

## Syllabus and Examination pattern for Post - Graduate Medical Courses

### NOTIFICATION

Ref. :

- (1) *Medical Council of India Regulation on Graduate Medical Education, 1997.*
- (2) *Amendment of the regulations on graduate medical education notified by Government of India from time to time :*
  - a. *Gazette Notification dated 29.05.1999.*
  - b. *Notification no. MCI-37 (2)/2001/Med-922, dated 12.04.2001.*
  - c. *Notification no. MCI-26 (3)/2003/Med-18503, dated 26.09.2003.*
  - d. *Notification no. MCI-26 (3)/2003/Med-20958, dated 15.10.2003.*

*In exercise of the powers, conferred under section 26 of Krishna Institute of Medical Sciences Deemed University, the Board of Management in its meeting held on 27<sup>th</sup> June, 2006, has been pleased to approve the Bye-law pertaining to Post Graduate Medical courses as given in schedule here to Annexed.*

*The Bye-law as above shall be effective for the students admitted to Post Graduate Medical courses from the academic year 2006-07 onwards.*

**By Order  
Registrar**

1. This byelaw shall be called Syllabus and Examination pattern for Post-Graduate Medical Course.

### **M.D. Microbiology**

The aim of this course is to train the students of Medicine in the field of Medical Diagnostic Microbiology. Knowledge and practical skills shall be acquired by the candidates in the sub-specialties of Bacteriology including Mycobacteriology, Virology, Parasitology, Immunology, and Serology & Mycology so as to be able to deal with diagnosis and prevention of infectious diseases in the community. They will be trained in basic research methodology including molecular biology so that they are able to conduct fundamental and applied research. They will also be trained in teaching methods so that they can take up teaching assignments.

#### **Goal**

The goal of the postgraduate medical education shall be to produce a competent specialist and Medical teacher:

- Who shall recognize the health needs of the community and carry out professional obligations ethically in keeping with the objectives of the national health policy
- Who shall have mastered most of the competencies, pertaining to Medical diagnostic Microbiology that are required to be practiced at the secondary and the tertiary levels of the health care delivery system;
- Who shall be aware of the contemporary advances and developments in the field of medical and diagnostic Microbiology.
- Who shall have acquired the spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology
- Who shall have acquired the basic skills of teaching of the medical and paramedical professionals.

## Educational Objectives

### A. Knowledge

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

1. State and explain the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of infectious diseases and apply that knowledge in the treatment, prevention and control of communicable diseases caused by microorganisms.
2. State and explain the principles of immunity and immunological phenomenon, which help to understand the pathogenesis, laboratory diagnosis of infectious and non-infectious diseases.
3. Establish and practice “laboratory medicine” for diagnosis of infectious diseases in hospitals and community in the field of bacteriology, parasitology, virology, mycology, serology and immunology in the light of clinical findings.
4. Organize the prevention and control of communicable diseases in the community.
5. Understand and practice the principle of prevention and control of health care associated infections and rational antibiotic policy.
6. State the recent advances in the field of Medical Microbiology and apply this knowledge in understanding aetiopathogenesis and diagnosis of diseases caused by microorganisms.
7. Carry out fundamental or applied research in the branches of medicine involving microbiological work.
8. Develop specialization in any of the above subspecialities.
9. Undertake teaching assignments in the subject of medical Microbiology.

### B. Skills

At the end of the course the student shall be able to

1. Plan the laboratory investigations for the diagnosis of infectious diseases.
2. Perform laboratory procedures to arrive at the etiological diagnosis of infectious diseases caused by bacteria, fungi, viruses and parasites including the drug sensitivity profile.
3. Perform and interpret immunological and serological tests.
4. Operate routine and sophisticated instruments in the laboratory.
5. Develop microteaching skills and Pedagogy.
6. Successfully implement the chosen research methodology.

## Course Content (Syllabus)

### Duration Of Course

The minimum period of training shall be three calendar years and the candidates can be admitted to this training after their full registration with the Medical Council. No exemption shall be given from this period of training of three years either for doing housemanship or for any other experience or diploma.

### Training Program

The candidates joining the course must work as full time residents during the whole period of their postgraduate training. They will be required to attend a minimum of 80% of training period. Candidate shall be given full time responsibility and assignments and their participation in all facets of the educational process assured. Postgraduate students must maintain a record

book of the work carried out by them and the training undergone by them during the period of training. These record books shall be checked and assessed by the faculty.

#### Teaching /Learning Methods

Learning in M. D. (Microbiology) will essentially be self-learning. Following teaching-learning methods shall be followed-

#### Group teaching sessions

- Journal review
- Subject seminar presentation
- Group discussion
- Slides seminars
- Clinical case presentations pertaining to infectious diseases
- Presentation of the findings of an exercise on any of the sub-specialties
- Participation in CME programs and conferences

#### Hands on experience (practical training)

Practical training shall be imparted by posting the students in various subspecialties (sections) as detailed in the intrinsic and extrinsic rotation. Student shall be actively involved in day to day working of all the sections. He/she will be trained under the guidance of teachers in all the aspects of Clinical Microbiology and applied aspects of laboratory medicine including 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, and infection control practices, maintenance of equipments, record keeping and quality control in Microbiology.

#### Suggested schedule of rotation

##### Intrinsic rotation

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

##### Extrinsic rotation

10. Clinical Pathology	3 months
11. Elective posting	3 months

<b>Total</b>	<b>36 months</b>
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**Emergency duty**

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

**Training in research methodology**

Training in research methodology shall 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 dissertation. The dissertation is aimed at training the candidate in research methods and techniques. It will 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 topic shall be communicated to the university within six months of registration and at least 12 months should be spent on the research project. The dissertation shall be completed and submitted by the student six months before appearing for the final university examination.

**Teaching experience**

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

**Broad Areas Of Study**

General Microbiology; Systematic Bacteriology, Mycology, Virology, Parasitology; Serology, Immunology, molecular diagnostics and Applied Clinical Microbiology including recent advances in Microbiology.

**General Microbiology**

1. History and pioneers in Microbiology.
2. Microscopy.
3. Morphology of bacteria and other microorganisms.
4. Nomenclature and classification of microbes.
5. Growth and nutrition of bacteria.
6. Bacterial metabolism.
7. Sterilization and disinfection.
8. Biomedical waste disposal.
9. Bacterial toxins.
10. Bacterial antagonism: Bacteriocins.
11. Bacterial genetics, gene cloning.
12. Antibacterial substances used in treatment of infections and drug resistance in bacteria.
13. Bacterial ecology-normal flora of human body, hospital environment, air, water and milk.
14. Host parasite relationship.
15. Quality control and Quality Assurance in Microbiology.
16. Laboratory Biosafety.
17. Health care associated infections- prevention and control.

**Immunology And Applied Aspects**

1. The normal immune system.
2. Innate immunity.

3. Antigens.
4. Immunoglobulins.
5. Complement.
6. Antigen and antibody reactions.
7. Hypersensitivity.
8. Cell mediated immunity.
9. Immunodeficiency.
10. Autoimmunity.
11. Immune tolerance.
12. Transplantation immunity.
13. Tumour immunity.
14. Prophylaxis and immunotherapy
15. Measurement of immunity.
16. Immunity and immunopathogenesis of specific infectious diseases
17. Molecular Biology Techniques. For e.g. PCR, DNA probes.

### **Systematic Bacteriology**

1. Isolation, description and identification of bacteria. The epidemiology, pathogenesis, antigenic characteristics and laboratory diagnosis of disease caused by them.
2. Staphylococcus and Micrococcus; Anaerobic Gram positive cocci.
3. Streptococci and Lactobacillus.
4. Neisseria, Branhamella and Moraxella.
5. Corynebacterium and other coryneform organisms.
6. Bacillus: the aerobic spore-bearing bacilli.
7. Clostridium: the spore-bearing anaerobic bacilli.
8. Non-sporing anaerobes.
9. The Enterobacteriaceae.
10. Vibrios, Aeromonas, Plasiomonas, Campylobacter and Spirillum, H.pylori.
11. Erysipelothrix and Listeria.
12. Pseudomonas.
13. Chromobacterium, Flavobacterium, Acinetobacter and Alkaligens.
14. Pasteurella, Francisella.
15. Haemophilus and Bordetella.
16. Brucella.
17. Mycobacteria.
18. The spirochaetes.
19. Actinomyces, Nocardia and Actinobacillus.
20. Mycoplasmatales: Mycoplasma, Ureaplasma and Acholeplasma.
21. Rickettsiae.
22. Chlamydiae.
23. Emerging bacterial pathogens.

### **Virology**

1. The nature of viruses.
2. Classification of viruses.
3. Morphology: virus structure.
4. Virus replication.
5. The genetics of viruses.
6. The pathogenicity of viruses.
7. Epidemiology of viral infections.

8. Vaccines and antiviral drugs.
9. Bacteriophages.
10. Poxviruses.
11. Herpes viruses.
12. Vesicular viruses.
13. Togaviridae.
14. Bunyaviridae.
15. Arenaviridae.
16. Marburg and Ebola viruses.
17. Rubella virus.
18. Orbi viruses.
19. Influenza virus.
20. Respiratory disease: Rhinoviruses, adenoviruses, corona viruses.
21. Paramyxoviridae.
22. Enteroviruses: Polio, Echo, Coxsackie viruses.
23. Other enteric viruses.
24. Hepatitis viruses.
25. Rabies virus.
26. Slow viruses.
27. Human immunodeficiency viruses.
28. Oncogenic viruses.
29. Teratogenic viruses.
30. Viruses of gastroenteritis.
31. Prion diseases.
32. Emerging viral infections - SARS, Avian influenza

#### **Parasitology**

1. Protozoan parasites of medical importance: Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Balantidium, Isospora, Cyclospora, and Microsporidium etc.
2. Helminthology: All those medically important helminths belonging to Cestoda, Trematoda and Nematoda. Cestodes: Diphyllbothrium, Taenia, Echinococcus, Hymenolepis, Dypylidium, Multiceps etc. Trematodes: Schistosomes, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc. Nematodes: Trichuris, Trichinella, Strongyloides, Ancylostoma, Nicator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus, etc.
3. Ectoparasites: Common arthropods and other vectors viz., Mosquito, Sandfly, Ticks, Mite, Cyclops.

#### **Mycology**

1. The morphology and reproduction of fungi and antimycotic agents.
2. Classification of fungi.
3. Contaminant and opportunistic fungi.
4. Fungi causing superficial mycoses.
5. Fungi causing subcutaneous mycoses.
6. Fungi causing systemic infections.
7. Antifungal agents

#### **Applied Clinical Microbiology**

1. Epidemiology of infectious diseases.
2. Hospital acquired infections.

3. Infections of various organs and systems of the human body.
4. Molecular genetics as applicable to Microbiology.
5. Automation in Microbiology.
6. Rapid diagnostic techniques for microbial diseases..
7. Vaccinology : principle, methods of preparation, administration of vaccines.
8. Outbreak investigations & disaster management.
9. Biological warfare

### Practicals (Skills)

#### Bacteriology

##### *Must acquire*

1. Care and operation of Microscopes viz. Light, Dark ground, Phase contrast, Inverted, Fluorescent microscopes.
2. Preparation of stains viz. Gram's, Albert's, Ziehl- Neelson and other special stains - performing of staining and interpretation of stained smears.
3. Washing and sterilization of glassware including plugging and packing.
4. Operation of incubator, autoclave, hot air oven, inspissator, distillation plant, filters like Seitz and membrane and sterility tests.
5. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
6. Preparation and pouring of liquid and solid media - Nutrient agar, Bloodagar, MacConkey agar, sugars, TSI agar, Robertson's cooked meat, Lowenstein- Jensen's, selective media.
7. Preparation of reagents - oxidase, Kovac, etc.
8. Tests for beta-lactamases including ESBLs.
9. Collection of specimens for Microbiological investigations such as blood, urine, throat swab, rectal swab, stool, pus, OT specimens.
10. Preparation, examination and interpretation of direct smears from clinical specimens, viz. Sputum for AFB - ZN & auramine O, slit smears for *M.leprae*, -ZN stain, conjunctival smear for Chlamydiae - Giemsa/Iodine.
11. Techniques of anaerobiosis - Gaspack system, anaerobic jars-evacuation & filling with H<sub>2</sub>, CO<sub>2</sub>.
12. Identification of bacteria of medical importance upto species level (except anaerobes - upto generic level).
13. Quantitative analysis of urine by pour plate method and semiquantitative analysis by standard loop test for significant bacteriuria.
14. Plating of clinical specimens on media for isolation, purification identification and quantitation.
15. Tests for motility: hanging drop, Craigie's tube, dark ground microscopy for Spirochaetes - Treponema & Leptospira.
16. In-vitro toxigenicity tests - Elek test, Nagler's reaction.
17. Special tests - Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, catalase test and slide agglutination tests, and other as applicable to identification of bacteria up to species level.
18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing by Kirby-Bauer disk diffusion method; estimation of

Minimum inhibitory /Bactericidal concentrations by tube/plate dilution methods. Tests for drug susceptibility of *Mycobacterium tuberculosis*.

19. Skin tests like Mantoux, Lepromin etc.
20. Testing of disinfectants- Phenol coefficient and 'in use' tests.
21. Quality control of media reagents etc. and validation of sterilization procedures.
22. Aseptic practices in laboratory and safety precautions.
23. Disposal of contaminated material like cultures.
24. Bacteriology of food, water, milk, air.
25. Maintenance of stock cultures.

***Desirable to acquire***

1. Care and breeding of laboratory animals viz. Mice, rats, guinea pigs and rabbits.
2. Techniques of withdrawal of blood from laboratory animals including sheep.
3. Inoculation of infective material in animals by different routes.
4. Animal pathogenicity /toxigenicity tests for *C.diphtheriae*, *Cl.tetani*, *S.pneumoniae*, *S.typhimurium*, *K. pneumoniae* etc.
5. Performance of autopsy on animals.
6. Isolation of plasmids and Conjugation experiments for transfer of drug resistance.
7. Serum antibiotic assays eg. Gentamicin.
8. Phage typing for staphylococci, *S.typhi* etc.
9. Bacteriocine typing eg. Pyocine, Proteocin etc.
10. Enterotoxigenicity tests like rabbit ileal loop, intragastric inoculation of mouse, Sereny's test.
11. Mouse footpad test for *M.leprae*.

**Immunology/ Serology**

***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 for widal, Weil-Felix, VDRL, etc. and their standardisation.
3. Preparation of adjuvants like Freund's adjuvant.
4. Raising of antisera in laboratory animals.
5. Performance of serological tests viz. Widal, Brucella tube agglutination, indirect haemagglutination, VDRL, Paul-Bunnell, Rose-Waaler, and IFA.
6. Performance and interpretation of Enzyme linked immunosorbant assay.
7. Latex and staphylococcal co-agglutination tests.

***Desirable to acquire***

1. Leucocyte migration inhibition test.
2. T-cell rosetting.
3. Flow Cytometry
4. Radial immunodiffusion.
5. Immunoelectrophoresis.
6. Neutrophil phagocytosis.
7. Immunodiffusion in gels, counter immunoelectrophoresis visualization and interpretation of bands.



## **Mycology**

### ***Must acquire***

1. Collection of specimens for mycology.
2. Direct examination of specimens by KOH, Gram, Kinyoun's, Giemsa, Lactophenol cotton blue stains.
3. Examination of histopathology slides for fungal infections.
4. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
5. Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture.
6. Maintenance of stock cultures.
7. Animal pathogenicity tests viz. Intracerebral and intraperitoneal inoculation of mice for cryptococcus.

## **Parasitology**

### ***Must acquire***

1. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formol - ether methods) and complete examination for other cellular features.
2. Egg counting techniques for helminths.
3. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears.
4. Examination of other specimens for e.g. urine, C.S.F., bone marrow etc. for parasites.
5. Histopathology sections - examination and identification of parasites.
6. Performance of stains - Leishman, Giemsa, Modified Acid Fast, Toluidine Blue O.
7. Identification of common arthropods and other vectors viz. Mosquito, sand fly, ticks, mite and cyclops.
8. Collection of specimens.
9. Preservation of parasites - mounting, fixing, staining etc.

### ***Desirable to acquire***

1. In-vitro culture of parasites like entamoeba, leishmania, P.falciparum.
2. Maintenance of toxoplasma gondii in mice.
3. Preparation of media - NIH, NNN etc.
4. Copro-culture for larva of hook worms.
5. Antigen preparation viz. Entamoeba, Filarial, Hydatid for serological tests like IHA and skin test like Casoni's.
6. Permanent staining techniques like iron haematoxylin

## **Virology**

### ***Must acquire***

1. Preparation of glassware for tissue culture (washing, sterilization).
2. Preparation of media like Hanks, MEM.
3. Preparation of clinical specimens for isolation of viruses.
4. Serological tests-ELISA and rapid tests for HIV, RPHA for HbsAg, Haemagglutination inhibition for influenza, AGD and counterimmunoelectrophoresis for detection of viral antigens or antiviral antibodies.

5. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

***Desirable to acquire***

1. Preparation of Monkey Kidney Cells (Primary) maintenance of continuous cell lines by subcultures. Preservation of cell cultures.
2. Recognition of CPE in tissue cultures.
3. Performance of haemadsorption, haemagglutination, immunofluorescence, neutralization tests for identification of viruses.
4. Chick embryo techniques - inoculation and harvesting.

**Suggested Reading**

**Books:**

**Reference books (Please refer the most recent edition)**

1. Topley and Wilson's Microbiology and Microbial infections. 8 volumes 2005, 10<sup>th</sup> edition.
2. Color Atlas and Textbook of Diagnostic Microbiology: Elmer W Koneman -2006, 6th edition.
3. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases - 2004, 6th edition.
4. Microbiology and Clinical Practice: Shanson-1999, 3rd edition.
5. Immunology: Janis Kuby- 2003.
6. Basic Clinical Immunology. Fudenburg, Stites, Caldwell, Weils.
7. Control of Hospital Infection- A practical handbook (most recent edition)-2000, 4th edition.
8. Bailey and Scott's Diagnostic Microbiology.
9. Textbook of Parasitology. Chatterjee K.D.
10. Microbiology in Clinical Practice. Shanson D.C.
11. Beaver's Parasitology Textbook.

**Further Reading**

1. Mycology - Rippons.
2. Essentials of Immunology- Roitt.
3. Virology- Clinical Virology by Rich.
4. Gradwohl's Clinical Laboratory Methods and Diagnosis.
5. Biochemical tests for the Identification of Medical Bacteria- MacFaddin JF.
6. Manual of Clinical Microbiology- ASM press.

**Journals**

1. Indian Journal of Medical Microbiology.
2. Clinical Microbiology Reviews.
3. Journal of Clinical Microbiology.
4. Journal of Medical Microbiology.
5. Journal of AIDS.
6. Journal of Hospital Infection.
7. Indian Journal of Tuberculosis and Lung Diseases..
8. Indian Journal of Medical Research.
9. JAAC.
10. Parasitology Today.
11. Journal of Infection.
12. Infection Control and Hospital Epidemiology.

13. Indian Journal of Tuberculosis.
14. Journal of Associations of Physicians of India.
15. Lancet-Infectious Diseases.
16. Emerging Infectious Diseases-online.
17. New England Journal of Medicine- online.
18. British Medical Journal.
19. Scandinavian Journal of Infectious Diseases.
20. ICMR Bulletin.
21. AIDS Research & Review.
22. MMWR
23. Tubercle.
24. WHO Bulletin.
25. Journal of American Medical Association.
26. Paediatric infectious diseases.
27. Indian Journal of Leprosy.
28. International Journal of Leprosy.
29. Immunology.
30. American journal of Epidemiology.

#### Important Websites

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

#### Scheme of Examination

Evaluation shall be done on the basis of Theory and Practical examination.

#### Passing

Minimum of 50% marks in theory in all papers taken together and 50% in practical shall be necessary for passing as detailed below: -

Evaluation Heads	Maximum Gradation Points	Minimum For Passing
1. Theory	400	200
2. Practical	200	100
3. Oral	100	50
4. Internal Assessment	100	50
5. Total	30	15
6. Total reduced to	10	5

#### Theory

Theory will consist of four papers with following distribution-

##### Paper I

General Microbiology and Immunology

**Paper II**

Systemic Bacteriology

**Paper III**

Mycology and Virology

**Paper IV**

Parasitology

Duration - Each paper will be of three hours duration.

**Format**

All papers will have the following format.

Section A -

Multiple choice question (MCQ's - 20)

Section B -

Modified short answer questions (Two - S1, S2)

Section C -

Long answer questions (Two - L1, L2)

Paper	Maximum Gradation Points					Total	Minimum for Passing in Each Paper	Minimum for Passing
	Section A MCQ's	Section B MSAQs		Section C C- LAQS				
		S1	S2	L1	L2			
Paper I	0-20	0-15	0-15	0-25	0-25	100	50	---
Paper II	0-20	0-15	0-15	0-25	0-25	100	50	---
Paper III	0-20	0-15	0-15	0-25	0-25	100	50	---
Paper IV	0-20	0-15	0-15	0-25	0-25	100	50	---
Total Marks						400	---	200
Internal Assessment						100	---	50

**Practical****Duration**

Practical examination shall be conducted on THREE consecutive days. The time shall be adjusted by the examiners to cover all exercises.

**Exercises**

The practical examination will consist of following exercises conjointly conducted and evaluated by the four examiners (Two internals and two externals).

**Exercises****A. Long Exercise:**

Exercise in Clinical Bacteriology: Problem Solving Exercise: where a brief history along with relevant clinical findings should be given. Student should be asked to list relevant investigations required & clinical specimen to be given. Isolation and identification of bacteria from the given clinical specimen and

antimicrobial sensitivity of the isolated organism to be performed.

#### B. Short Exercises

1. Exercises in Bacteriological/Mycobacteriological Techniques:  
Identification of bacteria (aerobe/anaerobe/Mycobacteria) in given pure culture.
2. Ziehl-Neelson Staining  
Preparation of smear; staining of prepared / given smear and reporting on findings. This exercise shall include acid - fast staining for tubercle bacilli or lepra bacilli or modified acid fast staining (for e.g. parasites/spores).
3. Exercises in Virology  
The following exercises to be performed -
  - A. Embryonated egg inoculation / harvesting
  - B. ELISA for HIV/ ELISA for detection of HBsAg, any rapid test for HIV antibodies or any other serological test for detection of viral antigen / antibody (eg. CIEP).
4. Identification of fungi in minimum two given cultures - one yeast and one mould.
5. Exercises in Parasitology  
Any one of the following exercises to be performed -
  - Examination of stool for ova/cyst by direct/ concentration method.
  - Preparation of peripheral smear and staining by Leishman stain. Reporting of parasites in the prepared/given smear.
6. Exercise in Immunology/Serology  
Any one of the Serology/Immunology techniques commonly used in diagnostic clinical microbiology to be performed. Serological test - (For e.g. Latex agglutination (ASO, CRP, RA etc.), tube agglutination (Widal, Brucella, Paul-Bunnell etc.), slide flocculation (VDRL), Passive haemagglutination (e.g. TPHA), RPHA (e.g. for HBsAg), Dot blot assay (e.g. HIV Rapid test).  
Note  
The test to be performed in this exercise should be different in serological / immunological principle from that performed in Exercise 3.
7. Animal experiment  
Details regarding care, handling and experimentation on animals shall be evaluated through simulations. Any common experimental procedure given to the student shall be subject to strict adherence to rules regarding handling, care and experimentation of animals.
8. Identification of microbiological findings in the given set of slides - parasitology, immunology, mycology, bacteriology or histopathology slides (10 slides). Parallel testing of given exercise shall be done at the examination centre for

checking the quality of chemicals, media, reagents and the test material.

#### Oral (Viva -Voce)

Student will be examined by all the examiners together regarding his knowledge of basic aspects and recent advances in the field of microbiology and its subspecialities.

Student will be assessed about his comprehension, analytical approach, expression, interpretation of data and his approach in solving the problem. Oral examination will also include presentation and discussion on dissertation.

#### Day- wise Distribution of Exercises

Day 1	Day 2	Day 3
Long Exercise	Long Exercise (Contd.)	Long Exercise (Contd.)
Short exercise	Short exercise (Contd.)	Identification of Slides
Special Staining	Exercise in Mycology	Oral (Viva - voce)
Exercise in Virology	Exercise in Parasitology	
Exercise in Parasitology.	Serology / Immunology techniques	

Day wise distribution of exercise may be changed as per the convenience of the examiners.

Marking Pattern for Practical and Oral Examination.

Exercise / Viva	Minimum Points
A) Long Exercise	80
B) Short Exercise	
Bacteriology technique	40
Special Staining	20
Exercise in Virology	30
Exercise in Mycology	40
Exercise in Parasitology	40
Serology/Immunology	30
Identification of slides	20

Animal experiment	20
Microteaching	20
C) Oral (Viva Voce)	60
<b>Total A+B+C</b>	<b>400</b>