



SRM
UNIVERSITY
(Under section 3 of UGC Act 1956)



MD Microbiology

Curriculum and Syllabus 2015

Branch Code: 16

SRM Medical College Hospital & Research Centre

SRM University

SRM Nagar, Kattankulathur

Kancheepuram (Dt). 603 203

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MD MICROBIOLOGY

1.A.GOAL:

The main aim of this course is to train students of Medicine in the field of Medical Microbiology. Theoretical as well as practical training is imparted to the students in various branches of Microbiology namely 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 in the subject which would enable them to take up teaching assignments in Medical Colleges/Institutes

B.PROGRAMME OBJECTIVES

To impart training to post graduates:

1. To acquire knowledge and skills in various branches of Microbiology, so as to enable them to become a competent Medical Microbiologist.
2. To apply their training in patient care for early diagnosis of the disease
3. To utilize knowledge acquired for preparation of guidelines regarding infection control and implementation of infection control methods of antibiotic policy
4. To plan and carry out fundamental and specialized research.
5. To operate routine and sophisticated instruments in the laboratory
6. To develop presentation skills for delivering scientific papers

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

1. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.

2. Plan, execute and evaluate teaching assignments in medical microbiology and
3. Plan, execute, analyze and present the research work in medical microbiology.

2.COURSE OVERVIEW:

Cognitive domain:

- A. To have knowledge about the clinical features, etiology, pathogenesis and laboratory diagnosis of communicable diseases caused by micro-organisms and apply that knowledge in the treatment, prevention and control of such diseases.
- B. To know the principles of immune mechanism which help to understand the pathogenesis and laboratory diagnosis of infectious and non-infectious diseases.
- C. To become a competent Microbiologist and to establish diagnostic Microbiology laboratory in hospitals and community for patient care
- D. To have sound knowledge of skills in microbiological laboratory methods
- E. To acquire teaching ability and to handle classes for undergraduates
- F. To prepare the student for fundamental and applied research

Psychomotor domain:

- A. To give guidelines for proper collection, transport and processing of clinical specimen
- B. To have a sound knowledge of techniques of sterilization, preparation of media, disposal of biomedical waste and implementation of infection control measures
- C. To learn serological and immunological techniques for diagnosis of infectious diseases

Affective domain:

- A. To acquire competency in teaching and diagnostic work
- B. To develop team spirit in organizing academic activities
- C. To follow ethics in routine and research activities

Duration of the Course

The period of certified study and training for the Post-Graduate MD MICROBIOLOGY shall be Three Academic years.(six academic terms). The academic terms shall mean six months training period.

Commencement of Academic Session

The academic session for the Post-Graduate shall commence from May/June of the Academic Year.

Date of Examination

The students admitted up to May / June of the academic year shall be registered for that academic year and shall take up their Final Third Year regular examination in April/October of the academic year after completion of 3 years/36 months.

Number of examinations

The University shall conduct not more than two examinations in a year, for any subject, with an interval of not less than 4 and not more than 6 months between the two examinations.

Attendance

All students joining the postgraduate training programme shall work as full time residents during the period of training, attending not less than 80% (eighty percent) of the training during each calendar year, and will be given full time responsibility, assignments and participation in all facets of the educational process.

The period of training for obtaining the degrees shall be three completed years including the period of examination.

3.COURSE CONTENTS (SYLLABUS)

BROAD AREAS OF STUDY

- 1. General microbiology**
- 2. Immunology**
- 3. Systematic bacteriology**
- 4. Mycology**
- 5. Virology**
- 6. Parasitology**
- 7. Applied microbiology**

COGNITIVE SKILL

GENERAL MICROBIOLOGY

1. History of microbiology
2. Microscopy
3. Physical and biological containment
4. Sterilization and disinfection
5. Morphology of bacteria and other microorganisms
6. Nomenclature and classification of microorganisms
7. Normal flora of human body
8. Growth & nutrition of bacteria
9. Bacterial metabolism
10. Bacterial toxins
11. Bacteriocins
12. Host-parasite relationship
13. Antibacterial substances and drug resistance
14. Bacterial genetics
15. Molecular genetics relevant for medical microbiology

IMMUNOLOGY

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

16. Transplantation immunology
17. Tumor immunity
18. Vaccines and immunotherapy
19. Measurement of immunological parameters
20. Immunological techniques
21. Immunopotential & immunomodulation

SYSTEMATIC BACTERIOLOGY

1. Isolation & identification of bacteria
2. Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
3. Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella etc.
4. Gram positive bacilli of medical importance including Lactobacillus, Corynebacteria, Bacillus, Actinomyces, Nocardia, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.
5. Gram negative bacilli of medical importance including Enterobacteriaceae, Proteus, Vibrio, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas & other non-fermenters, Pasturella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
6. Helicobacter, Campylobacter & Spirillum
7. Mycobacteria
8. Spirochaetes
9. Chlamydiae
10. Mycoplasmales: Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.
11. Rickettsiae, Coxiella, Bartonella etc.

VIROLOGY

1. General properties of viruses
2. Classification of viruses
3. Morphology: Virus structure & bacteriophages
4. Virus replication

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

PARASITOLOGY

1. General characters & classification of parasites
2. Host- parasite relationship
3. Pathogenesis of parasitic infections
4. Methods of identification of parasites
5. Protozoan parasites of medical importance including Entamoeba, Free living amoebae, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium Microsporidium, Cyclospora. Isospora, Babesia, Balantidium etc.
6. Helminthology of medical importance including those belonging to Cestoda (Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipylidium, Multiceps etc.), Trematoda (Schistosomes, Fasciola. Fasciolopsis, Paragonimus, Clonorchis, Opisthorchis etc.) and Nematoda (Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius. Filarial worms, Dracunculus etc.)
7. *Entomology*: common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
8. Antiparasitic agents.

MYCOLOGY

1. General characteristics & classification of fungi
2. Morphology & reproduction of fungi
3. Pathogenesis of fungal infections
4. Isolation & identification of fungi
5. Yeasts and yeast like fungi of medical importance including *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Saccharomyces* etc.
6. Mycelial fungi of medical importance including *Aspergillus*, *Zygomycetes*, *Pseudoallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
7. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffeii* etc.
8. Dermatophytes
9. Fungi causing mycetoma, keratomycosis & otomycosis.
10. Pneumocystis jirovecii infection
11. *Rhinosporidium seeberi* & *Loeblomyces loeblii*
12. Actinomycetes & *Nocardia*.
13. Common laboratory fungal contaminants
14. Mycetism & mycotoxicosis
15. Antifungal agents & in vitro antifungal susceptibility tests.
16. Hypersensitivity to fungi

APPLIED MICROBIOLOGY

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Management of hospital waste
4. Investigation of an infectious outbreak
5. Bio-safety including universal precautions
6. Microbiology of hospital environment
7. Microbiology of air, milk and water
8. Quality assurance & quality control in microbiology
9. Accreditation of laboratories
10. 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.

11. Opportunistic infections.
12. Sexually transmitted diseases
13. Vaccinology: principle, methods of preparation, administration of vaccines
14. Computers in microbiology
15. Gene cloning
16. Molecular techniques as applicable to microbiology
17. Automation in Microbiology
18. Statistical analysis of microbiological data and research methodology
19. Animal & human ethics involved in microbiological work

PSYCHOMOTOR SKILLS

BACTERIOLOGY - MUST ACQUIRE

1. Collection/transport of specimens for microbiological investigations
2. Preparation, examination & interpretation of direct smears from clinical specimens
3. Plating of clinical specimens on media for isolation, purification, identification and quantitation purposes.
4. Preparation of stains viz. Gram, Albert's, Ziehl Neelsen (ZN) Silver impregnation stain and special stains for capsule and spore etc.
5. Preparation and pouring of media like Nutrient agar, Blood Agar, Mac-conkey agar, Sugars, Serum sugars, Kligler iron agar, Robertson's cooked meat broth, Lowenstein Jensens medium, Sabouraud's dextrose agar etc.
6. Preparation of reagents -oxidase, Kovac etc.
7. Quality control of media, reagents etc.
8. Operation of autoclave, hot air oven, distillation plant, filters like Sietz and membrane filters
9. Care and operation of microscopes
10. Washing and sterilisation of glassware (plugging and packing)
11. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
12. Aseptic practices in laboratory and safety precautions
13. Sterility tests

14. Identification of bacteria of medical importance up to species level (except anaerobes which could be up to generic level).
15. Techniques of anaerobiosis
16. Tests for Motility: hanging drop, Cragie's tube, dark ground microscopy for spirochaetes
17. In-vitro toxigenicity tests- Elek test, Naegler's reaction
18. Special tests- Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for Mycobacterium, satellitism, CAMP test, catalase, slide & tube agglutination tests.
19. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing, eg. Kirby- Bauer, Stoke's method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/ plate dilution methods
20. Tests for Beta-lactamase production
21. Inoculation of infective material by different routes in animals
22. Bleeding techniques of animals including sheep
23. Performance of autopsy on animals & disposal of animals
24. Care and breeding of laboratory animals viz. mice, rats, guinea pigs, rabbits etc.
25. Testing of disinfectants -Phenol coefficient and "in use" tests
26. Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria
27. Disposal of contaminated materials like cultures
28. Disposal of infectious waste
29. Bacteriological tests for water, air and milk
30. Maintenance & preservation of bacterial cultures

BACTERIOLOGY - DESIRABLE TO ACQUIRE

1. Conjugation experiments for drug resistance
2. Serum antibiotic assays e.g. gentamicin
3. Phage typing for Staphylococci, S.typhi, etc.
4. Bacteriocin typing viz. Proteocin, etc.
5. Enterotoxigenicity tests like rabbit ileal loop, intragastric inoculation of infant mouse, Sereny's test.
6. Animal pathogenicity/toxigenicity test for C.diphtheriae, Cl.tetani, St.pneumoniae, S.typhimurium, K.pneumoniae etc.

6. Serologic grouping of Streptococci
7. Mouse foot pad test for *M leprae*
8. Antimicrobial susceptibility tests for Mycobacteria
9. Molecular typing methods
10. Special staining techniques for Mycoplasma, Treponemes, Gardenerella.

IMMUNOLOGY - MUST ACQUIRE

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
2. Preparation of antigens from bacteria or tissues for Widal, Weil Felix, VDRL, O Streptolysin and group polysaccharide of Streptococcus etc. and their standardisation. (Only theory pass)
3. Performance of serological tests viz. Widal, Brucella tube agglutination, indirect hemagglutination, VDRL, ASO, Rose Waaler test, IFA.
4. Immunodiffusion in gel (Ouchterlony), counter-immunoelectrophoresis.
5. Enzyme linked immunosorbent assay
6. Latex agglutination tests
7. Preparation & preservation of complement & complement titration
8. Immunofluorescence

IMMUNOLOGY - DESIRABLE TO ACQUIRE

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

MYCOLOGY - MUST ACQUIRE

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

MYCOLOGY-DESIRABLE TO ACQUIRE

1. Antigen preparation -viz. from Candida, Aspergillus, Histoplasma, Sporothrix
2. Antibody detection for candidiasis, aspergillosis, histoplasmosis, blastomycosis,
Cryptococcosis, zygomycosis, coccidioidomycosis
3. Antigen detection in cryptococcosis, aspergillosis, candidiasis
4. Skin test using aspergillin, candidin, histoplasmin, sporotrichin
5. Isolation and identification of actinomycetes.
6. Calcofluor staining & examination under fluorescent microscope
7. Animal pathogenicity tests viz. intravenous, intracerebral and intra peritoneal inoculation of mice for fungal pathogenicity study

PARASITOLOGY - MUST ACQUIRE

1. Collection and transport of specimens for diagnosis of parasitic diseases
2. Examination of faeces for parasite ova and cysts etc. by direct and concentration methods (salt floatation and formol-ether methods)
3. Egg counting techniques for helminths micrometry and mounting of slides
4. Examination of blood for protozoa and helminths by wet mount, thick and thin stained smears
5. Examination of blood for microfilariae including concentration techniques
6. Examination of other specimens eg. Urine, CSF, Bone marrow etc. for parasites
7. Histopathology sections -examination and identification of parasites
8. Preparation & performance of stains -Leishman, Giemsa, Lugol's iodine

9. Identification of medically important adult worms
10. Preparation of media -NIH, NNN etc.
11. Copro-culture for larvae of hook worms
12. Identification of common arthropods and other vectors viz. mosquito, sandfly, ticks, mites, cyclops
13. Preservation of parasites-mounting, fixing, staining etc.

PARASITOLOGY - DESIRABLE TO ACQUIRE

1. Maintenance of parasites in laboratory by in-vitro cultures
2. Permanent staining techniques like iron hematoxylin
3. QBC for malaria & filaria .
4. In-vitro culture of parasites like Entamoeba, Leishmania, P.falciparum, Acanthamoeba etc.
5. Antigen preparation -viz. Entamoeba, filaria, Toxoplasma, hydatid for serological tests for IRA, ELISA and skin tests like Casoni

VIROLOGY - MUST ACQUIRE

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

VIROLOGY - DESIRABLE TO ACQUIRE

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

6. Preservation in -70°C and liquid nitrogen
7. Performance of haemadsorption for Parainfluenza, Haemagglutination of Influenza, Immunofluorescence, Neutralisation for Enteroviruses and Respiratory viruses. Identification tests on tissue cultures and supernatants etc.

APPLIED MICROBIOLOGY

1. Planning and execution of investigations during an epidemic
2. Segregation and disposal of biological and hospital wastes
3. Handling automated systems
4. Performance of molecular techniques
5. Computer applications

TRAINING SCHEDULE

DURATION 3 YEARS

The Training is Given Under The Following Headings:

1. Seminars
2. Culture seminars
3. Animal experiments
4. Journal clubs
5. Symposia
6. Teaching Under graduate students
7. Slide seminars
8. Integrated teaching
9. Preparation for thesis under the guidance of a recognized teacher
10. Posting to other institutions
11. Invited Guest lectures

Students to be posted to different sections on rotation and are allowed to get acquainted with basic microbiology techniques for first three months

1. Seminars to be conducted fortnightly on theory topics
2. Culture seminars and discussions fortnightly in order to get trained in systematic way of identification of all the routine bacteria for the first few months followed by identification of rare cultures
3. To be posted to/ visit institutes (King's Institute, Pasteur Institute) involved in vaccine production and other special techniques like tissue culture for viruses
4. Posting to animal house to get trained in animal experiments

5. Journal clubs to be conducted every week , choosing the topics from recent journals
6. Symposia to be conducted every 6 months
7. Trained to teach and conduct practical demonstration classes for under graduates
8. To be encouraged to present short title papers in conferences, make improvements and submit them for publication in peer reviewed journals.

INTEGRATED TEACHING

For all PG Students from allied departments.

To be conducted in form of Seminar/Group Discussion.

Suggested Topics For Integrated Teaching:

1. Tuberculosis
2. Leprosy
3. Sexually Transmitted Diseases
4. Malaria
5. HIV / AIDS
6. Hepatitis
7. Arbovirus Diseases
8. Opportunistic Infections

TIME SCHEDULE

0-3 months: Orientation in various sections of Microbiology lab and department to get familiarized with basic knowledge in the subject; to observe collection of specimen, processing and reporting of bacterial isolates and serological investigations

4-6 months: To submit the synopsis of the thesis. Demonstration and conduction of practical classes, for small group of under graduates.

7-12 months: Group discussions of selected topics for under graduates
Demonstration and conduction of practical classes for under graduates
Culture seminar: processing and identification of pure culture (once in a month)

13-18 months: Culture seminars on clinical samples like stool, sputum pus etc,
(Involving mixed cultures) serological tests- methodology
Demonstration and conduction of practical classes for under
graduates Theory classes for under graduates
Seminar and journal club (alternatively once in 15 days)

19-24 months: Training in mycology; Special training in vaccine preparation,
Qualit control, virology and molecular techniques Demonstration and conduction
of practical classes for under graduates Theory classes for under graduates;
Seminar and journal club (alternatively once in 15 days)

25-30 months: Active participation in Journal club (once in a month) Culture
seminars (Once in a month) Project seminar presentation of respective projects).
submission of completed projects; Theory classes for under graduates;

31-33 months: Assessment tests in theory and symposia

34-36 months: Model practical and model theory examinations

4. MONITORING THE PROGRESS OF POST GRADUATES

1. MAINTENANCE OF LOG BOOK

Each post graduate student shall maintain a record of skills acquired during the
three years of training period

The head of the department should scrutinize the log book once in three months

At the end of the course the student should summarise the contents and get the
log book certified by the head of the department

The log book to be submitted at the time of practical examination for the scrutiny
of board of examiners

It is preferable that a post graduate student during the course to present
one poster presentation and /or to read one paper at a national /state conference
and /or to present one research paper which can be published/accepted for

publication/sent for publication during the period of his/her postgraduate studies.

2. Periodical assessment through assignments, performance in symposia, culture seminars and journal clubs

OTHER ACTIVITIES FOR FULFILLMENT OF THE COURSE

THESIS

Aim:

To Orient the students to various methodologies of research, induce them to get acquainted with them and facilitate fruitful research, which will add to existing body of knowledge in the fields of Microbiology.

Objectives:

- Identify relevant research, questions
- Conduct critical review of literature
- Formulate a hypothesis
- Determine most suitable study design
- State the objectives of the study
- Prepare a study protocol
- Get approval from the Ethical Committee
- Conduct the study, compile the data
- Analyse & interpret the data
- Draw conclusions, declare results
- Write a research paper

Guidelines:

Ethical issues and consideration must be given priority & all the concerned inclusive of entire department must be committed.

5.THESIS

Every student registered as post graduate shall carry out work on an assigned research project under the guidance of a recognized post graduate teacher, the result of which shall be written up and submitted in the form of a thesis.

Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. Thesis shall be submitted at least six months before the theoretical and clinical / practical examination.

The thesis shall be a bound volume of a minimum of 50 pages and not exceeding 75 pages of typed matter (Double line spacing and on one side only) excluding certification, acknowledgements, annexure and bibliography.

Thesis should consist of

- (a) Introduction
- (b) Review of literature
- (c) Aims and objectives
- (d) Material and methods
- (e) Result
- (f) Discussion
- (g) Summary and conclusion
- (h) Tables
- (i) Annexure
- (j) Bibliography

Four copies of thesis shall be submitted six months prior to the commencement of the theory examinations on the date prescribed by the Controller of Examinations of this University. The thesis should be approved by the Professor of that branch and the same has to be forwarded to the Controller of Examinations, by the head of the department through the Dean of the college.

Two copies in addition are to be submitted as an electronic version of the entire thesis in a standard C.D. format by mentioning the details and technicalities used in the C.D. format.

The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and clinical; and on the acceptance of the thesis by two examiners, the student shall be allowed to appear for the final examination.

EVALUATION OF THESIS :

ACCEPTED / NOT ACCEPTED

No marks will be given

6.SCHEME OF EXAMINATION

Final university examination shall be at the end of three years

THEORY:

	Duration	Marks
PAPER-I General Microbiology, Immunology, Molecular Methods	3 Hours	100
PAPER-II Systematic Bacteriology	3 Hours	100
PAPER-III Virology and Parasitology	3 Hours	100
PAPER-IV Applied Microbiology, Mycology & Recent Advances	3 Hours	100

Pattern of question paper: (same for all 4 papers)

Duration 3 hours	Total marks 100	
Essay Questions: 2 numbers	marks 20 x 2	40 marks
Short answers : 10 numbers	marks 10x6	60 marks

PRACTICAL:

Duration: 3 days

Practical schedule

Day 1:	F.N	A.N
	Pure culture	Fungal culture
	Mixed culture	Immunology exercise

Day 2:	Reporting of pure culture	Discussion of fungal culture
	Continuation of mixed culture	Slide discussion
	Discussion of immunology exercise	Parasitology exercise
		Animal experiments
Day 3:	Reporting mixed culture	Viva voce
	Pedagogy	Discussion on thesis

PRACTICAL EXERCISES:	Marks
Identification of pure culture	25
Processing of clinical sample and identification of mixed cultures	40
Identification of fungi and slide culture	20
Animal experiments	15
Virology techniques (egg inoculation / serology)	20
Parasitology (stool examination, Examination of Peripheral blood smear)	20
Immunology -serology	20
Slide discussion	20
Bacteriological techniques (special staining, media preparation, Microscopy, quality control etc.)	20
Total	200

Practicals	200
Viva Voce	60
Pedagogy	40

Total	300

MARKS QUALIFYING FOR A PASS

MARKS QUALIFYING FOR A PASS	MAXIMUM MARKS	QUALIFYING FOR A PASS 50% MARKS
Theory Examination	400	200
Practical Including clinical and Viva voce examination	300	150

A student shall secure not less than 50% marks in each head of passing which shall include 1. Theory, 2. Practical including clinical and viva voce examination.

* “The postgraduate medical students are required to pass theory and practical examinations separately. An examinee should obtain minimum 40% marks in each theory paper and not less than 50% marks cumulatively in all the four papers for Degree examination to be cleared as “Passed” at the said Degree examination”

**As per Medical Council of India notification date 03.09.2014 and the same approved in the 28th Academic council meet of SRM University held on 23/03/2015.*

7.EXAMINATION AND EVALUATION

(1) EXAMINERS

(a) All the Post Graduate Examiners shall be recognised Post Graduate Teachers holding recognised Post Graduate qualifications in the subject concerned.

(b) For all Post Graduate Examinations, the minimum number of Examiners shall be four, out of which at least two (50%) shall be External Examiners, who shall be invited from other recognised universities from outside the State and other two will be internal examiners for M.D.

(c) Under exceptional circumstances, examinations may be held with 3 (three) examiners provided two of them are external and Medical Council of

India is intimated the justification of such action prior to publication of result for approval. Under no circumstances, result shall be published in such cases without the approval of Medical Council of India.

(d) The guidelines regarding appointment of examiners are as follows;-

1. No person shall be appointed as an examiner in any subject unless he/she fulfils the minimum requirements for recognition as a Post Graduate teacher as laid down by the Medical Council of India and has teaching experience of 8 (Eight) years as a Lecturer / Assistant Professor out of which he has not less than 5 (Five) years teaching experience after obtaining Post Graduate degree. For external examiners, he should have minimum three years experience of examinership for Post Graduate diploma in the concerned subject. Out of internal examiners, one examiner shall be a Professor and Head of Department or Professor.
2. There shall be at least four examiners in each subject at an examination out of which at least 50% (Fifty percent) shall be external examiners. The external examiner who fulfils the condition laid down in clause - 1 above shall ordinarily be invited from another recognised university, from outside the State: provided that in exceptional circumstances examinations may be held with 3 (three) examiners if two of them are external and Medical council of India is intimated with the justification of such examination and the result shall be published in such a case with the approval of Medical council of India.
3. An external examiner may be ordinarily been appointed for not more than three years consecutively. Thereafter he may be reappointed after an interval of two years.
4. The internal examiner in a subject shall not accept external examinership for a college from which external examiner is appointed in his subject.
5. The same set of examiners shall ordinarily be responsible for the written, practical or part of examination.
6. There shall be a Chairman of the Board of paper - setters who shall be an external examiner and shall moderate the question papers.

7. The Head of the Department of the institution concerned shall ordinarily be one of the internal examiners and second internal examiner shall rotate after every two year.

(2) Number of candidates

The maximum number of candidates to be examined in Clinical / practical and Oral on any day shall not exceed six for M.D. degree examination.

3) Number of examinations

The university shall conduct not more than two examinations in a year, for any subject, with an interval of not less than 4 and not more than 6 months between the two examinations.

(4) Doctor of Medicine (M.D.) Microbiology

M.D. examination shall consist of Thesis, Theory Papers, and clinical/Practical and Oral examinations.

(a) Thesis

Every candidate shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis.

Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the candidate to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. Thesis shall be submitted at least six months before the theoretical and clinical / practical examination.

The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical; and on the acceptance of the thesis by two examiners, the candidate shall appear for the final examination.

(b) Theory

- (i) There shall be four theory papers.
- (ii) Out of these one shall be on recent advances.
- (iii) The theory examinations shall be held sufficiently earlier than the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the start of the Clinical/Practical and Oral examination.

(c) Practical and Oral

- (i) Practical examination for the subjects in Basic Medical Sciences shall be conducted to test the knowledge and competence of the candidates for making valid and relevant observations based on the experimental/Laboratory studies and his ability to perform such studies as are relevant to his subject.
- (ii) The Oral examination shall be thorough and shall aim at assessing the candidate knowledge and competence about the subject, investigative procedures, therapeutic technique and other aspects of the speciality, which form a part of the examination.

A candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory, (2) Practical including clinical and viva voce examination.

Evaluation of Answer Scripts

The answer books will be valued by two examiners. One of the two examiners will be from this university and the other will be from any other university. The Average of the two marks secured by the candidate will be taken into account. If the difference between two marks exceeds 20%, the answer scripts shall be valued by the third examiner. The average of the nearest two marks shall be considered as the final mark.

8. MODEL QUESTION PAPER

M.D MICROBIOLOGY

Paper - I

General Microbiology, Immunology, Molecular methods

Duration: 3 hours

Max.Marks: 100

Essay question

2 x 20 = 40 marks

1. Enumerate various mechanisms of drug resistance in bacteria at different levels with suitable diagram
2. Explain the mechanism of generation of diversity in antibodies (genetic recombination)

Short answers

10 x 6 = 60 marks

1. Koch's postulates
2. Vapour phase disinfectants
3. RT-PCR
4. Major Histocompatibility complex
5. Super antigens
6. Transduction
7. Pasteurisation
8. Fluorescent Microscopy
9. Adansonian classification
10. Genetic engineering

MODEL QUESTIONS

M.D MICROBIOLOGY Paper II Systematic Bacteriology

Duration: 3 hours

Max.Marks: 100

Essay question

2 x 20 = 40 marks

1. Discuss the laboratory diagnosis of leptospirosis
2. Discuss "Acinetobacter as an emerging super bug"

Short answers

10 x 6 = 60 marks

1. Staphylococcal Scalded Skin Syndrome
2. Pneumococcal vaccines
3. Clostridium difficile
4. Sereny test
5. Salmonella gastroenteritis
6. Aeromonas hydrophila
7. Melioidosis
8. Classification of Non tuberculous Mycobacteria (NTM)
9. Relapsing fever
10. H.pylori

MODEL QUESTIONS
M.D MICROBIOLOGY
Paper III
Virology & Parasitology

Duration 3 hours

Max.Marks: 100

Essay question

2 x 20 = 40 marks

1. Epidemiology of H1N1 infection
2. Discuss stonyloidosis in the context of HIV infection

Short answers

10 x 6 = 60 marks

1. Application of bacteriophage
2. Cytomegalovirus
3. Serological markers of HBV
4. Chikungunya
5. Preservation of stool for ova and cyst
6. Rota virus
7. Antigenic structure of HIV
8. Pathogenesis and laboratory diagnosis of neurocysticercosis
9. Rapid serological tests for Malaria
10. Occult filariasis

MODEL QUESTIONS
M.D MICROBIOLOGY
Paper IV

Applied Microbiology, Mycology & Recent advances

Duration 3 hours

Max.Marks: 100

Essay question

2 x 20 = 40 marks

1. Enumerate the fungi causing systemic mycosis. Discuss the laboratory diagnosis of *Cryptococcus meningitis*
2. Tabulate and compare the Ambler and Bush & Jacoby Classification schemes of ESBL

Short answers

10 x 6 = 60 marks

1. Opportunistic infections in HIV
2. Disposal of hospital wastes
3. Newer vaccines against cholera
- 4 *Penicillium marneffi*
- 5 Non-*Candida albicans* spp
6. Rapid evaluation of drug susceptibility of *M.tuberculosis*
7. Community Acquired MRSA
8. E test for assessing drug susceptibility
9. Dermatophytes
10. Mycotoxins

9.RECOMMENDED BOOKS & JOURNALS

1. Principles of Bacteriology, Immunity, Virology – Topley & Wilson. 8 volumes 10th Edition, Arnold, 2006.
2. Mackie McCartney Medical Microbiology- J.G.Collee, 14th Edition Churchill Livingston, 2007.
3. Mackie McCartney Medical Microbiology- David Greenwood. (Volume 1) 18th Edition Churchill Livingston, 2012.
4. Jawetz, Melnick & Adelberg's Medical Microbiology – Geo Brooks. 25th Edition Megraid Hill, 2010.
5. Medical Microbiology- David Greenwood. 18th Edition, Elsevier, 2012.
6. District Laboratory practice in tropical countries. PRT. I & II – 2nd Edition by Monica Chees Brough, Cambridge University 2009.
7. Bailey & Scott's Diagnostic Microbiology Sydney, Finegold and Ellen Jo Baron 13th Edition Mosby, 2014.
8. Diagnostic Microbiology- Connie Mahon .Etel. 4th Edition Saunders, 2014.
9. Roitt's Essential Immunology Ivan Roitt 12th Edition Black Well, 2011.
10. Basic and clinical immunology- Peakman, mark. 2nd Edition, Churchill Livingston, 2009
11. Parasitology- KD Chatterjee. 13th Edition CBS Publishers, New Delhi, 2009.
12. Text book of Medical Parasitology –SC Parija. 3rd Edition All India Publishers, Chennai, 2011.
13. Medical Microbiology- preparatory manual- for Undergraduates 2nd Edition Nagoba & Spichare. Elsevier New Delhi, 2012.
14. Sherris Medical Microbiology 6th Edition – Kenneth J.Ryan, C. George Ray Mc Graw Hill, 2014

REFERENCE BOOKS

1. Diagnosis skills in clinical laboratory science – Mahon connie.R. Mcgraw Hill, 2004
2. Principles and Practice of Infectious diseases- Mandell, Douglas and Bennett. 2 volume 8th Edition Elsevier, 2014.
3. Manual of clinical Microbiology – James Versalovic. 2volume 10th Edition ASM Press, Washington, 2011.
4. Medical Microbiology- 7th Edition. Patrick R Murray, Elsevier, 2013

JOURNALS

1. Annual Review of Microbiology
2. Journal of Medical Microbiology
3. WHO Technical report series
4. Indian Journal of Medical Research
5. The Journal of Infestations diseases
6. Journal of Virology
7. Immunology Today
8. Journal of Parasitology
9. Journal of Microbiological Methods
10. WHO bulletin
11. Infection control and Hospital Epidemiology
12. Indian Journal Of Medical Microbiology
13. Journal Of Association of Physicians of India
14. Emerging Infectious Diseases-on line
15. Journal Of American Medical Association

IMPORTANT WEBSITES

1. Centre for disease control-www.cdc.gov
2. World health Organisation-www.who.int
3. National Library of Medicine-www.pubmed.com
4. Tuberculosis Research Centre-www.trc-chennai.org
5. Johns Hopkins Infectious Diseases-www.hopkins-id.edu
6. Infectious Disease Society of America-www.idsociety.org

Men are born to succeed, not to fail
- *Henry David Thoreau.*