

## **PG Curriculum MD Microbiology Index**

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# Curriculum MD Microbiology

Infrastructure and faculty will be as per MCI guidelines

## 1. Goal

The main goal 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.

## 2. Objectives

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

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

## 3. Syllabus

### 3.1 Theory

- ❖ **General Microbiology**
  - History of microbiology
  - Microscopy
  - Bio-safety including universal precautions
  - Physical and biological containment
  - Sterilization and disinfection
  - Morphology of bacteria and other microorganisms
  - Nomenclature and classification of microorganisms
  - Normal flora of human body
  - Growth & nutrition of bacteria
  - Bacterial metabolism
  - Bacterial toxins
  - Bacteriocins
  - Microbiology of hospital environment
  - Microbiology of air, milk and water
  - Host-parasite relationship
  - Antibacterial substances and drug resistance
  - Bacterial genetics & bacteriophages
  - Molecular genetics relevant for medical microbiology
  - Quality assurance & quality control in microbiology
  - Accreditation of laboratories

### ❖ Immunology

- Components of the immune system
- Innate and acquired immunity
- Cells involved in immune response
- Antigens
- Immunoglobulins
- Mucosal immunity
- Complement
- Antigen & antibody reactions
- Hypersensitivity
- Humoral & Cell mediated immunity
- Cytokines
- Immunodeficiency
- Auto-immunity
- Immune tolerance
- MHC complex
- Transplantation immunity
- Tumor immunity
- Vaccines and immunotherapy
- Measurement of immunological parameters
- Immunological techniques
- Immunopotiation & immunomodulation

### ❖ Systematic bacteriology

- Isolation & identification of bacteria
- Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
- Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella etc.
- 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.
- Gram negative bacilli of medical importance including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas & other non-fermenters, Pasturella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
- Helicobacter, Campylobacter & Spirillum
- Enterobacteriaceae
- Mycobacteria
- Spirochaetes
- *Chlamydiae*
- Mycoplasmatales: *Mycoplasma*, *Ureaplasma*, *Acholeplasma* and other *Mycoplasmas*.
- Rickettsiae, Coxiella, Bartonella etc.

### ❖ Virology

- General properties of viruses
- Classification of viruses
- Morphology: Virus structure
- Virus replication
- Isolation & identification of viruses

- Pathogenesis of viral infections
- Genetics of viruses
- DNA viruses of medical importance including Poxviridae, Herpesviridae, Adenoviridae, Hepadna virus, Papova and Parvo viruses etc.
- RNA viruses of medical importance including Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Retroviridae, Filoviruses, Human immunodeficiency virus, Arboviruses, Coronaviridae, Calciviruses etc.
- Slow viruses including prions
- Unclassified viruses
- Hepatitis
- Virioids
- Vaccines & anti-viral drugs
- ❖ **Parasitology**
  - General characters & classification of parasites
  - Methods of identification of parasites
  - Protozoan parasites of medical importance including Entamoeba, Free living amoebae, *Giardia Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora*, *Isospora*, *Babesia*, *Balantidium* etc.
  - 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.)
  - *Entomology*: common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
  - Antiparasitic agents.
- ❖ **Mycology**
  - General characteristics & classification of fungi
  - Morphology & reproduction of fungi
  - Isolation & identification of fungi
  - Tissue reactions to fungi
  - Yeasts and yeast like fungi of medical importance including *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Saccharomyces* etc.
  - Mycelial fungi of medical importance including *Aspergillus*, *Zygomycetes*, *Pseudoallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
  - Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffe* etc.
  - Dermatophytes
  - Fungi causing mycetoma, keratomycosis & otomycosis.
  - *Pythium insidiosum*
  - *Prototheca*
  - *Pneumocystis carinii* infection
  - *Rhinosporidium seeberi* & *Loboa lobo*
  - Common laboratory contaminant fungi
  - Mycetismus & mycotoxicosis
  - Antifungal agents & invitro antifungal susceptibility tests.

### ❖ **Applied Microbiology**

- Epidemiology of infectious diseases
- Hospital acquired infections
- Management of hospital waste
- Investigation of an infectious outbreak
- Infections of various organs and systems of human body and their lab diagnosis 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, skin & wound infections septicaemia, endocarditis, haemorrhagic fever etc.
- Opportunistic infections.
- Sexually transmitted diseases
- Vaccinology: principle, methods of preparation, administration of vaccines
- Information technology (Computers) in microbiology
- Gene cloning
- Molecular techniques as applicable to microbiology
- Epidemiological typing techniques
- Automation in Microbiology
- Statistical analysis of microbiological data and research methodology
- Animal & human ethics involved in microbiological work

### ❖ **Recent Advances in Medical Microbiology**

## **3.2 Practical**

### ❖ **Bacteriology**

- Aseptic practices in laboratory and safety precautions
- Collection/transport of specimens for microbiological investigations
- Preparation, examination & interpretation of direct smears from clinical specimens
- Plating of clinical specimens on media for isolation, purification, identification and quantitation purposes.
- Preparation of stains viz. Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN) Silver impregnation stain etc.
- Preparation 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.
- Preparation of reagents -oxidase, Kovac etc.
- Quality control of media, reagents etc.
- Operation of autoclave, hot air oven, distillation plant, filters like Sietz and membrane filters
- Care and operation of microscopes
- Washing and sterilisation of glassware (plugging and packing)
- Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
- Sterility tests
- Identification of bacteria of medical importance upto species level (except anaerobes which could be upto generic level).
- Techniques of anaerobiosis

- Tests for Motility: hanging drop, Cragie's tube, dark ground microscopy for spirochaetes
  - In-vitro toxigenicity tests- Elek's test, Negler's reaction
  - Special tests- Bile solubility, sheep cell haemolysis, CAMP test, satellitism, catalase, oxidase, slide & tube agglutination tests etc.,
  - Preparation of antibiotic discs; performance of antimicrobial susceptibility testing, eg. Kirby-Bauer, Stoke's method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/ plate dilution methods
  - Tests for Beta-lactamase production
  - Inoculation of lab animals by different routes
  - Bleeding techniques of animals including mice, guinea pig, rabbit and sheep
  - Animal pathogenicity/toxigenicity tests for C.diphtheriae, C.tetani, S.pneumoniae, S.typhimurium, K.pneumoniae etc.
  - Care and breeding of laboratory animals viz. mice, rats, guinea pigs, rabbits etc.
  - Testing of disinfectants
  - Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria
  - Disposal of contaminated materials like cultures
  - Disposal of infectious waste
  - Bacteriological tests for water, air and milk
  - Maintenance & preservation of bacterial cultures
  - Serologic grouping of Streptococci
  - Antimicrobial susceptibility tests for Mycobacteria
  - Special staining techniques for Mycoplasma, Treponemes, Gardnerella.
- ❖ **Immunology**
- Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods.
  - Performance of serological tests viz. Widal, Brucella tube agglutination, indirect hemagglutination, VDRL, ASO, Rose Waaler test, IFA. Enzyme linked immunosorbent assay
  - Latex agglutination tests
  - Separation of lymphocytes by centrifugation, gravity sedimentation etc.
- ❖ **Mycology**
- Collection and transport of specimens
  - Processing of samples for microscopy and culture
  - Direct examination of specimens by KOH, Gram's, Acid fast, Giemsa, Lactophenol cotton blue & special fungal stains
  - Examination of histopathology slides for fungal infections
  - Isolation and identification of medically important fungi & common laboratory contaminants
  - Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture
  - Maintenance of stock cultures
  - Antibody detection in candidiasis, aspergillosis, histoplasmosis, blastomycosis, Cryptococcosis, zygomycosis, coccidioidomycosis
  - Antigen detection in cryptococcosis, aspergillosis, candidiasis
  - Isolation and identification of actinomycetes .
  - Calcofluor staining & examination under fluorescent microscope

### ❖ Parasitology

- Collection and transport of specimens for diagnosis of parasitic diseases
- Examination of faeces for parasite ova and cysts etc. by direct and concentration methods (salt floatation and formol-ether methods)
- Egg counting techniques for helminths micrometry and mounting of slides
- Examination of blood for protozoa and helminths by wet mount, thick and thin stained smears
- Examination of blood for microfilariae including concentration techniques
- Examination of other specimens eg. Urine, CSF, Bone marrow etc. for parasites
- Preparation & performance of stains -Leishman, Giemsa, Lugol's iodine
- Micrometry
- Identification of medically important adult worms
- Identification of common arthropods and other vectors viz. mosquito, sandfly, ticks, mites, cyclops
- Preservation of parasites-mounting, fixing, staining etc.

### ❖ Virology

- Preparation of glassware for tissue cultures (washing, sterilisation).
- Preparation of buffers like PBS, Hank's
- Preparation of clinical specimens for isolation of viruses
- Collection & transport of specimens
- Serological tests -ELISA for HIV & HBsAg etc
- Chick Embryo techniques-inoculation and harvesting
- Handling of mice, rats and guinea pigs for collection of blood.
- Molecular techniques in virology

## 4. Teaching Programme

### 4.1. General Principles

Acquisition of practical competencies being the keystone of postgraduate medical education, postgraduate training is skills oriented.

Learning in postgraduate program is essentially self-directed and primarily emanating from clinical and academic work. The formal sessions are merely meant to supplement this core effort.

### 4.2 Teaching Sessions:

- ❖ Seminar
- ❖ Journal club
- ❖ PG Practicals
- ❖ PG discussion
- ❖ Thesis/Case Discussion

### 4.3 Teaching Schedule

The suggested departmental teaching schedule is as follow:-

- |            |             |
|------------|-------------|
| 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 shall be written and submitted in the form of a Thesis
- ❖ Every candidate shall submit thesis plan to the university as per university guidelines
- ❖ Thesis shall be submitted to the university as per university guidelines.
- ❖ (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.

## 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/clinical. In addition, thesis is also assessed separately.



## 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 1<sup>st</sup>, 2<sup>nd</sup> year and after 2 years 9 months.

## 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	<u>Marks</u>
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

## 8. Job Responsibilities

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

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

During 3<sup>rd</sup> 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	CP Baveja
❖ Text Book of Parasitology	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



## MODEL QUESTION PAPER

MD (Microbiology)

Paper-I

General Microbiology &amp; Immunology

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*Max. Marks:100**Time: 3 hrs*

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- **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 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

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*Max. Marks:100**Time: 3 hrs*

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- **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 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 enterotoxin
- 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

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*Max. Marks:100**Time: 3 hrs*

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- **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 ameobae. 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.

## MODEL QUESTION PAPER

MD (Microbiology)  
Paper-IV

Applied Microbiology and Recent Advances in Microbiology

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Max. Marks:100

Time: 3 hrs

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- **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     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.