

## **BRANCH –IV M.D. (MICROBIOLOGY)**

### **GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME FOR M.D. MICROBIOLOGY**

#### **Preamble :-**

The purpose of the programme is to standardize Microbiology teaching at Post Graduate level through out the country so that it will benefit in achieving uniformity in undergraduate teaching as well.

#### **Programme Objectives :-**

A candidate upon successfully qualifying in the M.D. (Microbiology) examinations should be able to:

- a) Be a competent Microbiologist.
- b) Conduct such clinical/ experimental research as would have significant bearing on human health and patient care.
- c) Interact with the allied departments by rendering services in advanced laboratory investigations.
- d) Acquire skills in conducting collaborative research in the field of Microbiology & allied sciences.
- e) Must be able to demonstrate to the students how the knowledge of Microbiology can be used in a variety of clinical settings to solve diagnostic and therapeutic problems.

#### **Specific Learning Objectives:-**

- a) Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.
- b) Plan, execute and evaluate teaching assignments in Medical Microbiology.
- c) Plan, execute, analyse and present the research work in Medical Microbiology.
- d) Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.
- e) Encourage interaction with the allied departments by rendering services in advanced laboratory investigations and relevant expert opinion.
- f) Encourage the student to participate in various workshops / seminars / journal clubs /demonstration in the allied departments, to acquire various skills for collaborative research.
- g) Uphold the prestige of the discipline amongst the fraternity of doctors.
- h) Undergo specialization in any of the above subspecialties.

#### **Post-Graduate Training :-**

Based on the available facilities, Department can prepare a list of post-graduate pertaining to basic and applied microbiology. Active learning should form the mainstay of post-graduate training. There should be lectures for post-graduates alongwith seminars, symposia, group-discussions, Journal clubs. They should render special investigative services in their respective area of specialization. Each college should have a Medical Education Unit to generate teaching resource material for U.G. and evolving of problem solving modules.

## RECOMMENDED LIST OF BOOKS

### **I. ESSENTIAL READING :-**

- 1) Robbins Pathologic basic of disease – 7<sup>th</sup> edn Elsevier
- 2) Diagnostic Surgical Pathology – Sternberg.
- 3) Ackerman's Surgical Pathology – Juan Rosai -9<sup>th</sup> edn Mosby
- 4) Diagnostic Histopathology of Tumours – Fletcher-2<sup>nd</sup> edn Churchill Livingston.
- 5) Soft Tissue Tumours –Enzinger & Weiss
- 6) Manual and Atlas of fine needle aspiration cytology –Orell 2<sup>nd</sup> edn 2005 elsevier.
- 7) Diagnostic exfoliative Cytology – Koss 5<sup>th</sup> edn 2006 Lippincott.
- 8) AFIP fascicles on various tumours.
- 9) WHO fascicles.
- 10) Wintrobe's Haematology, 2004
- 11) Practical Haematology, Dacie ELBS edn
- 12) Theory & Practice of Histological techniques -& staining – Bancroft & stevens.
- 13) Recent Advances in Pathology Churchill Livingston.
- 14) Handbook of autopsy practice Ludwig Humana press.

### **II EXTENDED READING :-**

- 1) Pathology of Liver – Macsween
- 2) Breast pathology by Rosen Lippincott 2011
- 3) Gastrointestinal pathology – Morson & Dawson Blackwell 2003
- 4) Practical pulmonary pathology Leslie & Wick Churchill Livingston 2005
- 5) Iochim's Lymph node pathology Iochim & Ratech Lippincott William Wilkins.
- 6) Blaustein's pathology of female genital tract Springer 2002
- 7) Atlas of orthopedic pathology –Wold, adleer,Sim, Unni 2003
- 8) Histopathology of Skin –Lever.
- 9) Pathology of Skin – Mckee, Calonje Elsevier Mosby 2005
- 10) Bone Marrow pathology –Bain Claud Lampert Wilkins 2001
- 11) Ophthalmic pathology –Spencer WB Saunders latest edn.
- 12) Biopsy interpretation series
- 13) Paediatric Pathology - Stocker & Dehner William & Wilkins 2001
- 14) Surgical pathology of nervous system and its coverings – Burger, Scheithaur, Vogel Churchill Livingston 2002.

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<b><u>Bacteriology :-</u></b>	<b><u>Marks</u></b>
1) Identification of a pure culture.	40
2) Isolation and identification of bacteria from clinical samples.	50
3) Bacteriological techniques :	10
a) Special Staining.	
b) PH Adjustment.	
c) Media Preparation.	
d) Anaerobic Culture.	
e) Antimicrobial Susceptibility Testing. M.I.C., M.B.C.	

**Immuno serology :** 20

Serological Tests:-

- 1) Conventional Serological Test.  
ELISA, VDRL, WIDAL, Agglutination Tests, IFA.
- 2) Rapid Tests.  
*(One conventional and one rapid test to be performed for the practical examination).*

**Virology:** 15

- 1) Haemagglutination, Haemagglutination inhibition.
- 2) ELISA – HIV / HBSAG.
- 3) Interpretation of Tissue Culture slides with CPE.

**Mycology:** 15

- 1) Identification of fungal cultures.

**Parasitology:** 20

- 1) Processing and identification of ova and cysts in stool samples.  
Saline / Iodine / Concentration technique.
- 2) Blood smear examination for malarial parasite, microfilaria & special Staining techniques for stool examination.

**Animal Experiments :-** 10

- 1) Bleeding techniques of animals.
- 2) Inoculation of infective material, by different routes in animals.

**Histopathology Slides:-** 20

- |                    |   |                                 |
|--------------------|---|---------------------------------|
| a) Stained Smear   | } | Applied to microbial infections |
| b) Tissue Sections |   |                                 |

Total	----- 200 -----
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Pedagogy and Oral (50 + 50)

100 Marks.

**Pedagogy**

The teaching skills of the candidate will be assessed. The candidate will be given a topic by the 4 examiners at the end of the first day of practical examination for a lecture presentation. The examiners shall evaluate the candidates ability.

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**DISSERTATION:**

(No Marks)

**APPROVED / NOT APPROVED**

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**\*\* MARKS QUALIFYING FOR A PASS**

**MAXIMUM  
MARKS**

**QUALIFYING  
FOR A PASS  
50% MARKS**

Theory Examination	400	200
Practical Examination	200	100
Oral / Viva & Pedagogy (50+50)	100	No Minimum
Aggregate	700	350

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\*\*33<sup>th</sup> SAB held on 20-06-2007 - March 2008 Examination onwards.

**List of Books:**

- 1) Medical Microbiology – Greenwood Vol.1 and 11.
- 2) Zinsser’s Microbiology.
- 3) Review of Medical Microbiology – Jawaetz et al.
- 4) Topley and Wilson’s textbook of Bacteriology, Virology and Immunology -6 volumes.
- 5) Essential Immunology –Ivan Roitt.
- 6) Basic and Clinical Immunology – Daniel P. stites et al.
- 7) Immunology by Joseph A.Bellanti.
- 8) Diagnostic Microbiology – By Finegold.
- 9) Cumitech series 1-25 (By American Society for Microbiologists).

### **Post-Graduate Examinations:-**

The Post-graduate examination should be in 3 parts:

- 1) These, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.
- 2) Theory: There shall be four theory papers – as given separately.
- 3) Practicals and Viva/Oral.

### **Course Content :-**

#### **General Microbiology -**

- 1) History of Microbiology.
- 2) Microscopy.
- 3) Biosafety including universal containment.
- 4) Physical and biological containment.
- 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) Molecular techniques in diagnosis of microbial infections.
- 20) Quality assurance & 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 & 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) Tumour immunity.
- 18) Vaccines and immunotherapy.
- 19) Measurement of immunological parameters.
- 20) Immunological techniques.
- 21) Immunopotiation & immunomodulation.
- 22) Immuno Haematology.

### **Systematic Bacteriology:**

- 1) Isolation & identification of bacteria.
- 2) Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, Anaerobic cocci, etc.
- 3) Gram positive cocci of medical importance including Neisseria, Branhamella, Moraxella, etc.
- 4) c Lactobacillus, Coryneform organisms, Bacillus & Aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other Actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing Anaerobic bacilli, etc.
- 5) Gram positive cocci of medical importance including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas & other non-fermenters, Pasturella, Francisella, Bacteriodes, 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.
- 13) Miscellaneous bacteria.

**Mycology :**

- 1) General characteristics & classification of fungi.
- 2) Morphology & 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*, *Pseudoallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes, etc.
- 7) Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium mameffeii*, etc.
- 8) Dermatophytes.
- 9) Fungi causing mycetoma, keratomycosis & oomycosis.
- 10) *Phythium insidiosum*.
- 11) *Prototheca*.
- 12) *Pneumocystis carinii* infection; *Pneumocystis jirovecii*.
- 13) *Rhinosporidium seeberi* & *Loboa loboii*.
- 14) Common laboratory contaminant fungi.
- 15) Mycetism & mycotoxicosis.
- 16) Antifungal agents & in vitro antifungal susceptibility tests.

**Virology:-**

- 1) General properties of viruses.
- 2) Classification of viruses.
- 3) Morphology : Viral structure, Bacteriophages.
- 4) Viral replication.
- 5) Isolation & identification of viruses.
- 6) Cultivation of viruses.
- 7) Epidemiology and Pathogenesis of viral infections.
- 8) Genetics of viruses.
- 9) DNA viruses of medical importance including Poxviridae, Herpesviridae, Adenoviridae, Hepadna virus, Papova and Parvo viruses, etc.
- 10) 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.
- 11) Slow viruses including prions.
- 12) Oncogenic & Teratogenic Viruses.
- 13) Hepatitis viruses.
- 14) Virioids.
- 15) Unclassified viruses.
- 16) Vaccines, anti-viral drugs & anti-viral agents.

## **Parasitology:-**

- 1) General characters & classification of parasites.
- 2) Laboratory diagnosis of parasitic infections.
- 3) Protozoan parasites of medical importance including Entamoeba, Free living amoebae, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Leishmania, Microsporidium, Cyclospora, Isospora, Babesia, Balantidium, etc.
- 4) Helminths of medical importance including those belonging to Cestodes (Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps, etc.), Trematodes (Schistosomae, Fasciola, Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis, etc.) and Nematodes (Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius, Filarial worms, Dracunculus, etc.).
- 5) Cultivation of parasites.
- 6) Entomology: common arthropods & other vectors viz, mosquito, sandfly, ticks, mite, Cyclops, louse, myiasis.
- 7) Antiparasitic agents.

## **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.
- 9) Information technology (Computers) in microbiology.
- 10) Automation in Microbiology.
- 11) Statistical analysis of microbiological data and research methodology.
- 12) Animal and human ethics involved in microbiological work.

## **Practical Training:-**

### **General Bacteriology, Systematic Bacteriology and Applied Microbiology:-**

- 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 quantification purposes.
- 4) Preparation of stains viz., Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN) Silver impregnation stain and special stains, 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 Jenson's 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 sinter and membrane filters.
- 9) Care and operation of microscopes.
- 10) Washing and sterilization 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.
- 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 Coagulase test.
- 19) 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.
- 20) Test 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.
- 32) Intradermal test like Mantoux

### **Practical Training in Immunology :-**

- 1) Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods.
- 2) Preparation of antigens and their standardization.
- 3) Preparation of antiserum in laboratory animals.
- 4) Performance of serological tests viz., Widal, Brucella agglutination, Weil Felix, cold agglutination, VDRL, Paul Bunneel, Rose Waaler, IFA.

- 5) ELISA.
- 6) Latex and staphylococcal co-agglutination test separation of lymphocyte.
- 7) Separation of Lymphocyte and T cell rosette.
- 8) Immunoelectrophoresis.

**Practical Training in Virology :-**

- 1) Preparation of glassware for tissue cultures (washing, sterilization).
- 2) Preparation of media like Hanks, MEM.
- 3) Preparation of clinical specimens for isolation of viruses.
- 4) Preparation of monkey kidney cells (Primary) and maintenance of continuous cell lines by subcultures, Preservation in  $-70^{\circ}\text{C}$  and liquid nitrogen.
- 5) Recognition of CPE producing viruses.
- 6) Performance of Haemadsorption for Parainfluenza Haemagglutination for influenzas, Immunofluorescence, neutralization for Enteroviruses and Respiratory viruses identification tests on tissue cultures and supernatants etc.
- 7) Serologica tests –Elisa for HIV, HBsAg, Haemagglutination inhibition and Haemadsorption for influenza virus.
- 8) Chick embryo techniques –Inoculation and harvesting.
- 9) Handling of Mice, rat, guinea pigs for collection of blood /pathogenicity tests etc.,

**Mycology- (Practical Training):-**

- 1) Collection of Specimen.
- 2) Direct Examination of Specimen.
- 3) Examination and Histopathology slides.
- 4) Isolation and identification of fungi & slide culture.
- 5) Special techniques.
- 6) Maintenance of stock cultures.
- 7) Animal Pathogenicity.

**Parasitology – (Practical Training):-**

- 1) Collection of Specimen.
  - 2) Examination of faeces for parasitic ova and cyst by direct and concentration method.
  - 3) Egg counting techniques for helminths.
  - 4) Examination of blood smears for protozoa.
  - 5) Histopathology sections –Examination and identification of parasites.
  - 6) Leishman and Giemsa staining.
  - 7) Identification of common arthropods and vectors.
  - 8) Preservation of parasites – mounting fixing & staining.
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## **Details of Training M.D. (MICROBIOLOGY)**

- 1) Collection of Clinical samples in the Central Laboratory : 1 month.
- 2) Sterilization of Laboratory material : 1 month.
- 3) Media preparation : 1 month.
- 4) Bacteriological techniques : 2 month.
- 5) Reporting culture : 4 month.
- 6) Serology : 2 month.
- 7) Preparation for Dissertation Protocol submission : 2 month.
- 8) Special Microscopy and Staining : 1 month.
- 9) Bacterial culture and antibiogram : 4 month.
- 10) Mycobacteriology : 1 month.
- 11) Anaerobic culture : 15 days.
- 12) Mycology : 1 month.
- 13) Parasitology : 1 month.
- 14) Dissertation Work : 3 month.
- 15) Virology : 2 month.
- 16) Immunology : 2 month.
- 17) Animal Experiment : 15 days.
- 18) Vaccine & Biological control : 1 month.
- 19) Molecular Biology & Biotechnology : 15 days.
- 20) Medical Statistics : 1 week.
- 21) Bacterial Genetics : 1 week.
- 22) Epidemiology : 1 week.

23) STD : 1 week

24) Pathology : 1 week.

- The P.Gs. will participate in Seminars, Symposiums, Journal Clubs and Tutorials and Clinical Meetings.
- They should organize and conduct Practicals for U.Gs. and paramedical students.
- The services from the Institutions having the facilities for the technique can be sought for the above training.

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### **PATTERN OF EXAMINATIONS**

FOUR PAPERS -100 Marks each                      3 Hours Duration

<b><u>Theory</u></b>	<b><u>Title</u></b>	<b><u>Duration</u></b>	<b><u>Marks</u></b>
Paper –I	General Microbiology and Immunology	3 Hours	100
Paper-II	Systematic Bacteriology	3 Hours	100
Paper-III	Virology & Parasitology	3 Hours	100
Paper-IV	Mycology, Applied Microbiology and Recent Advances.	3 Hours	100
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Total			400

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\* 30<sup>th</sup> SAB held on 20-12-2005 - March 2006 Exam. Onwards.

### **Distribution of Marks:**

2	Essays	(2 X 20)	=	40 Marks
10	Short Notes	(10 X 6)	=	60 Marks
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Total				100 Marks

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**Practical (3 days):**

<b><u>Practical</u></b>	<b><u>Time</u></b>
<b>Day 1</b> Practical 1 – Clinical Bacteriology	10.00 to 11.30 a.m.
2 – Bacteriological Techniques	11.30 to 1.00 p.m.
3 – Immuno Experiments	2.00 to 3.30 p.m.
4 – Animal Experiments	3.30 to 5.00 p.m.
<b>Day 2</b> Continuation of Clinical Bacteriology	11.00 to 11.30 a.m.
5 – Virology	11.30 to 1.00 p.m.
6 – Mycology	2.00 to 3.30 p.m.
7 – Parasitology	3.30 to 5.00 p.m.
<b>Day 3</b> Clinical Bacteriology (Final Report)	10.00 to 11.30 a.m.
Histopathology	11.30 to 12.30 p.m.

Oral

and Pedagogy

NOTE: No. of candidates to be examined 6. Per day for Practical /Viva

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**Post-graduate Examination :**

**Practicals –**

Should be spread over 3 days and include the following components.  
(Total Marks -200).

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\*\* 32<sup>th</sup> SAB held on 21-12-2006 - March 2008 Examination onwards.