

# Syllabus for MD Microbiology, Faculty of Medicine & Health Sciences

## **PREAMBLE**

The main aim of this course is to train students of Medicine in the field of Medical Microbiology. Theoretical as well as practical training is imparted to the candidates in the subspecialties viz. Bacteriology, Virology, Parasitology, Immunology and Mycology so that they can participate in good patient care and prevention of infectious diseases in the community. They are introduced to basic research methodology so that they can conduct fundamental and applied research. They are also imparted training in teaching methods in the subject which may enable them to take up teaching assignments in Medical Colleges/Institutes.

## **AIMS & OBJECTIVES**

**At the end of the course the students should be able to :**

1. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology .
2. Plan, execute and evaluate teaching assignments in medical microbiology and
3. Plan, execute, analyse and present the research work in medical microbiology.

## **Course contents (Syllabus)**

*Desirable*

PAPER-I GENERAL MICROBIOLOGY AND IMMUNOLOGY

PAPER-II BACTERIOLOGY + MYCOLOGY

PAPER-III VIROLOGY AND PARASITOLOGY

PAPER-IV APPLIED MICROBIOLOGY & RECENT ADVANCES

## **General Microbiology**

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

## **Immunology**

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

19. Measurement of immunological parameters Course and Curriculum of M D  
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20. Immunological techniques
21. Immunopotentialiation & immunomodulation

### **Systematic bacteriology**

1. Isolation & identification of bacteria
2. Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
3. Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella etc.
4. Gram positive bacilli of medical importance including Lactobacillus, 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, Bruce/la, Gardnerella, Pseudomonas & other non-fermenters, Pasture/ la, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
6. Helicobacter, Campylobacter & Spirillum
7. Enterobacteriaceae
8. Mycobacteria
9. Spirochaetes
10. Chlamydiae
11. Mycoplasmatales: Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.
12. Rickettsiae, Coxiella, Bartonella etc.

### **Virology**

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

8. DNA viruses of medical importance including Poxviridae, Herpesviridae, Adenoviridae, Hepadna, virus, Papova and Parvo viruses etc.
9. RNA viruses of medical importance including Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Retroviridae, Filoviruses, Human immunodeficiency virus, Arboviruses, Coronaviridae, Calci viruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepatl.
13. Virioids
14. Vaccines & anti-viral drugs

## **Parasitology**

1. General characters & 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 (Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius. Filarial worms, Dracunculus etc.)
5. Entomology: common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
6. Antiparasitic agents.

## **Mycology**

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

6. Mycelial fungi of medical importance including *Aspergillus*, Zygomycetes, *Pseudoallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
  7. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffeii* etc.
  8. Dermatophytes
  9. Fungi causing mycetoma, keratomycosis & otomycosis.
  10. *Pythium insidiosum*
  11. *Prototheca*
  12. *Pneumocystis carinii* infection
  13. *Rhinosporidium seeberi* & *Loeblia loeblii*
  14. Actinomycetes & *Nocardia*.
  15. Common laboratory contaminant fungi
  16. Mycetismus & mycotoxicosis
  17. Antifungal agents & invitro antifungal susceptibility tests.
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### **Applied Microbiology**

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Management of hospital waste
4. Investigation of an infectious outbreak
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

## **Psychomotor Skills for Postgraduates Students in M.D. (Microbiology)**

### **Bacteriology - Must acquire**

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

19. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing, eg. KirbyBauer, Stoke's method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/plate dilution methods.
20. Tests for Beta-lactamase production.
21. Inoculation of infective material by different routes in animals
22. Bleeding techniques of animals including sheep
23. Performance of autopsy on animals & disposal of animals
24. **Animal pathogenicity/toxigenicity tests for C.diphtheriae, C.tetani, S.pneumoniae, S.typhimurium, K.pneumoniae etc.**
25. Care and breeding of laboratory animals viz. mice, rats, guinea pigs, rabbits etc.
26. Testing of disinfectants -Phenol coefficient and "in use" tests
27. **Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria**
28. Disposal of contaminated materials like cultures
29. Disposal of infectious waste
30. Bacteriological tests for water, air and milk
31. Maintenance & preservation of bacterial cultures

#### **Bacteriology - Desirable to acquire**

1. Conjugation experiments for drug resistance
  2. Serum antibiotic assays e.g. gentamicin
  3. Phage typing for Staphylococci, S.typhi, etc.
  4. Bacteriocin typing viz. Proteocin, etc.
  5. Enterotoxigenicity tests like rabbit ileal loop, intragastric inoculation of infant mouse, Sereny's test.
  6. Serologic grouping of Streptococci
  7. Mouse foot pad test for M leprae
  8. Antimicrobial susceptibility tests for Mycobacteria
  9. Molecular typing methods
  10. Special staining techniques for Mycoplasma, Treponemes, Gardnerella.
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#### **Immunology - Must acquire**

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods

2. **Preparation of antigens from bacteria or tissues like Widal, Weil Felix, VDRL, SLO and group polysaccharide of Streptococcus etc. and their standardisation.**
3. Raising of antisera in laboratory animals
4. Performance of serological tests viz. Widal, Brucella tube agglutination, indirect hemagglutination, VDRL, ASO, Rose Waaler test, IFA.
5. Immunodiffusion in gel (Ouchterlony), counter-immunoelectrophoresis.
6. Enzyme linked immunosorbent assay
7. Latex agglutination tests
8. Preparation & preservation of complement & complement titration

### **Immunology - Desirable to acquire**

1. Radial immunodiffusion for estimation of serum Immunoglobulins
2. Immuno-electrophoresis
3. Crossed immuno-electrophoresis
4. Neutrophil phagocytosis
5. Immunoblotting
6. Performance of serological tests viz. Weil Felix, cold agglutination, Paul Bunnell test
7. Leukocyte migration test
8. T - cell resetting
9. Separation of lymphocytes by centrifugation, gravity sedimentation etc.

### **Mycology - Must acquire**

1. Collection and transport of specimens
2. Processing of samples for microscopy and culture.
3. Direct examination of specimens by KOH, Gram's, Acid fast, Giemsa, Lactophenol cotton blue & special fungal stains
4. Examination of histopathology slides for fungal infections
5. Isolation and identification of medically important fungi & common laboratory contaminants
6. Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture
7. Maintenance of stock cultures
8. Animal pathogenicity tests viz. intravenous, intracerebral and intra peritoneal inoculation of mice for fungal pathogenicity study.



### **Mycology-desirable to acquire**

1. Antigen preparation -viz. from Candida, Aspergillus, Histoplasma, Sporothrix
2. Antibody detection in candidiasis, aspergillosis, histoplasmosis, blastomycosis, cryptococcosis, zygomycosis, coccidioidomycosis
3. Antigen detection in cryptococcosis, aspergillosis, candidiasis
4. Skin test using aspergillin, candidin, histoplasmin, sporotrichin
5. Isolation and identification of actinomycetes.
6. Calcofluor staining & examination under fluorescent microscope

### **Parasitology - Must acquire**

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

### **Parasitology - Desirable to acquire**

1. Maintenance of parasites in laboratory either in vivo in animals or by in-vitro cultures
2. Permanent staining techniques like iron hematoxylin
3. QBC for malaria & filaria .
4. In-vitro culture of parasites like Entamoeba, Leishmania, P. falciparum, Acanthamoeba etc.

5. Antigen preparation -viz. Entamoeba, filaria, Toxoplasma, hydatid for serological tests for IRA, ELISA and skin tests like Casoni ' s

### **Virology - Must acquire**

1. Preparation of glassware for tissue cultures (washing, sterilisation).
2. Preparation of buffers like PBS, Hank's
3. Preparation of clinical specimens for isolation of viruses
4. Collection & transport of specimens
5. Recognition of CPE producing viruses
6. Serological tests -ELISA for HIV & HBsAg, Haemagglutination Inhibition test for Influenza, MeaslesCourse and Curriculum of M D Microbiology 131
7. Chick Embryo techniques-inoculation and harvesting
8. Handling of mice, rats and guinea pigs for collection of blood, pathogenicity tests, etc.
9. Special staining procedure for viruses

### **Virology - desirable to acquire**

1. Electron microscopy of virus -TEM, SEM
2. Preservation of viruses
3. Preparation of viral antigens.
4. Molecular techniques in virology
5. Preparation of monkey kidney cells (primary) and maintenance of continuous cell lines by subculture.

### **Preservation in -70°C and liquid nitrogen**

6. Performance of haemadsorption for Parainfluenza, Haemagglutination of Influenza, Immunofluorescence, Neutralisation for Enteroviruses and Respiratory viruses. Identification tests on tissue cultures and supernatants etc.
7. Serological tests: haemadsorbtion for Parainfluenza

### **4. Teaching Schedule**

- |                           |             |
|---------------------------|-------------|
| 1. Seminar                | Once a week |
| 2. PG Practicals          | Once a week |
| 3. Journal club           | Once a week |
| 4. PG discussion          | Once a week |
| 5. Thesis/Case Discussion | Once a week |

## 5. Posting

Section/Subject

- ❖ Bacteriology:
- ❖ Mycology:
- ❖ Immunology:
- ❖ Parasitology:
- ❖ Mycobacteriology:
- ❖ Serology:
- ❖ Virology:

## 6. Thesis

- ❖ Every candidate shall carry out work on an assigned research project under the guidance of a recognized Postgraduate Teacher, the project plan of thesis shall be submitted with in the first six months of admission to MD course.
- ❖ (i) The student will Identify a relevant research question; (ii) conduct a critical review of literature; (iii) formulate a hypothesis; (iv) determine the most suitable study design; (v) state the objectives of the study; (vi) prepare a study protocol; (vii) undertake a study according to the protocol; (viii) analyze and interpret research data, and draw conclusions; (ix) write a research paper.
- ❖ The Thesis shall be submitted at least six months before the final examination

## 7. Assessment

All the PG residents are assessed daily for their academic activities and also periodically.

### 7.1. General Principles

The assessment is valid, objective, and reliable.

It covers cognitive, psychomotor and affective domains.

Formative, continuing and summative (final) assessment is also conducted in theory as well as practicals/clinicals. In addition, thesis is also assessed separately.

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### 7.2. Formative Assessment

The formative assessment is continuous as well as end-of-term. The former is based on the feedback from the senior residents and the consultants concerned. End-of-term assessment is held at the end of each semester (upto the 5th semester). Formative assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.

### 7.3. Internal Assessment

The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student. Marks should be allotted out of 100 as followed.

Sr. No.	Items	Marks
1.	Personal Attributes	20
2.	Practical Work	20
3.	Academic activities	20
4.	End of term theory examination	20
5.	End of term practical examination	20

#### 1. Personal attributes:

**Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situations shows positive approach.

**Motivation and Initiative:** Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.

**Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.

**Interpersonal Skills and Leadership Quality:** Gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

#### 2. Practical Work:

- ❖ **Availability:** Punctual, available continuously on duty, responds promptly on assignments and takes proper permission for leave.
- ❖ **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in practical work.

- ❖ **Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.
- ❖ **Performance:** Proficient in presentations and discussion during academic sessions in the department.

**3. Academic Activity:** Performance during presentation at Journal club/ Seminar/ Case discussion/ Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

**4. End of term theory examinations** conducted at end of 1st, 2nd year and after 2 years 9 months. Curriculum M.D. Microbiology

**5. End of term practical/oral examinations** after 2 years 9 months.

Marks for personal attributes and work done should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.

Marks for academic activity should be given by the all consultants who have attended the session presented by the residents.

The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examinations.

#### **7.4. Summative Assessment**

- Ratio of marks in theory and practicals will be equal.
- The pass percentage will be 50%.
- Candidate will have to pass theory and practical examinations separately.

#### **A. Theory Examination (Total=400)**

Paper	Marks
Paper-I General Microbiology and Immunology	100
Paper-II Bacteriology + Mycology	100
Paper-III Virology And Parasitology	100
Paper-IV Applied Microbiology & Recent Advances	100

#### **B. Practical & Viva-Voce Examination (Total=400)**

Ex.1 Bacteriology	
a)Clinical exercise	80 marks
b)Identification of pure culture	40 marks
Ex.2 Mycology	50 marks

Ex.3	Spots	40 marks
Ex.4	Serology	30 marks
Ex.5	Virology	30 marks
Ex.6	Animal Inoculation	20 marks
Ex.7	Parasitology	10 marks
Viva-voce		100 Marks

## **Microbiology**

### **8. Job Responsibilities**

During 1st year the resident will work under direct supervision of the consultants /Sr. Resident / 2nd yr & 3rd yr residents and will be responsible for handling and processing of the specimens in their respective sections.

During 2nd yr, they will be responsible for reporting in their respective sections under the supervision.

During 3rd yr, they should be able to handle all the emergencies in the evening and night.

All the junior residents should be able to take practical demonstrations of undergraduates.

### **9. Suggested Reading**

#### **9.1 Core Books**

##### **Title Author**

- ❖ Text Book of Microbiology (vol I & II) Mackie & MacCarteney
- ❖ Diagnostic Microbiology Bailey & Scot
- ❖ Text Book of Microbiology Ananthanaryan
- ❖ Text Book of Microbiology
- ❖ Text Book of Parasitology
- ❖ CP Baveja
- ❖ KD Chatteraji
- ❖ Review of Medical Microbiology Jawetz

#### **9.2 Reference Books**

##### **Title Author**

- ❖ Microbiology and Microbial Infection
- ❖ (Vol I- VI)

- ❖ Topley & Wilson
- ❖ Colour Atlas & Text Book of Diagnostic
- ❖ Microbiology
- ❖ Koneman
- ❖ Immunology Ivan Roitt
- ❖ Text Book of Mycology Emmons
- ❖ Medical Virology Fenner

### **9.3. Journals**

- ❖ Indian Journal of Medical Microbiology
- ❖ Indian Journal of Medical Research
- ❖ Clinical Microbiological Reviews
- ❖ Journal of Hospital Infection
- ❖ Lancet
- ❖ North American Clinics of Infectious Diseases
- ❖ Review of Infectious Diseases
- ❖ Tuberculosis
- ❖ Indian Journal of Tuberculosis
- ❖ Journal of Tropical Medicine

### **10. Model Test Papers Curriculum M.D. Microbiology**

**MODEL QUESTION PAPER**  
**MD (Microbiology)**  
**Paper-I**  
**General Microbiology & Immunology**

**Max. Marks:100**

**Time: 3 hrs**

- **Attempt ALL questions**
- **Answer each question & its parts in SEQUENTIAL ORDER**
- **ALL questions carry equal marks**
- **Illustrate your answer with SUITABLE DIAGRAMS**
  - i. Discuss genetic basis of drug resistance in bacteria.
  - ii. Enlist important primary immunodeficiency diseases. Describe DiGeorge's syndrome.
  - iii. What are histocompatibility antigens? Discuss HLA typing.
  - iv. What is microarray? Describe its principle and applications in microbiology.
  - v. Explain hybridoma technology and give its applications in microbiology.
  - vi. What is redox potential? Describe giving suitable examples.
  - vii. Enumerate various tests used for determining the efficacy of disinfectants. Discuss briefly the phenol-coefficient test.
  - viii. Enumerate various tests used for determining the efficacy of disinfectants. Discuss briefly the phenol-coefficient test.
  - ix. Differentiate between classical and alternate pathways of complement activation. Discuss the role of complement in various serological tests.
  - x. Categorize pathogens according to hazard and categories of containment. Discuss various types of microbiological biosafety cabinets.



**MODEL QUESTION PAPER**  
**MD (Microbiology)**  
**Paper-II**  
**Bacteriology and Mycology**

**Max. Marks:100**

**Time: 3 hrs**

- **Attempt ALL questions**
  - **Answer each question & its parts in SEQUENTIAL ORDER**
  - **ALL questions carry equal marks**
  - **Illustrate your answer with SUITABLE DIAGRAMS**
- 
- i. Discuss the laboratory diagnosis of antibiotic associated diarrhea.
  - ii. Discuss etiology, pathogenesis and laboratory diagnosis of Weil's disease.
  - iii. What are PBP's ? Discuss their role in drug resistance.
  - iv. Discuss briefly GISA.
  - v. Explain the mechanism of action and methods of detection of enter toxin
  - vi. Discuss etiology, pathogenesis and laboratory diagnosis of Cat Scratch Disease.
  - vii. Enumerate various dematiaceous fungi and discuss their pathogenicity.
  - viii. What are mycotoxins ? Discuss mycotoxicosis.
  - ix. Classify antifungal agents. Discuss the methods of anti-fungal susceptibility testing.
  - x. Define conidiogenesis and explain with suitable diagrams.

**MODEL QUESTION PAPER**  
**MD (Microbiology)**  
**Paper-III**  
**Virology & Parasitology**

**Max. Marks:100**

**Time: 3 hrs**

- **Attempt ALL questions**
  - **Answer each question & its parts in SEQUENTIAL ORDER**
  - **ALL questions carry equal marks**
  - **Illustrate your answer with SUITABLE DIAGRAMS**
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- i. Name various nonpathogenic amoebae. Discuss the life cycle, pathogenicity and laboratory diagnosis of any one of them.
  - ii. Discuss rapid diagnostic tests in parasitology along with their clinical applications.
  - iii. Enlist and discuss laboratory diagnosis of opportunistic parasitic infections in immunocompromised patients.
  - iv. Discuss the etiology, pathogenesis and diagnosis of Tropical Pulmonary Eosinophilia.
  - v. Classify oncogenic viruses and explain the various mechanisms of viral oncogenesis.
  - vi. What are Interferons ? Explain their mechanism and clinical applications.
  - vii. Discuss etiology, pathogenesis and laboratory diagnosis of viral hemorrhagic fever.
  - viii. Define Prions. Classify Prion diseases and discuss their pathogenesis and diagnosis.
  - ix. Enumerate various congenital viral infections and discuss their laboratory diagnosis.
  - x. Write briefly on transfusion transmitted hepatitis. Curriculum M.D.

# MODEL QUESTION PAPER

## MD (Microbiology)

### Paper-IV

#### Applied Microbiology and Recent Advances in Microbiology

Max. Marks:100

Time: 3 hrs

- **Attempt ALL questions**
  - **Answer each question & its parts in SEQUENTIAL ORDER**
  - **ALL questions carry equal marks**
  - **Illustrate your answer with SUITABLE DIAGRAMS**
- 
- i. What are the edible vaccines? Discuss the current status and future of edible vaccines.
  - ii. What is flowcytometry? Give its principle and uses in clinical microbiology.
  - iii. Define transgenic mice and discuss its role in study of microbial pathogenicity.
  - iv. What is the role of microbiologist in Hospital Infection Control Committee?
  - v. What is quality control ? Describe various methods adopted for internal quality control in microbiology.
  - vi. Discuss the emerging and reemerging bacterial infections.
  - vii. What are biofilms. Describe their significance in clinical microbiology.
  - viii. Discuss PEP in case of needle stick injury.
  - ix. Define and categorize biomedical waste. Discuss its management.
  - x. Discuss various methods used for bacteriological examination of water.