



SHRI
DHARMASTHALA
MANJUNATHESHWARA
UNIVERSITY

Ordinance Governing
M D Microbiology
Curriculum 2019-20

SHRI DHARMASTHALA MANJUNATHESHWARA UNIVERSITY

(A State Private University established under the Shri Dharmasthala Manjunatheshwara University
Act No 19 of 2018 of Government of Karnataka and Notification No. ED 261 URC 2018 dated 19th December 2018)

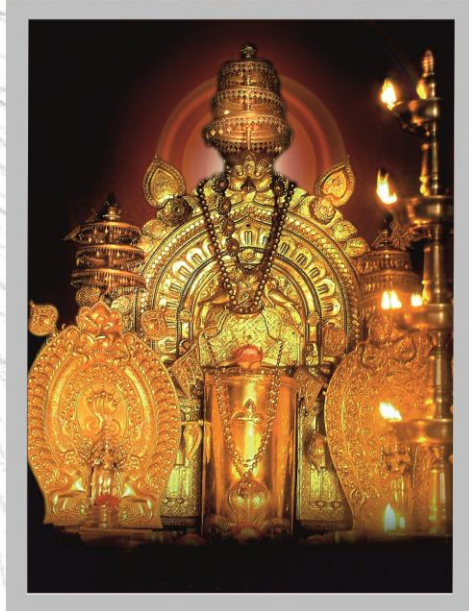
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|| Om Shri Manjunathaya Namaha ||



Shree Kshethra Dharmasthala

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THE LOGO

Poojya Dr D. Veerendra Heggade, Hon'ble Chancellor of the University, while searching for an appropriate Logo for the University, saw a photograph picked from Temple Architecture showing Wings of a Bird, sculpted in Indian style and wanted it to be incorporated in the logo for the University, as the Wings symbolize 'Spreading of Knowledge beyond Boundaries'. Further it was felt that the Central theme of the logo should be 'Rudra' (The Linga) with three wings on each side. In this way, the logo of the University was conceptualized.

Hence:

1. The central part represents **Rudra** who Demolishes Darkness.
2. The Three **horizontal lines on The Linga** stand for Samyak Darshan (Right Belief), Samyak Gyan (Right Knowledge) and Samyak Charitra (Right Conduct).
3. The **Wings** symbolize spreading of Knowledge across the boundaries.
4. Base line "**Truth Liberates**" highlights the Purpose of Education: to liberate oneself unconditionally. It shows that it is not discipline, nor knowledge nor the efforts to freedom that liberate but Truth is what liberates you from all your conditioning and ignorance.

The overall significance of Shri Dharmasthala Manjunatheshwara University's Logo is:

Darkness of ignorance is destroyed by the flow of knowledge to bring Liberty to everyone, by realizing the truth. And, it should spread globally without the boundaries as hindrance.



SHRI
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VISION

Shri Dharmasthala Manjunatheshwara University will set the highest standards of teaching and learning by awakening the intelligence of the students and nurturing the creativity hidden in them by creating an environment where the ancient wisdom blends with modern science, to transform them into whole human beings to face the challenges.

MISSION

- ▶ To ensure that the journey of education is inspiring, pleasant and enjoyable.
- ▶ Attract the best of teachers and students.
- ▶ Achieve high principles of trust, love and spirituality in the students.
- ▶ Create a collaborative, diverse and exclusive community.
- ▶ Transform the student of today to be a leader of tomorrow and a better human being.
- ▶ Produce passionate teachers.
- ▶ Evolve innovative teaching techniques.
- ▶ Create a peaceful environment.
- ▶ Prepare the student to face the social challenges.
- ▶ Create a University of which the Nation is proud of.
- ▶ Be an effective partner in Nation Building.
- ▶ Create an Eco-friendly University.
- ▶ Create a University based on the principles of beauty, love and justice.

||Om Shanti! Om Shanti! Om Shanti||



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SDMU/ACAD/MED/PG/129A/2019

Date: 25-04-2019

NOTIFICATION

Ordinance governing Curricula of Medical Postgraduate Degree Courses in Para-clinical Subjects - 2019

- Ref:
1. Minutes of the 1st Meeting of Academic Council held on 20th March 2019
(Letter No: SDMU/AC/M-01/093/2019; Dated:21-03-2019)
 2. Minutes of the 2nd Meeting of Board of Management held on 22nd March 2019
(Letter No: SDMU/BOM/M-02/094/2019; Dated:23-03-2019)

In exercise of the powers conferred under Statutes 1.2 (Powers and functions - section viii), 1.4 (Powers and functions - section ix & x) of Shri Dharmasthala Manjunatheshwara University, the Board of Management is pleased to approve and notify the ordinance governing the Curricula of the following Medical Postgraduate Degree Courses in Para-clinical Subjects - 2019:

1. MD in Pathology
2. MD in Microbiology
3. MD in Pharmacology
4. MD in Forensic Medicine
5. MD in Community Medicine

The ordinance shall be effective for the students joining the course during 2019-20 and onwards.


REGISTRAR
REGISTRAR,
Shri Dharmasthala Manjunatheshwara
University, Dharwad

To: The Principal, SDM College of Medical Sciences & Hospital.

Copy for kind information to:

1. Hon'ble Vice Chancellor - Shri Dharmasthala Manjunatheshwara University.
2. Pro Vice-Chancellor (Academics) - Shri Dharmasthala Manjunatheshwara University.
3. Controller of Examinations - Shri Dharmasthala Manjunatheshwara University.



MD in Microbiology

I. GOALS:

The goal of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

This document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by faculty of the Department of Microbiology and various post graduate curricula have been referred. The latest PG curriculum proposed by Medical Council of India for the course of M.D. in Microbiology has been consulted. The PG curriculum committee, Dept. of Microbiology has prepared the curriculum to make the students qualified from this institute ready to meet the expectations from the health care system from post graduates in Microbiology and they will be clinically oriented as far as possible without compromise to purpose and subject content. Consideration has been given to “domains of learning” under the heading “competencies”. The student having successfully completed the M. D. (Microbiology) course should have acquired skills and expertise in the practice of clinical Microbiology. She/he would be able to teach effectively, plan teaching programme, manage a diagnostic laboratory, evaluate the data generated, interact with clinical fraternity, design research projects and publish the findings.

II. SUBJECT SPECIFIC OBJECTIVES

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

1. Demonstrate competence as a clinical microbiologist.
2. Interact effectively with the allied departments by rendering services in basic as well as advanced laboratory investigations.
3. Demonstrate application of microbiology in a variety of clinical settings to solve diagnostic and therapeutic problems along with preventive measures.
4. Play a pivotal role in hospital infection control.
5. Should be able to formulate antibiotic policy for the place or institute where she/he is working.

6. She/he should ably advise the administration of the institute on biomedical waste management.
7. Conduct such clinical/experimental research as would have significant bearing on human health and patient care.
8. Demonstrate effective communication skills required for the practice of clinical microbiology and while teaching undergraduate students.
9. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.
10. Plan, execute and evaluate teaching assignments in Medical Microbiology.
11. Acquire skills in conducting collaborative research in the field of Microbiology and allied sciences.
12. Plan, execute, analyse and present the research work in medical microbiology.
13. To participate in various workshops/seminars/journal clubs/demonstration in the allied departments.
14. Uphold the prestige of the discipline amongst the fraternity of doctors.

Post-graduate training

The post graduate training should include the following components for a holistic approach.

1. Laboratory and Diagnostic skills in Clinical Microbiology
2. Teaching Skills
3. Research Methodology
4. Communication and attitudinal skills

1. Laboratory and Diagnostic skills in Clinical Microbiology

Based on the available facilities, the department should prepare a list of Post Graduate experiments pertaining to basic, diagnostic and applied Microbiology. Active learning should form the mainstay of the postgraduate training. There should be a minimum of 20 lectures for the postgraduate students along with seminars/symposia/group discussions and journal clubs. The periodicity of the seminars, journal clubs etc. should be decided by the department. At least two post graduate activities per week should be scheduled by the department. The postgraduate student should also attend a minimum of 20 ward rounds, discuss with the faculty. They should be able to render consultative and investigative services in Microbiology. A log book to record all these post graduate activities should be designed by the department that would faithfully reflect the training undergone by the student.

2. Teaching Skills

The Medical Education Department/Unit of the institution should be able to sensitize the postgraduate students in basic concepts of medical education like domains of learning, teaching skills, teaching - learning methods, learning resource material, evaluation techniques etc. The postgraduate students should attend all undergraduate lectures in the subject of Microbiology and participate actively in the undergraduate teaching programme including tutorials, demonstrations and practicals.

3. Research Methodology

The postgraduate students should be able to plan, design and conduct research in microbiology, as well as collaborate with other departments, analyse data and become familiar with basic biostatistics. They should also be able to write a research paper. All this can be achieved by writing a thesis on a current and relevant topic in Microbiology.

4. Communication and attitudinal skills

The post graduate student should be able to communicate effectively with patients, their relatives, peers, and consultants for better clinical correlation of laboratory findings as well as research. They should work as an effective team member and leader. They should also demonstrate right kind of attitude while handling clinical material and reports.

III. SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain:

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

General Microbiology

1. Important historical events and developments in microbiology.
2. Basic as well as advanced knowledge in various microscopes and microscopic techniques used in diagnostic microbiology.
3. Various bio-safety issues including physical and biological containment, universal containment, personal protective equipment for biological agents.
4. Various isolation precautions including standard and transmission based precautions.

5. In-depth knowledge about various method of Sterilization, disinfection and lyophilisation.
6. Nomenclature, classification and morphology of bacteria as well as other microorganisms.
7. Various types and significance of normal flora of human body in health and disease states.
8. Requirements for growth and nutrition of bacteria along with bacterial metabolism.
9. Various types and role of bacterial toxins and bacteriocins.
10. Microbiology of air, milk, water as well as hospital environment.
11. Various types of host-parasite relationship and their significance.
12. Various antimicrobial agents and mechanisms drug resistance.
13. Bacterial genetics, bacteriophages and molecular genetics relevant for medical microbiology.
14. Applications of quality assurance, quality control in microbiology and accreditation of laboratories.

Immunology

1. Components of immune system, types of immunity (Innate, acquired, mucosal, humoral and cell mediated immunity) and immune response.
2. Describes and identifies uses of various antigens, immunoglobulins (antibodies) and antigen and antibody reactions.
3. Complement system and Cytokines.
4. Various disorders like hypersensitivity, immunodeficiency and auto-immunity involving immune system.
5. MHC complex, Immune tolerance, Transplantation and Tumor immunity.
6. Various types, techniques, advances, and applications of vaccines and immunotherapy.
7. Measurement of immunological parameters.
8. Immunological techniques and their applications in diagnostic microbiology as well as research.
9. Mechanisms and significance of immune-potential and immune-modulation.

Systemic bacteriology

1. Demonstrate knowledge and skills in various techniques for isolation and identification of bacteria.
2. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications,

laboratory diagnosis treatment and prevention of major bacterial pathogens of medical importance given below-

- a. Gram positive cocci including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
- b. Gram negative cocci including Neisseria, Branhamella, Moraxella etc.
- c. Gram positive bacilli including Lactobacillus, Coryneform bacteria, Bacillus and aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.
- d. Gram negative bacilli including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas and other non-fermenters, Pasteurella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
- e. Helicobacter, Campylobacter, Calymmatobacterium, Streptobacillus, Spirillum and miscellaneous bacteria.
- f. Enterobacteriaceae
- g. Mycobacteria
- h. Spirochaetes
- i. Chlamydia
- j. Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.
- k. Rickettsia, Coxiella, Bartonella etc.

Mycology

1. Explain general characteristics including morphology, reproduction and classification of fungi.
2. Demonstrate knowledge and skills for isolation and identification of fungi.
3. Explain tissue reactions to fungi.
4. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major fungal pathogens of medical importance given below-
 - a. Yeasts and yeast like fungi including Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces etc.
 - b. Mycelial fungi including Aspergillus, Zygomycetes, Pseudallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.

- c. Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffeii etc.
 - d. Dermatophytes
 - e. Fungi causing Mycetoma, Chromoblastomycosis, Occulomycosis and Otomycosis.
 - f. Pneumocystis jirovecii infection
 - g. Rhinosporidium seeberi and Lacazia loboi (formerly named Loboii)
 - h. Pythium insidiosum
 - i. Prototheca
5. Able to identify laboratory contaminant fungi.
 6. Explain Mycetism and mycotoxicosis along with agents involved.
 7. Demonstrates knowledge about antifungal agents and perform in vitro antifungal susceptibility tests.

Virology

1. Demonstrates knowledge about general properties, classification, morphology, virus replication and genetics of viruses.
2. Explain pathogenesis of viral infections.
3. Demonstrates knowledge about isolation and identification of viruses.
4. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major DNA viruses of medical importance including Pox viruses, Herpes viruses, Adenoviruses, Hepadnavirus, Papovaviruses and Parvoviruses etc.
5. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major RNA viruses of medical importance including Entero viruses, Toga viruses, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reo viruses, Rhabdoviruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human Immunodeficiency Virus, Arbo viruses, Corona viruses, Caliciviruses etc.
6. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major Hepatitis viruses.
7. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of unclassified viruses and slow viruses including prions.
8. Demonstrate knowledge about viral vaccines and anti-viral drugs.

Parasitology

1. Demonstrate knowledge about general characters, classification and methods of identification of parasites.
2. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of Protozoan parasites of medical importance including Entamoeba, Free living amoebae, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Microsporidium, Cyclospora Isospora, Babesia, Balantidium, etc.
3. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of helminths of medical importance including those belonging to Cestoda (Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps etc.), Trematoda (Schistosomes, Fasciola, Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc.) and Nematoda (Trichuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus etc.).
4. Demonstrate knowledge about common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops, louse, myiasis of medical importance.
5. Demonstrate knowledge about anti-parasitic vaccine and drugs.

Applied Microbiology

1. Demonstrate knowledge about epidemiology of infectious diseases.
2. Demonstrate knowledge about antimicrobial prophylaxis and therapy.
3. Demonstrate knowledge about hospital acquired infections.
4. Demonstrate knowledge about management of biomedical waste.
5. Effectively investigate an infectious outbreak in hospital and community.
6. Demonstrate knowledge about 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 and nose, septicaemia, endocarditis, haemorrhagic fever etc.
7. Demonstrate knowledge about opportunistic infections.
8. Demonstrate knowledge about various sexually transmitted diseases.
9. Demonstrate knowledge about principles, methods of preparation, administration and types of vaccines.
10. Effectively use information technology (Computers) in microbiology.

11. Demonstrate knowledge and applications of Automation in Microbiology.
12. Demonstrate knowledge and applications about molecular techniques in the laboratory diagnosis of infectious diseases.
13. Demonstrate knowledge in statistical analysis of microbiological data and research methodology.
14. Demonstrate knowledge in animal and human ethics involved in microbiology.
15. Demonstrate knowledge in safety in laboratory and Laboratory management.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopts ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and students for effective teaching.

C. Psychomotor domain:

1. She/he should know specific details of collection/transportation of specimens from various sources for microbiological investigations. However, collection of specimens is not the routine part of her/his duty. The collection of the specimens should be done by the clinicians and only in special situations the microbiologist may be called for collection of the specimens.
2. Preparation, examination and interpretation of direct smears from clinical specimens.
3. Plating of clinical specimens on media for isolation, purification, identification and quantification purposes.
4. Preparation of stains viz. Gram, Albert's, Ziehl-Neelsen (ZN), Silver impregnation stain and special stains for capsule and spore etc.
5. Preparation and pouring of media like Nutrient agar, Blood Agar, MacConkey's agar, Sugars, Kligler iron agar/Triple sugar iron agar (TSI), Robertson's cooked meat broth, Lowenstein Jensen medium, Sabouraud's dextrose agar etc.
6. Preparation of reagents - oxidase, Kovac's etc.
7. Quality control of media, reagents etc.
8. Operation of autoclave, hot air oven, filters like Seitz and membrane filters etc.
9. Handling and care of microscopes.

10. Washing and sterilization of glassware (including plugging and packing).
11. Care, maintenance and use of common laboratory equipment like autoclave, hot air oven, water bath, centrifuge, refrigerators, incubators etc.
12. Aseptic practices in laboratory and safety precautions. Selection of Personal Protective Equipment according to task and donning. (gloves, mask, eye protection, gown etc.)
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, Cragie tube, dark ground microscopy for spirochaetes.
17. Routine and Special tests - Catalase test, Oxidase test, slide and tube coagulase tests, niacin and catalase tests for Mycobacterium, bile solubility, chick cell agglutination (optional), sheep cell haemolysis (optional), satellitism, CAMP test, and other biochemical tests.
18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing e.g. Kirby-Bauer, Stokes method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/plate dilution methods.
19. Tests for β -lactamase production.
20. Screening of gram negative isolates for ESBL and MBL.
21. Screening of Staphylococci for Methicillin Resistance.
22. Screening of Enterococci for Vancomycin resistance.
23. Testing of disinfectants.
24. Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria.
25. Disposal of contaminated materials like cultures.
26. Disposal of infectious waste.
27. Bacteriological tests for water, air and milk.
28. Maintenance and preservation of bacterial cultures.
29. Environmental surveillance for operation theatres and other critical care areas.

IV. TIME FRAME TO ACQUIRE KNOWLEDGE & SKILLS:

A. Knowledge

1 st Year	2 nd Year	3 rd Year
<p>GENERAL MICROBIOLOGY:</p> <ol style="list-style-type: none"> 1. History and Pioneers in Microbiology 2. Microscopy 3. Nomenclature and classification of microbes 4. Morphology of bacteria and other micro-organisms 5. Growth and Nutrition of bacteria 6. Bacterial metabolism 7. Sterilization and disinfection 8. Culture media and culture methods 9. Identification of bacteria 10. Bacterial toxins 11. Bacterial antagonism: Bacteriocins 12. Bacterial genetics 13. Gene cloning 14. Antibacterial substances used in the treatment of infections and drug resistance in bacteria 15. Bacterial ecology, Normal flora of human 	<p>IMMUNOLOGY : Clinical</p> <ol style="list-style-type: none"> 1. Hypersensitivity 2. Immunodeficiency 3. Auto-immunity 4. Immune tolerance 5. Transplantation immunity 6. Tumour immunity 7. Immunoprophylaxis and immunotherapy 8. Measurement of immunity 	<p>GENERAL MICROBIOLOGY & IMMUNOLOGY: All</p>

1 st Year	2 nd Year	3 rd Year
body, Hospital environment, Air, Water and Milk 16. Host-parasite relationship		
<p>IMMUNOLOGY :</p> <ol style="list-style-type: none"> 1. Innate and acquired immunity 2. Antigens 3. Immunoglobulins 4. Antigen and antibody <p>Reactions</p> <ol style="list-style-type: none"> 5. Complement System 6. The normal immune system: structure and function 7. Immune Response 	<p>SYSTEMATIC BACTERIOLOGY</p> <ol style="list-style-type: none"> 1. Streptococcus and Lactobacillus 2. Staphylococcus and Micrococcus 3. Pseudomonas 4. The Enterobacteriaceae 5. Mycobacteria 6. Corynebacterium and other Coryneform bacteria 7. Vibrios, Aeromonas, Plesiomonas, Campylobacter & Spirillum 8. Neisseria, Branhamella & Moraxella 9. Haemophilus and Bordetella 10. Bacillus: the aerobic spore-bearing bacilli 11. Clostridium: the spore bearing anaerobic bacilli 12. Non-sporing anaerobe 13. The Spirochaetes 	<p>SYSTEMATIC BACTERIOLOGY (2nd year) : plus</p> <ol style="list-style-type: none"> 1. Actinomycetes, Nocardia and Actinobacillus 2. Erysipelothrix and Listeria 3. The Bacteroidaceae: Bacteroides, Fusobacterium and Leptotrichia 4. Chromobacterium, flavobacterium, Acinetobacter and Alkaligenes 5. Pasteurella, Francisella 6. Brucella 7. Chlamydia 8. Rickettsiae 9. Mycoplasmatales: Mycoplasma, Ureaplasma and Acholeplasma 10. Miscellaneous Bacteria

1 st Year	2 nd Year	3 rd Year
<p>MICROBIOLOGY APPLIED TO TROPICAL MEDICINE AND RECENT ADVANCES</p> <ol style="list-style-type: none"> 1. Normal Microbial flora 2. Epidemiology of infectious diseases 3. Hospital acquired infections & Hospital waste disposal 4. Bacteriology of water milk and air 	<p>VIROLOGY:</p> <ol style="list-style-type: none"> 1. The nature of viruses 2. Classification of viruses 3. Morphology: virus structure 4. Virus replication 5. The genetics of viruses 6. The pathogenicity & lab diagnosis of viruses 7. Epidemiology of viral infections 8. Anti-viral drugs 9. Bacteriophages 10. Herpes viruses 11. Paramyxoviruses 12. Influenza virus 13. Hepatitis viruses 14. Rabies virus 15. Human immunodeficiency viruses 	<p>VIROLOGY (2nd year): plus</p> <ol style="list-style-type: none"> 1. Vaccines 2. Pox viruses 3. Vesicular viruses 4. Toga viruses 5. Bunya viruses 6. Arena viruses 7. Marburg and Ebola viruses 8. Rubella virus 9. Orbiviruses 10. Respiratory diseases : Rhinoviruses, adenoviruses and corona viruses 11. Enteroviruses; Polio, Echo, and Coxsackie viruses 12. Other enteric viruses 13. Slow viruses 14. Oncogenic viruses 15. Teratogenic Viruses

1 st Year	2 nd Year	3 rd Year
	<p>PARASITOLOGY:</p> <ol style="list-style-type: none"> 1. General Parasitology 2. Protozoan parasites of medical importance: Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium 	<p>PARASITOLOGY (2nd year): plus</p> <ol style="list-style-type: none"> 1. Protozoan parasites of Medical importance: Toxoplasma, Sarcocystis, Cryptosporidium, Babesia, Balantidium etc. 2. Helminthology: All those medically important helminthes belonging to Cestoda, Trematoda and Nematoda. 3. Cestodes: Diphyllbothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps etc. 4. Trematodes: Schistosomes, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc. 5. Nematodes: Trichuris, Trichinella,

1 st Year	2 nd Year	3 rd Year
		<p>Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus, etc.</p> <p>6. Ecto-parasites: Common arthropods and other vectors viz., Mosquito, Sand fly, Ticks, Mite, Cyclops</p>
	<p>MYCOLOGY</p> <ol style="list-style-type: none"> 1. The morphology and reproduction in fungi 2. Classification of fungi 3. Dermatophytes 4. Candida 5. Aspergillus 	<p>MYCOLOGY (2nd year): plus</p> <ol style="list-style-type: none"> 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>MICROBIOLOGY APPLIED TO TROPICAL MEDICINE AND RECENT ADVANCES</p>

1 st Year	2 nd Year	3 rd Year
		<ol style="list-style-type: none"> 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>ALLIED BASIC SCIENCES</p> <p>(a) Biochemistry: Basic understanding of biochemistry as applied to immunological/ molecular methods for study of microbial diseases and pathogenesis of infections.</p> <ol style="list-style-type: none"> 1. Protein purification and estimation 2. Protein estimation

1 st Year	2 nd Year	3 rd Year
		<p>3. Nucleic acid purification and characterization</p> <p>4. Agarose and polyacrylamide gel electrophoresis – principles</p> <p>5. Ultracentrifugation – principles</p> <p>6. Column chromatography principles</p> <p>(b) Molecular biology: Basic knowledge as applicable to molecular diagnostics and molecular epidemiology.</p> <p>1. Recombinant DNA technology</p> <p>2. Southern, northern and Western blotting</p> <p>3. DNA amplification techniques</p> <p>4. Diagnostic PCR, different methods of PCR product detection (liquid hybridization, ELISA).</p>

1 st Year	2 nd Year	3 rd Year
		<p>5. Genotyping of microbes and viruses</p> <p>(c) Pathology: (as applied to Microbiology)</p> <p>Basic knowledge of</p> <ol style="list-style-type: none"> 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

A. Skills:
1st Year -Skills list

Area	Sr. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed independently (under supervision)
General microbiology	1.	Microscopy for unstained preparations/ wet mount	5	5	10
	2.	Microscopy for stained preparation	5	5	10
	3.	Preparation of direct smears from clinical specimens	5	5	10
	4.	Hanging drop preparation	5	5	10
	5.	Washing, sterilization and packing of glassware	10 sessions	-	-
	6.	Infection control activities- environmental sampling	10	10	-
	7.	Identification of HAI	5	5	--
	8.	Calculation of HAI quality indicators	5	5	--
	9.	Bacteriology of water	5	5	-
	10.	Bacteriology of air	5	5	-
	11.	Antibiotic disc preparation	-	-	-
	12.	Handling of laboratory animal	-	-	-
	13.	Methods for preservation of bacteria	10	-	-
	14.	Maintenance of stock cultures	10	-	-
Staining	1.	Gram staining	10	20	30
	2.	Acid fast staining (Ziehl-Neelsen method)	10	20	30
	3.	Albert staining	5	10	10
	4.	Modified ZN staining for M. leprae	5	5	5
	5.	Modified ZN staining for	5	5	5
	6.	Nocardia	5	5	5

Media preparation	1.	Preparation of stains	4	4	4
	2.	Preparation of reagents	10	10	10
	3.	Preparation, plugging, pouring & Quality Control (QC) of culture media	20	20	30
	4.	Operation & maintenance of autoclave	10	10	20
Bacteriology	1.	Specimen collection for Blood	5	5	5
	2.	Culture	20	20	30
	3.	Inoculation of liquid & solid media	20	20	30
	4.	Identification test	10	20	30
	5.	Antimicrobial sensitivity testing-modified Kirby-Bauer technique	5	5	-
	6.	IQC- Antibiotic disc potency	5	10	20
	7.	Operation of BacT/ALERT	5	10	20
	8.	Operation of Vitek 2 compact	10	10	20
	9.	Petroff's concentration technique	5	10	20
Mycology	1.	KOH Wet mount	5	10	20
	2.	Germ tube test	5	10	20
	3.	Slide culture	5	10	20
	4.	Negative staining for fungus	5	5	5
	5.	LPCB mount	10	10	10
Parasitology	1.	Giemsa staining for thick & thin peripheral blood smear	5	-	-
	2.	Stool wet mount for R/M	10	20	30
	3.	Stool concentration techniques	5	10	5
	4.	Modified ZN staining for C. parvum	2	2	2
Serology/Immunology	1.	Phlebotomy & separation of serum	10	10	5
	2.	Operation & maintenance of mini-VIDAS	5	10	20
	3.	Operation & maintenance of ELISA reader & washer	5	10	--

Performance of serological Tests					
	1.	Latex agglutination test(RA, ASO)	10	20	30
	2.	RPR card test	10	20	30
	3.	Tube agglutination test	10	20	30
	4.	Gold conjugate Rapid card test	10	20	30
	5.	ANA by IF	5	5	--
	6.	ANA by Immunoblot	5	5	--
	7.	IQC-serology	5	5	5

2nd year -Skill list

Area	Sr. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed Independently no. (under supervision)
General microbiology	1	Microscopy for unstained preparations/ wet mount	---	--	--
	2	Microscopy for stained preparation	--	--	--
	3	Preparation of direct smears from clinical specimens	--	--	--
	4	Preparation of slit skin smear for lepra bacilli	5	5	5
	5	Hanging drop preparation	--	--	10
	6	Washing, sterilization and packing of glassware	05 sessions	-	-
	7	Infection control activities- environmental sampling	--	10	10
	8	Identification of HAI	--	5	5

Area	Sr. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed Independently no. (under supervision)
	9	Calculation of HAI quality indicators	--	5	5
	10	Bacteriology of water	--	5	5
	11	Bacteriology of air	--	5	5
	12	Antibiotic disc preparation	05 lots	-	-
	13	Handling of laboratory animal	-	-	-
	14	Methods for preservation of bacteria	--	05	10
	15	Maintenance of stock cultures	--	05	10
Staining	1	Gram staining	--	--	30
	2	Acid fast staining (Ziehl- Neelsen method)	--	--	30
	3	Albert staining	--	--	05
	4	Modified ZN staining for <i>M. leprae</i>	--	--	5
	5	Modified ZN staining for <i>Nocardia</i>	--	--	5
	6	IQC-staining	--	--	5
Media preparation	1	Preparation of stains	--	--	5
	2	Preparation of reagents	--	--	15
	3	Preparation, plugging, pouring & Quality Control (QC) of culture media	--	--	50
	4	Operation & maintenance of autoclave	--	--	20
Bacteriology	1	Specimen collection for Blood Culture	--	--	5

Area	Sr. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed Independently no. (under supervision)
	2	Inoculation of liquid & solid media	--	--	30
	3	Identification test	--	--	30
	4	Antimicrobial sensitivity testing- modified Kirby- Bauer technique	--	--	30
	5	IQC- Antibiotic disc potency	--	5	5
	6	Operation of BacT/ALERT	--	--	20
	7	Operation of Vitek 2 compact	--	--	20
	8	Petroff's concentration technique	--	--	20
	9	AFB culture & sensitivity	--	--	20
	Mycology	1	KOH Wet mount	--	--
2		Germ tube test	--	--	20
3		Slide culture	--	--	20
4		Negative staining for fungus	--	--	5
5		LPCB mount	--	--	10
Parasitology	1	Giemsa staining for thick & thin peripheral blood smear	-	10	-
	2	Stool wet mount for R/M	--	--	30
	3	Stool concentration techniques	--	--	5
	4	Modified ZN staining for <i>C. parvum</i>	--	--	2
Serology/ Immunology	1	Phlebotomy & separation of serum	--	--	5
	2	Operation & maintenance of mini-VIDAS	--	--	20

Area	Sr. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed Independently no. (under supervision)
	3	Operation & maintenance of ELISA reader & washer	--	--	20
		Performance of serological tests			
	1	Latex agglutination test(RA, ASO, CRP)	--	--	30
	2	RPR card test	--	--	30
	3	Tube agglutination test	--	--	30
	4	Gold conjugate rapid card test	--	--	30
	5	ANA by IF	--	--	10
	6	ANA by Immunoblot	--	--	10
	7	IQC-serology	--	--	5

3rd year -skill list

Area	Sr. no.	Procedure	Observed no.	Assisted no./ practice on dummy	Performed independently no. (under supervision)
General microbiology	1	Microscopy for unstained preparations/ wet mount	---	--	--
	2	Microscopy for stained preparation	--	--	--
	3	Preparation of slit skin smear for lepra bacilli	--	--	--
	4	Hanging drop preparation	--	--	--
	5	Washing, sterilization and packing of glassware	05 sessions	-	-
	6	Infection control activities- environmental sampling	--	--	10
	7	Identification of HAI	--	--	5
	8	Calculation of HAI quality indicators	--	--	5
	9	Bacteriology of water	-	-	5
	10	Bacteriology of air	-	-	5
	11	Antibiotic disc preparation	-	5 lots	2 lots
	12	Handling of laboratory animal	-	-	10
	13	Methods for preservation of bacteria	-	-	10
	14	Maintenance of stock cultures	-	-	10

<i>Staining</i>	1	Gram staining	--	--	30
	2	Acid fast staining (Ziehl-Neelsen method)	--	--	30
	3	Albert staining	--	--	05
	4	Modified ZN staining for M. leprae	--	--	5
	5	Modified ZN staining for Nocardia	--	--	5
	6	IQC-staining	--	--	5
<i>Media preparation</i>	1	Preparation of stains	--	--	10
	2	Preparation of reagents	--	--	15
	3	Preparation, pouring & Quality Control (QC) of culture media	--	--	50
	4	Operation & maintenance of autoclave	--	--	20
<i>Bacteriology</i>	1	Specimen collection for Blood Culture	--	--	5
	2	Inoculation of liquid & solid media	--	--	30
	3	Identification test	--	--	30
	4	Antimicrobial sensitivity testing-modified Kirby- Bauer	--	--	30
	5	technique			
	6	IQC- Antibiotic disc potency	--	--	5
	7	Operation of BacT/ALERT	--	--	20
	8	Operation of Vitek 2 compact	--	--	20
	9	Petroff's concentration technique	--	--	20
		AFB culture & sensitivity	--	--	20
<i>Mycology</i>	1.	KOH Wet mount	--	--	20
	2.	Germ tube test	--	--	20
	3.	Slide culture	---	---	20

	4.	Negative staining for fungus	--	--	5
	5.	LPCB mount	--	--	10
<i>Parasitology</i>	1.	Giemsa staining for thick & thin peripheral blood smear	--	--	-
	2.	Stool wet mount for R/M	--	--	30
	3.	Stool concentration techniques	--	--	5
	4.	Modified ZN staining for <i>C. parvum</i>	--	--	2
<i>Serology/ Immunology</i>	1.	Phlebotomy & separation of serum	--	--	5
	2.	Operation & maintenance of mini-VIDAS	--	--	20
	3.	Operation & maintenance of ELISA reader & washer	--	--	20

Performance of serological tests					
1.	Latex agglutination test(RA, ASO, CRP)	--	--	30	
2.	RPR card test	--	--	30	
3.	Tube agglutination test	--	--	30	
4.	Gold conjugate rapid card test	--	--	30	
5.	ANA by IF	--	--	10	
6.	ANA by Immunoblot	--	--	10	
7.	IQC-serology	--	--	5	

V. SYLLABUS

Course contents:

General Microbiology

1. History of microbiology
2. Microscopy
3. Bio-safety including universal containment, personal protective equipment for biological agents
4. Physical and biological containment
5. Isolation precautions including standard precautions and transmission based precautions
6. Sterilization, disinfection and lyophilization
7. Morphology of bacteria and other microorganisms
8. Nomenclature and classification of microorganisms
9. Normal flora of human body
10. Growth and nutrition of bacteria
11. Bacterial metabolism
12. Bacterial toxins
13. Bacteriocins
14. Microbiology of hospital environment
15. Microbiology of air, milk and water
16. Host-parasite relationship
17. Antimicrobial agents and mechanisms drug resistance
18. Bacterial genetics and bacteriophages
19. Molecular genetics relevant for medical microbiology
20. Quality assurance and quality control in microbiology
21. Accreditation of laboratories

Immunology

1. Components of immune system
2. Innate and acquired immunity
3. Cells involved in immune response
4. Antigens
5. Immunoglobulins
6. Mucosal immunity
7. Complement
8. Antigen and antibody reactions

9. Hypersensitivity
10. Cell mediated immunity
11. Cytokines
12. Immunodeficiency
13. Auto-immunity
14. Immune tolerance
15. MHC complex
16. Transplantation immunity
17. Tumor immunity
18. Vaccines and immunotherapy
19. Measurement of immunological parameters
20. Immunological techniques
21. Immunopotential and immunomodulation

Systematic bacteriology

1. Isolation and 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, Coryneform organisms, Bacillus and 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 and other non-fermenters, Pasteurella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
6. Helicobacter, Campylobacter, Calymmatobacterium, Streptobacillus, Spirillum and miscellaneous bacteria
7. Enterobacteriaceae
8. Mycobacteria
9. Spirochaetes
10. Chlamydia

11. Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other mycoplasma
12. Rickettsia, Coxiella, Bartonella etc.

Mycology

1. General characteristics and classification of fungi
2. Morphology and 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, Pseudallescheria, 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, Chromoblastomycosis, Occulomycosis and Otomycosis.
10. Pythium insidiosum
11. Prototheca
12. Pneumocystis jirovecii infection
13. Rhinosporidium seeberi and Lacazia loboi (Loboa loboi)
14. Laboratory contaminant fungi
15. Mycetism and mycotoxicosis
16. Antifungal agents and in vitro antifungal susceptibility tests.

Virology

1. General properties of viruses
2. Classification of viruses
3. Morphology: Virus structure
4. Virus replication
5. Isolation and identification of viruses

6. Pathogenesis of viral infections
7. Genetics of viruses
8. DNA viruses of medical importance including Pox viruses, Herpes viruses, Adenoviruses, Hepadnavirus, Papova and Parvoviruses etc.
9. RNA viruses of medical importance including Enteroviruses, Toga viruses, Flavi viruses, Orthomyxoviruses, Paramyxoviruses, Reoviruses, Rhabdoviruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human immunodeficiency virus, Arbo viruses, Corona viruses, Caliciviruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepatitis viruses
13. Viroids, prions
14. Vaccines and anti-viral drugs.

Parasitology

1. General characters and classification of parasites.
2. Methods of identification of parasites
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 (etc.)
5. Entomology: common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops, louse, myiasis.
6. Anti-parasitic agents.

Applied Microbiology

1. Epidemiology of infectious diseases
2. Antimicrobial prophylaxis and therapy
3. Hospital acquired infections
4. Management of biomedical waste
5. Investigation of an infectious outbreak in hospital and community
6. 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 and nose, septicaemia, endocarditis, haemorrhagic fever etc.
7. Opportunistic infections
8. Sexually transmitted diseases
9. Vaccinology: principles, methods of preparation, administration of vaccines, types of vaccines
10. Information technology (Computers) in microbiology
11. Automation in Microbiology
12. Molecular techniques in the laboratory diagnosis of infectious diseases
13. Statistical analysis of microbiological data and research methodology
14. Animal and human ethics involved in microbiological work.
15. Safety in laboratory and Laboratory management

VI. TEACHING AND LEARNING METHODS

The training programme should be designed to enable the student to acquire a capacity to learn and investigate, to synthesize and integrate a set of facts and develop a faculty to reason. The curricular programme and scheduling of postings must provide the student with opportunities to achieve the above broad objectives. Much of the learning is to be accomplished by the student himself. Interactive discussions are to be preferred over didactic sessions. The student must blend as an integral part of the activities of an academic department that usually revolves around three equally important basic functions of teaching, research and service. As mentioned earlier, the emphasis recommended under a residency programme is of learning while serving/working.

Post Graduate Training programme

Teaching methodology

Based on the available facilities, the Department can prepare a list of post graduate experiments pertaining to basic and applied microbiology. Active learning should form the mainstay of post graduate training; there should be lectures for post graduates (at least 20 per year), along with seminars, symposia, group-discussions and Journal clubs. The post graduate students should regularly do the ward rounds of various clinical departments and learn cases of interest for discussion with the clinical faculty. Each college should have a Medical Education Unit to generate teaching resource material for undergraduates and evolving of problem solving modules.

Rotation:

Postings to laboratories/assignments

The three-year training programme for the MD degree may be arranged in the form of postings to different assignments/laboratories for specified periods as outlined below. The period of such assignments/postings is recommended for 35 months. Posting schedules may be modified depending on needs, feasibility and exigencies. For facilities not available in the parent institution as well as for additional knowledge and skill, extramural postings may be undertaken.

Suggested schedule of rotation:

Within Department

1. Bacteriology
2. Mycobacteriology
3. Serology/Immunology
4. Mycology
5. Virology
6. Parasitology
7. Media preparation

Other Departments

1. Clinical Pathology – 15 days
2. Clinical Biochemistry – 15 days
3. ICTC & RNTCP – 15 days
4. Skin & VD – 15 days
5. Internal Medicine – 15 days
6. Paediatrics – 15 days

Practical training

Practical training should be imparted by posting the students in various sub-specialties (sections) as detailed in the intrinsic and extrinsic rotation. The student should be actively involved in day to day working of all the sections. He/she should be trained under the guidance of teachers in all the aspects of Clinical Microbiology and applied aspects of laboratory medicine including collection and transport of specimens, 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 equipments, record keeping and quality control in Microbiology.

Skills & performance

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

Emergency duty

The student should be posted for managing emergency laboratory services in Microbiology. She/he should deal with all the emergency investigations in Microbiology.

Training in research methodology

Training in research methodology should 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 thesis.

The thesis is aimed at training the post graduate student in research methods and techniques. It should 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 thesis should be completed and submitted by the student six months before appearing for the final university examination.

Communication and attitudinal skills

Post-graduate student is expected to imbibe professional attributes of honesty, integrity, accountability, honour, humanism and excellence and demonstrate the same in the day- by-day conduct and dealings with the teacher, peers, the nursing and paramedical staff and most-importantly patients. To ensure that student is able to acquire these attributes, their personal conduct should be keenly observed by the teachers and student should be counselled as and when required. Personal attributes of the student should be regularly assessed by peers, senior and junior students and Head of the Unit/ in charge.

The following is a rough guideline to various teaching/learning activities that may be employed.

1. Collection of specimens, smear examination, culture and sensitivity analysis
2. Discussion during routine activities such as during signing out of cases.
3. Presentation and work-up of cases including the identification of special stains and ancillary procedures needed.
4. Clinico-microbiological conferences, active involvement with hospital infection control committee
5. Intradepartmental and interdepartmental conferences related to case discussions.
6. Conferences, Seminars, Continuing Medical Education (CME) Programme.
7. Journal Club.
8. Research Presentation and review of research work.
9. A postgraduate student of a postgraduate degree course in broad specialties/super specialties would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.
10. Participation in workshops, conferences and presentation of papers etc.

Laboratory work.

1. Use and maintenance of equipment.
2. Maintenance of records. Log books should be maintained to record the work done which shall be checked and assessed periodically by the faculty members imparting the training.
3. Postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.
4. Department should encourage e-learning activities.
5. During the training programme, patient safety is of paramount importance, therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, provision of skills laboratories in medical colleges is mandatory.

VII. ASSESSMENT

A. FORMATIVE ASSESSMENT, i.e., assessment during the training

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

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. The Internal Assessment should be conducted in theory and practical/clinical examination.

Half yearly assessment during the MD programme should be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

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

B. SUMMATIVE ASSESSMENT: Assessment at the end of training

The summative examination would be carried out as per the recommendations by Medical Council of India - POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The marks distribution for the summative examination will be as follows...

Subject	Theory	Practical	Viva-voce	Total
Microbiology	400	200	100	700

The post-graduate examinations should be in three parts:

1. Thesis.

Every post graduate student 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 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 post graduate 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 Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory Examination

The examinations shall be organized on the basis of 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

There should be four theory papers:

Paper I	General Microbiology and Immunology
Paper II	Systematic Bacteriology
Paper IV	Virology, Parasitology and Mycology
Paper IV	Applied Microbiology and Recent advances

3. Practical and Oral/viva-voce Examination

Practical should be spread over two days and include the following components:

a. Bacteriology:

Identification of a pure culture.

Isolation and Identification of Bacteria from Clinical Samples

b. Serology:

Common Serological Tests like ELISA/VDRL/Widal/Brucella Agglutination test etc.

c. Virology:

Preparation of tissue cultures

Virus Titration

Haemagglutination and its inhibition test

Virus Neutralization Test

Other rapid tests for diagnosis of viral infections

d. Mycology

Identification of fungal cultures

Slide culture techniques

Examination of histopathology slides for fungus

e. Parasitology

Processing and Identification of ova and cysts in stool samples

Amoebic Serology

Microscopic Slides

Examination of histopathology slides for parasites

f. Spots: 10 spots

Oral/Viva-Voce Examination:

This must include a component of teaching session of not more than 15 minutes duration.

VIII. Recommended Reading:

The students are expected to refer to the latest editions of the following recommended books.

1. Bailey and Scott's Diagnostic Microbiology, Mosby, St. Louis.
2. Koneman's Colour Atlas and Textbook of Diagnostic Microbiology, J.B. Lippincott, Philadelphia.
3. Murray PR etc. Manual of Clinical Microbiology, American Society for Microbiology.
4. Garcia LS, Bruckner DA. Diagnostic Medical Parasitology, American Society for Microbiology.
5. Mackie & McCartney – Practical Medical Microbiology.
6. Apurba Sastry, Sandhya Bhat – Essentials of Medical Microbiology.
7. Ananthanarayan & Paniker's Textbook of Microbiology.
8. Field's Virology.
9. Wiedbrauk DL, Johnston SLG. Manual of Clinical Virology, New York, Raven Press.
10. Chatterjee KD, Textbook of Parasitology.

Journals

1. Indian Journal of Medical Microbiology
2. Journal of Clinical Microbiology
3. Journal of Infectious Diseases
4. Indian Journal of Medical Research
5. Journal of Laboratory Physicians of India
6. Clinical Infectious Diseases
7. Journal of Medical Microbiology



SDM College of Medical Sciences & Hospital



SDM College of Dental Sciences & Hospital



SDM College of Physiotherapy &
SDM Institute of Nursing Sciences



Shri Dharmasthala Manjunatheshwara University



SDM Research Institute for Biomedical Sciences



Panoramic View of Campus