Program and Course Structure

School of Medical Science and Research

MD (Microbiology)

Session: 2020-23

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.2 Vision and Mission of the School

Vision of the School

To serve the society by being a premier institute that promotes a comprehensive approach to human health through excellence inacademics, research and clinical care

Mission of the School

- Provide a transformative educational experience in Medical Science
- Develop skills and competencies to create global leaders in clinical care
- Promote innovative and collaborative research through intellectual and technological advancement
- Establish a center for excellence in preventive, promotive and curative health care

Core Values

- Integrity
- Leadership
- Ethics
- Community Health

B. Program Structure Template

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

5. Transformative educational experience
6. Enrichment by educational initiatives that encourage global outlook
7. Develop research, support disruptive innovations and accelerate entrepreneurship
8. Seeking beyond boundaries

Creative Campaign Can be TEDs: This is guiding principle for promotion and wide circulation among various stakeholder.
Guidelines: Similar Mnemonics can be designed by schools.

Core Values

- Integrity
- Leadership
- Diversity
- Community

Note: Detailed Mission Statements of University can be used for developing Mission Statements of Schools/ Departments.

1.2 Vision and Mission of the School

Vision of the School

To serve the society by being a premier institute that promotes a comprehensive approach to human health through excellence inacademics, research and clinical care

Mission of the School

- Provide a transformative educational experience in Medical Science
- Develop skills and competencies to create global leaders in clinical care
- Promote innovative and collaborative research through intellectual and technological advancement
- Establish a center for excellence in preventive, promotive and curative health care

1.3 Program Educational Objectives (PEO)

1.3.1 Writing Program Educational Objectives (PEO)

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Program educational Objectives

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

1. Demonstrate competence in application of microbiology in a variety of clinical settings to solve diagnostic and therapeutic problems along with preventive measures.

2. Interact effectively with the allied departments by rendering services in basic as well as advanced laboratory investigations

3. Play a pivotal role in hospital infection control, including formulation of antibiotic policy and management of biomedical waste.

4. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology

5. Acquire skills in conducting collaborative research in the field of Microbiology with allied sciences.

6. Demonstrate effective communication skills required for the practice of clinical microbiology and while teaching undergraduate students

7. Plan, execute and evaluate teaching assignments in Medical Microbiology.

8. Acquire various skills for collaborative research and plan, execute, analyse and present the research work in medical microbiology.

9. Conduct such clinical / experimental research as would have significant bearing on human health & patient care.

10. To Participate in various workshops / Seminars / Journal clubs / Demonstration in the allied department.

1.3.2 Map PEOs with Mission Statements:

PEO Statements	**Mission 1** Provide a transformative educational experience in Medical Science	**Mission 2** Develop skills and competencies to create global leaders in clinical care	**Mission 3** Promote innovative and collaborative research through intellectual and technological advancement	**Mission 4** Establish a center for excellence in preventive, promotive and curative health care

PEO1: Demonstrate competence in application of microbiology in a variety of clinical settings to solve diagnostic and therapeutic problems along with preventive measures	**3**	**3**	**3**	**3**
PEO2. Interact effectively with the allied departments by rendering services in basic as well as advanced laboratory investigations	**3**	**3**	**3**	**3**
PEO3. Play a pivotal role in hospital infection control, including formulation of antibiotic policy and management of biomedical waste.	**3**	**3**	**3**	**3**
PE04: Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology	**3**	**3**	**3**	**3**
PEO5: Acquire skills in conducting collaborative research in the field of Microbiology with allied sciences	**3**	**3**	**3**	**3**
PEO6: Demonstrate effective communication skills required for the practice of clinical microbiology and while teaching undergraduate students	**3**	**3**	**3**	**3**
PEO7: Plan, execute and evaluate teaching assignments in Medical Microbiology.	**3**	**3**	**3**	**3**
PEO8: Acquire various skills for collaborative research and plan, execute, analyse and present the research work in medical microbiology	**3**	**3**	**3**	**3**
PEO9: Conduct such clinical / experimental research as would have significant bearing on human health & patient care.	**3**	**3**	**3**	**2**
PEO10: To Participate in various workshops / Seminars / Journal clubs / Demonstration in the allied department	**3**	**3**	**3**	**2**

Enter correlation levels 1, 2, or 3 as defined below:

1. **Slight (Low)** **2. Moderate (Medium)** **3. Substantial (High)**

If there is no correlation, put "-"

1.3.2 Program Outcomes (PO's)

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1. Cognitive Domain

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

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 lyophilization
6. Nomenclature, classification and morphology of bacteria and other microorganisms as well as their requirements for growth, nutrition and their metabolism.
7. Various types and significance of normal flora of human body in health and disease states
8. Various types of host parasite relationship & their significance.
9. Bacterial genetics, bacteriophages and molecular genetics relevant for medical microbiology
10. Component & functions of immune system, various antigen – antibody reactions and their applications and complement system.
11. Various disorders like hypersensitivity, immune deficiency & autoimmune diseases.
12. Demonstrate knowledge & skills in various techniques for isolation & identification of bacterial pathogens of medical importance including various Gram positive (Staphylococcus, Micrococcus, Streptococcus, Lactobacillus, Listeria, Clostridium, Actinomyces, Nocardia, Mycobacterium etc.) and gram negative (Vibrios, Aeromonas, Haemophilus, Bordetella, Brucella, Pseudomonas, Enterobacteriaceae members, spirochaetes, chlamydia etc.) .
13. Explain the general characteristics (morphology, reproduction and classification) and also identify major fungal pathogens including yeasts & moulds and also identify various laboratory contaminant fungi.

14. Explain the general properties, classification, morphology, replication, pathogenesis and laboratory diagnosis of major DNA and RNA viruses.

15. Demonstrate knowledge about general character, classification, pathogenesis & laboratory diagnosis of medically important protozoan's (Amobae, Giardia , Trichomonas , Leishmania, trypanosome, Plasmodium, Toxoplasma, Cryptosporidium, cyclospora etc.) and helminthes (cestodes, trematodes and Nematodes).

16. Microbiology of air, milk, water as well as hospital environment.

17. Demonstrate knowledge about epidemiology of various infections diseases and hospital required infections.

18. Demonstrate knowledge about management of biomedical waste.

19. Demonstrate knowledge about infections of various organ systems of human body (respiratory tract , urinary tract , central nervous system, reproductive system, gastrointestinal system, cardiovascular system).

20. Demonstrate knowledge & applications of automation and molecular techniques in Microbiology.

21. Applications of quality assurance, quality control in microbiology and accreditation of laboratories

B Affective domain

A post graduate student having qualified the MD (Community Medicine) examination should be able to

22. 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.

23. Always adopt 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.

24. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C**. Psychomotor Domain**

The student should be able to perform independently the following:

25. Collection/transportation, Preparation, examination and interpretation of direct smears and culture and other microbiological test from clinical specimens and their disposal

26. Aseptic practices in laboratory and safety precautions. Selection of Personal Protective Equipment according to task and donning (gloves, mask, eye protection, gown etc).

27. Operation of autoclave, hot an oven, filters like Seitz and membrane filters etc.

28. Identification of bacteria of medical importance up to species level.

29. Techniques of anaerobiosis..

30. Tests of motility: hanging drop, cragies tube.

31. Performance of antimicrobial susceptibility testing and detection of enzymes leading to drug resistance.

32. Testing of disinfectants.

At the end of the program, the student should have acquired following competencies(PSOs):

1.3.4 Mapping of Program Outcome Vs Program Educational Objectives

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO10
PO1	2	2	3/2	1	2	3	2	2	3	2
PO2	3	3	2	2	3	3	2	3	2	2
PO3	3	2	3	3	3	3	2	3	2	3
PO4	2	2	2	3	3	3	2	3	2	3
PO5	3	3	3	3	3	3	3	3	3	3
PO6	2	1	1	1	2	3	3	2	3	2
PO7	3	1	2	1	3	3	3	3	3	2
PO8	3	3	3	2	2	3	3	2	2	2
PO9	3	2	3	3	3	3	2	3	2	2
PO10	3	2	1	2	2	3	2	2	3	3
PO11	3	2	1	2	3	3	3	3	3	3
PO12	3	3	3	3	2	2	2	2	3	3
PO13	1	3	2	3	3	1	1	3	2	3
PO14	1	1	1	3	3	1	1	3	2	3
PO15	3	1	1	1	2	3	1	2	1	3
PO16	3	3	3	3	3	3	3	3	3	2
PO17	3	2	3	3	3	3	3	3	2	2
PO18	3	3	3	3	2	3	3	2	3	2
PO19	1/3	2	1	3	1	3	1	1	3	3
PO20	3	3	2	3	3	3	1	2	3	3
PO21	3	3	3	3	3	1	1	2	1	1
PO22	1	3	3	3	2	1	1	2	1	2
PO23	1	3	1	3	3	3	1	3	1	3
PO24	2	3	3	3	3	3	1	3	1	3

PO25	3	3	3	3	3	3	2	3	2	1
PO26	3	3	3	3	3	1	2	3	3	3
PO27	3	3	3	3	3	2	1	3	3	3
PO28	3	3	3	3	3	3	1	3	3	3
PO29	3	3	3	3	3	2	1	3	3	3
PO30	3	3	3	3	2	2	1	3	3	3
PO31	3	3	3	3	3	1	1	3	3	3
PO32	3	3	3	3	3	1	1	3	3	3

Syllabus

Course contents:

Paper I: 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. Immunopotentiation and immunomodulation

Paper II: 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 Mycoplasmas.*
12. *Rickettsiae, 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 marneffei* etc.
8. *Dermatophytes*
9. Fungi causing Mycetoma, Chromoblatomycosis, 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.

Paper III: 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, Adeno viruses, Hepadna virus, Papova and Parvo viruses etc.
9. RNA viruses of medical importance including Enteroviruses, Toga viruses, Flavi viruses, Orthomyxo viruses, Paramyxo viruses, Reo viruses, Rhabdo viruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human immunodeficiency virus, Arbo viruses, Corona viruses, Calci viruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepatitis viruses
13. Viriods, 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, Dipyllidium, 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, myasis.
6. Anti-parasitic agents.

Paper IV: 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

ASSESSMENT 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.

Quarterly 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).

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

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

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 up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the 26 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 'Grading' or '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./ MS 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 III: 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:

• **Bacteriology:**

1. Identification of a pure culture.
2. Isolation and Identification of Bacteria from Clinical Samples

• **Serology:**

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

• **Virology:**

1. Preparation of tissue cultures
2. Virus Titration
3. Haemagglutination and its inhibition test
4. Virus Neutralization Test
5. Other rapid tests for diagnosis of viral infections

• **Mycology**

1. Identification of fungal cultures
2. Slide culture techniques
3. Examination of histopathology slides for fungi

• **Parasitology**

1. Processing and Identification of ova and cysts in stool samples
2. Amoebic Serology
3. Microscopic Slides
4. Examination of histopathology slides for parasites
5. Spots: 10 spots

Oral/Viva-Voce Examination:

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

Recommended Reading:

Books (Latest edition)

1. Forbes B, Sahm D, Weissfeld A. Bailey and Scott's Diagnostic Microbiology, Mosby, St. Louis.
2. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. Color Atlas and Textbook of Diagnostic Microbiology, J.B. Lippincott, Philadelphia.
3. Murray PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH. Manual of Clinical Microbiology, American Society for Microbiology.
4. Garcia LS, Bruckner DA. Diagnostic Medical Parasitology, American Society for Microbiology.
5. Wiedbrauk DL, Johnston SLG. Manual of Clinical Virology, New York, Raven Press.
6. Bailey and Scott's Diagnostic Microbiology.

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

Annexure I

Postgraduate Students Appraisal Form Pre / Para /Clinical Disciplines

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM……TO……

Sr. No.	PARTICULARS	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
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 /				
6	CMEs				
7	Thesis / Research work				

8	Log Book Maintenance				

Publications **Yes/ No**

Remarks*_____

_____

_____

_____

_____ _____ *REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE SIGNATURE OF CONSULTANT SIGNATURE OF HOD