



**YENEPOYA UNIVERSITY**

**Deralakatte, Mangalore - 575018**

**REGULATIONS AND CURRICULUM GOVERNING  
POSTGRADUATE PROGRAM (MD) IN  
MICROBIOLOGY**

**(CURRICULUM - EFFECTIVE FROM 2010-11)**

**ATTESTED**  


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Ref: No.YU/REG/ACA/4-ACM/2010

02.07.2010

**NOTIFICATION**

Sub: Curriculum for starting MD/MS in the departments of Anatomy,  
Biochemistry, Physiology, Pharmacology, Microbiology,  
and Forensic Medicine

Ref: Resolution of the Academic Council at its 4<sup>th</sup> Academic Council  
meeting held on 02.07.2010, supplementary agenda - 1

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The Academic Council at its 4<sup>th</sup> meeting and subsequently the Board of Management at its 11<sup>th</sup> meeting held on 02.07.2010 have resolved to approve the curriculum for starting the MD/MS in the departments of Anatomy, Biochemistry, Physiology, Pharmacology, Microbiology and Forensic Medicine.

This notification is issued for implementation with effect from the academic year 2010-2011.



**REGISTRAR**

To:

The Principal - YMC

Copy to:

1. Controller of Examinations
2. Academic Section

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## MD MICROBIOLOGY

### A. SYLLABUS

#### GOALS

The main goal of this course is to train students of medicine in the field of medical microbiology. Theoretical and practical training is given to students 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 trained in teaching methods which may enable them to take up teaching assignment in medical colleges/institutions.

#### OBJECTIVES

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

1. Establish good 'Laboratory medicine' in hospitals and community in the field of bacteriology, virology, parasitology, immunology and mycology.
2. Undertake teaching assignment of microbiology in a medical college.
3. Undergo specialization in any of the above subspecialties.
4. Carry out applied and fundamental research in various branches of medicine involving microbiological work.

#### COURSE CONTENT

##### General Microbiology:

1. Historical Introduction
2. Microscopy
3. Morphology and Physiology of Bacteria and other organisms
4. Nomenclature and classification of microbes
5. Growth and nutrition of bacteria
6. Bacterial metabolism
7. Sterilisation and Disinfection
8. Bacterial toxins
9. Bacterial antagonism: Bacteriocins
- 10 Bacterial Genetics
11. Gene cloning
12. Antibacterial substances used in the 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. Diagnostic tests based on molecular biology
16. Organization of clinical microbiology laboratory and quality control/quality assurance.

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17. Hospital waste management: Organization for health care waste management [biomedical waste], techniques for treatment and disposal of biomedical waste, regulation on biomedical waste management, 1998.

**Immunology:**

1. Normal immune system
2. Innate Immunity
3. Antigens
4. Antibodies – Immunoglobulins
5. Antigen – Antibody Reactions
6. Complement System
7. Cell mediated immunity
8. Hypersensitivity
9. Immunodeficiency Diseases
10. Autoimmunity
11. Immunotolerance
12. Immunology of Transplantation
13. Immunology of Malignancy
14. Prophylaxis and immunotherapy
15. Measurement of immunity
16. Immunogenetics
17. Cell of the immune system
18. Immune response

**Systematic Bacteriology:**

1. Isolation, description and identification of bacteria.
  2. Staphylococcus and Micrococcus: The aerobic gram positive cocci
  3. Streptococcus and Lactobacillus
  4. Pneumococcus
  5. Neisseria, Branhamella & Moraxella
  6. Corynebacterium and other coryniform organisms
  7. Bacillus: the aerobic spore bearing bacilli
  8. Clostridium: the anaerobic spore bearing bacilli
  9. Nonsporing anaerobes: bacteroidaceae
  - 10 . Enterobacteriaceae
  - 11 . Vibrios, Aeromonas, Plesiomonas
  12. Pseudomonas
  13. Yersinia, Pasteurella, Francisella
  14. Haemophilus
  15. Bordetella
  16. Brucella
  17. Mycobacteria
  18. Spirochetes
  19. Mycoplasmatales: Mycoplasma, Ureaplasma, Acholeplasma
  20. Actinomycetes, Nocardia and Actinobacillus
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21. Rickettsiaceae
  22. Chlamydiae
  23. Erysipelothrix and Listeria
  24. Chromobacterium, Flavobacterium, Acinetobacter
  25. Campylobacter and Helicobacter
  26. Miscellaneous Bacteria

**Virology:**

1. The nature of viruses
2. Classification of viruses
3. Morphology, virus structure
4. Viral replication
5. The genetics of viruses
6. Pathogenicity of viruses
7. Epidemiology of viral infections
8. Vaccines and Anti viral drugs
9. Bacteriophage
10. Poxviruses
11. Herpes viruses
12. Vesicular viruses
13. Togaviridae
14. Flaviviridae
15. Arena viridae
16. Marburg and Ebola viruses
17. Rubella
18. Orbi viruses
19. Influenza viruses
20. Respiratory diseases: Rhinoviruses, Adenoviruses and Corona viruses
21. Paramyxoviridae
22. Enteroviruses: Polio and other enteric viruses
23. Hepatitis viruses
24. Rabies virus
25. Slow viruses
26. Human immunodeficiency viruses
27. Oncogenic viruses
28. Viruses of gastroenteritis
29. Teratogenic viruses
30. Bunyaviridae

**Parasitology:**

1. Protozoan parasites of medical importance: Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Babesia, Balantidium coli etc.
  2. Helminthology: All those medically important helminths belonging to Cestodes, Trematode and Nematode.
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Cestodes: Diphylobothrium, Taenia, Echinococcus, Hymenolepis and Dipylidium, Multiceps, etc.

3. Trematodes: Schistosoma, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis, etc.

4. Nematodes: Trichuris, Trichinella, Strongyloides, Ancylostoma, Ascaris, Enterobius, Filarial worms, Dracunculus, etc.

Ectoparasites: Common arthropods and other vectors.

**Mycology:**

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

**Microbiology Applied to Tropical Medicine & Pathology**

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Infections of various organs and systems of human body
4. Molecular genetics as applicable to microbiology
5. Vaccinology: Principle, methods of preparation, administration of vaccines.
6. Bioterrorism
7. Emerging and Re-emerging microbial infections.

**MISCELLANEOUS:**

1. Normal Microbial flora of the Human Body
2. Bacteriology of Water, Milk and Air
3. Medical Mycology
4. Laboratory Control of Antimicrobial therapy
5. Immunoprophylaxis
6. Hospital Infections & Biomedical waste management.

**SKILLS:**

1. Preparation and pouring of media – Nutrient agar, Blood agar, MacConkey agar, Sugars, Triple sugar iron Agar [TSI] etc.
2. Operation and maintenance of autoclave, hot air oven, distillation plant, filters like Seitz and Membrane and sterility tests.
3. Washing and sterilisation of glassware.
4. Preparation of reagents – Oxidase, Kovac etc.
5. Disposal of contaminated material
6. Testing of disinfectants – Phenol coefficient and in use test
7. Quality control of media, reagents etc.
8. Aseptic practice in Lab and safety precautions
9. Care and maintenance of common laboratory equipments

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10. Preparation of antibiotic discs; performance of Kirby Bauer, Stokes etc. Estimation of Minimal inhibitory/Bactericidal concentrations by tube/plate dilution methods.
  11. Tests for a Beta lactamases
  12. Collection of specimens for Microbiological investigations.
  13. Techniques of anaerobiosis
  14. Identification of Bacteria of Medical Importance upto species level [except Anaerobes which could be upto generic level]
  15. Preparation of stains viz, Grams, Alberts, Capsules, spores, Zeihl Neelsen etc., and performing staining procedure, identification and interpretation.
  16. Care and operation of microscopes viz., light dark ground, phase contrast and fluorescent microscopes, electron microscopy.
  17. Care and breeding of lab animals viz., Mice, Rats, Guinea pigs, Rabbits and also experiments on various laboratory animals.
  18. Skin tests Mantoux, Lepromin, Casoni's etc.
  19. Conjugation experiments
  20. Serum antibiotic assay.
  21. Phase typing of bacteria
  22. Enterotoxigenicity
  23. Sero grouping of streptococci
  24. Antibiotic susceptibility test for Mycobacteria.

**Immunology:**

1. Collection and preservation of serum
2. Preparation of antigens
3. Preparation of adjuvants and rising of antisera in animals.
4. Performance of common serological tests
5. Immunodiffusion of CIEP
6. ELISA
7. Radial immune diffusion
8. Immuno electrophoresis
9. CD4, CD8 counts

**Mycology**

1. Collection and processing of clinical specimen for fungi.
2. Special techniques like woods lamp examination, hair baiting techniques, slide cultures.
3. Stock culture maintenance.
4. Animal pathogenicity test for Cryptococcus and Candida.

**Parasitology**

1. Examination of faeces for ova and cysts: Direct and Concentration methods.
  2. Egg counting techniques
  3. Examination of peripheral blood, urine, CSF and other fluids for parasites.
  4. Examination and identification of histopathology slides for parasitic infection.
  5. Serological tests for parasitic diseases
  6. Preservation of parasites.
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7. Examination of faeces for ova, cysts and larvae
  8. Permanent staining techniques for parasites
  9. In-vitro culture for parasites, viz., malarial parasites and Amoeba.
  10. Maintenance of Toxoplasma
  11. Fecal culture for diagnosis of Nematode larvae.

### **Virology**

1. Preparation and identification of CPE in various tissue cultures.
2. Serological tests for viral infections.
3. Chick embryo techniques
4. Handling of experimental animals and collection of various samples for evidence of viral infection in animals
5. Laboratory diagnosis of HIV infection and AIDS
6. Laboratory diagnosis of Hepatitis
7. Prevention and laboratory safety measures.



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## **B. METHODS OF TRAINING:**

Duration of degree course: 3 years [6 terms]

The training is given under the following headings:

1. Diagnostic Lab postings
2. Seminars
3. Culture seminars and serological tests
4. Animal experiments-Charts
5. Journal clubs
6. Teaching – undergraduate students
7. Preparation of Dissertation under the guidance of a recognized teacher.
8. Postings to other institutions
9. Guest lectures
10. Lecture classes/ Discussions

Each candidate is posted to different sections on rotation. They should get acquainted with the basic microbiology for first three months. The next three months they are expected to submit a synopsis on dissertation topic that has been chosen by them.

- Seminars shall be conducted once a week on the theory question topic.
- Culture seminar and discussions are held once a week which helps in systematic way of identification of all the routine bacteria for first few months followed by identification of rare culture.
- Clinical sample seminars are held once a month by processing the clinical samples in identification of the microbe causing that condition.
- Animal experiments, egg inoculation Charts are discussed.
- Journal clubs are conducted every week-choosing topics from recent journal.

- The candidates are encouraged to take part in clinical meeting and discussions. The MD Postgraduate students are trained to conduct practical demonstration classes for undergraduates in their 2<sup>nd</sup> year of study. They are expected to take theory lectures for undergraduates during their final year.

**a). Schedule of training:**

Each student shall undergo orientation in various sections in microbiology during the first 3 months so as to get familiarized with the basic knowledge in the subject. At the end of the next 3 months the student shall have to submit the synopsis of the dissertation.

I term :Orientation and culture Media preparation

II term: Culture seminars – pure culture of all bacteria

III term: Culture seminars on clinical samples like stool, pus etc., and serological Tests- Methodology.

IV term: Training in Mycology, Parasitology, UG teaching – theory for smaller Batches and practicals and demonstrations.

V term: Virology experiments.  
UG teaching – Theory and practical for smaller batches.  
Submission of dissertation.

VI term: Slide seminars, Mock examinations.

SI No	Section	Duration in months
1	Glass ware, Culture media, Staining, sterilization,	2
2	Bacteriology	12
3	Serology, Immunology	6
4	Mycology, Parasitology	4
5	Hospital infection control	1
6	Molecular Diagnostic Lab	4
7	Pathology	1
8	Biochemistry	1
9	Peripheral posting-Virology/Vaccines	1
	Total	32

**b). Posting in other departments**

Students will be posted for allied and applied departments during the period of III, IV and

V term. Total period not exceeding 3 months. The departments are:

1. Virology & Vaccinology etc.,- 1 month
2. Clinical Pathology - 1 month
3. Clinical Biochemistry - 1 month

The candidates are posted to different institutions for applied Microbiology like virology, Vaccinology etc.

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The students shall maintain a Log Book for the period of his/her posting to other departments institutions and get the certificate from the departmental Head at the end of posting.

**c). Monitoring learning progress**

- a. The progress of the student is monitored by conducting periodical Internal assessment tests.
- b. The student shall maintain a Log Book and assessment records are maintained

**d). Dissertation**

1. The topic selected for Dissertation shall be on the applied aspects of Microbiology
2. The synopsis should be submitted at the end of the first six months of course, as notified by the university.
3. The dissertation shall be submitted six months prior to final university examination on the date notified by the university to the Controller of Examination
4. Acceptance of dissertation is an essential precondition for appearing in the final examination.

**C. Scheme of examination**

Theory consists of four papers each of 100 marks	:	400 Marks
Practical conducted for 2 days	:	200 Marks
Viva voce	:	100 Marks

**i) Theory**

There shall be four questions papers, each of three hours duration. Each paper shall consist of two long easy questions each question carrying 20 marks and 6 short essay questions each carrying 10 marks. Total marks for each paper will be 100. Questions on recent advances may be asked in any or all the papers.

**Details of distribution of topics for each paper will be as follows:**

**Paper I:** General Microbiology and Immunology

**Paper II:** Systematic Bacteriology

**Paper III:** Virology Parasitology and Mycology

**Paper IV:** Applied Microbiology and Recent advances

The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.

**ii) Practical and Oral/viva voce Examination**

Duration of examination: 2 days : Marks: 200

The examination will consists of the following exercises conjointly conducted and evaluated by four examiners [2 internals and 2 externals]

**Bacteriology:**

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

**Serology:**

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

**Virology:**

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

### **Mycology**

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

### **Parasitology**

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

### **Oral/Viva-Voce Examination:**

- iii) **Viva voce** : Marks: 100

The viva voce examination consists of questions on Bacteriology, Mycology, Virology, Immunology, and Parasitology topics; it will also include recent advances, history and scope of Microbiology.

1. Viva Voce examination [80 marks]

Students will be examined by all the examiners together about comprehension, analytical approach, expression and interpretation of data. Student shall also be given case report, charts for interpretation. It includes discussion on dissertation.

2. Pedagogy Exercise: [20 marks]

A topic is given to each candidate along with the practical examination question paper on the first day. Student is asked to make a presentation/a lecture class on the topic on the second day for 15 minutes.

Maximum Marks for	Theory	Practical	Viva voce	Total
M.D. Microbiology	400	200	100	700

### **Recommended Books:**

1. Medical Microbiology 4<sup>th</sup> Ed. By Patric R Murray
  2. Widman's Clinical interpretation of laboratory test 10<sup>th</sup> Ed. Ronald A Sacher
  3. Manual of Clinical Microbiology 9<sup>th</sup> Ed. Volume-I & II by Murray & Barren
  4. Samuel Baron, **Medical Microbiology**, 3<sup>rd</sup> edn., Churchill Livingstone Inc.
  5. Edmin H Lennette, **Laboratory diagnosis of viral infections**, 2<sup>nd</sup> edn, Newyork, Marcel Dekker, Inc.
  6. Gordon Cook, **Manson's Tropical Diseases**, 20<sup>th</sup> edn. London, ELBS.
  7. John G Holt et al, **Bergey's Manual of Determinative bacteriology**, 9<sup>th</sup> edn. Maryland, Williams & Wilkins
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8. Albert Balows, **Manual of Clinical Microbiology**, 5<sup>th</sup> edn, Washington D.C. American Society for Microbiology
  9. Ellen Jo Baron et al; **Bailey & Scott's Diagnostic Microbiology**, 9<sup>th</sup> edn, Missouri, Mosby
  10. Douglas D Richman, **Clinical Virology**, Newyork, Churchill Livingstone.
  11. Bob A Freeman, **Burrows Textbook of Microbiology**, 21<sup>st</sup> edn, W.B. Saunders
  12. Brian I Duerden & B S Drasar, **Anaerobes in Human Disease**, Great Britain, Edward Arnold
  13. Elmer W Koneman et al, **Introduction to Diagnostic Microbiology**, Philadelphia, J B Lippincott Company
  14. Bernard N Fields et al, **Field Virology**, Vol.11 3<sup>rd</sup> edn, Philiadelphia, Lippincott-Ramen
  15. Bernard Fields et al. **Field Virology**, Vol.2, 3<sup>rd</sup> edn, Philiadelphia, Lippincott-Ramen
  16. Danial Greenwood et al **Medical Microbiology**, a Guide to Microbial inections, pathogenesis, Immunity, Laboratory Diagnosis and control, 15<sup>th</sup> edn, London, Churchill Livingstone.
  17. J.G College et al, Mackie & McCartney **Practical Medical Microbiology** 14<sup>th</sup> edn, London, Churchill Livingstone.
  18. John V Bennett and Philip S Brachman, **Hospital infections**, 3<sup>rd</sup> edn. Little Brown.
  19. Noel R Rose et al, **Manual of clinical laboratory immunology**, 4<sup>th</sup> edn, Washington, D.C, American society for Microbiology.
  20. William E. Paul; **Fundamental Immunology**, 3<sup>rd</sup> end, Newyork, Raven Press
  21. Ivan Roitt, **Essential Immunology**
  22. Stites, **Clinical Basic Immunology**
  23. Parasitology: Paul Chester Beaver, Rodney Clifton jung, Eddie Wayne cipp.  
**Clinical Parasitology**: Philadelphia Lea and Febiger.
  24. **Field Virology**, Vol.11 3<sup>rd</sup> edn, Philiadelphia, Lippincott-Ramen

**Journals:**

1. Journal of Medical Microbiology, Lippincott-Raven publishers, Pathological Society of Great Britain & Ireland,
  2. Clinical infectious diseases, Pub: The university of Chicago press, Chicago, Illinois 60637
  3. Clinical Microbiology Reviews. Pub: The American Society for Microbiology
  4. Microbiology and Molecular Biology Review [mmbr] Pub: American Society for Microbiology
  5. Journal of Clinical Microbiology [JCM]; Pub: American Society for Microbiology
  6. The Journal of infectious Diseases, Pub: The University of Chicago Press
  7. Journal of Communicable diseases, Pub: The Indian Society for Malaria and other communicable disease
  8. Infectious disease clinics of North America, Pub: W B Saunde company, A Division of Harcourt Brace & Company
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9. Indian Journal of Medical Microbiology, Pub: Indian Associates of Medical Microbiologists
  10. The Indian Journal of Medical Research, Pub: Indian council of Medical research, New Delhi
  11. Annual Review of Microbiology, Pub: Annual Reviews, Inc. Palo Alto. California, USA.

### **Additional reading**

1. Compendium of recommendations of various committees on Health and development, DGHS, Central Bureau of Health Intelligence, Directorate General of Health services, min. of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi, P-335.
2. National Health policy, Min. of Health and family welfare, Nirman Bhawan, New Delhi
3. Santhosh Kumar, The elements of research, writing and editing, dept. of Urology, JIPMER, Pondicherry
4. Srinivasa D K et al, Medical education principles and practice, National teacher training centre, JIPMER, Pondicherry
5. Indian council of medical research, 'Policy statement of Ethical considerations involved in research of human subjects', ICMR, New Delhi.
6. Code of Medical Ethics framed under section 33 of the Indian Medical council Act. Medical Council of India, Kotla Road, New Delhi.
7. Francis CM, Medical ethics, J P Publicaitns, Bangalore, II Ed.
8. Indian National science academy, guidelines for care and use of animals in scientific research, New Delhi.
9. International Committee of Medical journal editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991:424-8
10. Kirkwood B R, Essential of Medical Statistics, 1<sup>st</sup> ed. Oxford: Blackwell scientific publications
11. Mahajan B K, Methods in Bio statistics for medical students, 5<sup>th</sup> ed. New Delhi, Jaypee Brothers Medical publishers

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