbiology
2. IP International Journal of Medical Microbiology and Tropical Diseases
3. The Indian Journal of Medical Research
4. Journal of Clinical Microbiology
5. Journal of Hospital Infection control
6. Journal of Medical Microbiology
7. Indian Journal of STD
8. Journal Clinical Diseases and Research
9. International journal of antimicrobial agents
10. International journal of Medical Microbiology
11. Current topics in Microbiology and Immunology
12. Clinical Microbiology Reviews (CMR)
13. Journal of Infectious Disease
14. Journal of global antimicrobial resistance
15. European Journal of clinical microbiology and Infectious diseases
16. Annals of Clinical Microbiology and Antimicrobials
17. PLoS Neglected tropical diseases
18. Lancet-Infectious Diseases
19. Indian Journal of Tuberculosis and Lung Diseases.

20. Journal of American Medical Association
21. Indian Journal of Leprosy
22. International Journal of Leprosy
23. American journal of Epidemiology
24. Parasitology Today
25. Emerging Infectious Diseases-online
26. New England Journal of Medicine- online

Important Websites:

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