KRISHNA INSTITUTE OF MEDICAL SCIENCES, KARAD

DEPARTMENT OF MICROBIOLOGY

M.Sc. Code - 1502

MICROBIOLOGY Code – 1502-11 to 1502-14
CURRICULUM - CBCS

PREAMBLE:

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-specialities of Bacteriology including Mycobacteriology, Virology, Parasitology, Immunology, 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.

COURSE 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 micro-organisms.
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 micro-organisms.
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 OUTCOME:

At the end of 3 yrs the PG Students shall be able to:

1) To commit to effective utilization of resources and continuous improvement in the provision of an infection free atmosphere for the well being of patients and healthcare workers. Identify the microorganism isolated from patient's sample by using various media and biochemical tests.

2) To ensure latest diagnostic modalities of investigations in the field of Microbiology.

3) To formulate policies and protocols on the methods of sterilization and disinfection.

4) To incorporate quality improved principles in the effective infection control for the benefit of patients and health care workers

5) To implement an effective antibiotic policy to control the spread of antibiotic resistance.

6) To create awareness healthcare workers regarding biomedical waste management

7) To give the society competent clinical microbiologists with thorough and updated knowledge in the field of Microbiology.

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 PROGRAMME:

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. Sc.. (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-specialities
- Participation in CME programs and conferences

Hands on experience (practical training)

Practical training shall be imparted by posting the students in various subspecialities (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, infection control practices, maintenance of equipments, record keeping and quality control in Microbiology.

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 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 micro-organisms.
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 medidated 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. Streptococcus and Lactobacillus.
4. Neisseria, Branhamnella 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. Pox viruses
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,Microsporidium etc.

2. Helminthology : All those medically important helminths belonging to Cestoda, Trematoda and Nematoda.

Cestodes : Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dypyllidium,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 and. subcutaneous mycoses

5. Fungi causing systemic infections

6. 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 maintainance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
6. Preparation and pouring of liquid and solid media - Nutrient agar, Blood agar, MacConkey agar, sugars, TSI agar, Robertson's cooked meat, Lowenstiein- 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 H2, CO2
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, Craige'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 upto 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. pnumoniae 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 foot pad test for *M.leprae*

IMMUNOLOGY/ SEROLOGY

1. Collection of blood by venepuncture, seperation 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-Bunnel, Rose-Waaler, 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. Immunodiffusion in gels, counter immunoelectrophoresis- visualization and interpretation of bands.
5. Radial immunodiffusion.
6. Immunoelectrophoresis.
7. Neutrophil phagocytosis.

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 pathogenecity 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. Maintainance 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 couterimmunoelectrophoresis 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 subcutures. 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

A. Duration of Study: The duration of the study for M.Sc. Medical Microbiology will be of six semesters spread over three years.

Program pattern- Commencement of Semester

- First Semester: August
- Second Semester: February
- Third Semester: August
- Fourth Semester: February
- Fifth Semester: August
- Sixth Semester: February

B-Duration - Three years

C- Eligibility - Any of the following bachelor degree passing with not less than II class

- B.Sc graduates of biological Sciences.
- B.Sc. Zoology/Microbiology/Botany/Physiology

Other health sciences

- BHMS
- BAMS

D- : Fee As per University policy**.**

E- Selection Method: Entrance Examination conducted by the University

F- Faculty : Dr Mrs. G. S. Karande (Professor &Head of Microbiology)

Dr. S. R. Patil (Professor of Microbiology)

Dr. R. V. Shinde (Assoc. Professor of Microbiology)

Dr. S. K.Pawar (Assoc. Professor of Microbiology)

Dr. H. V. Patil (Assoc. Professor of Microbiology)

Medium of instruction: English

Attendance: Compulsory

Teaching-learning methods :

- Lectures
- Demonstrations
-Seminars
- Practical

COURSE CONTENT:

Ist Year

- Attend all lectures, demonstrations and practicals
- Attend seminar and present seminar as per the schedule.
- Visit to library & get acquainted with scientific journals
- Review of literature to choose topic for the dissertation & it submission in consultation of respective PG guide.
- Carryout dissertation work.

IInd Year

- Attend all lectures, demonstrations and practicals
- Attend seminar and present seminar as per the schedule
- Attend seminar and present seminar as per the schedule
- Continue dissertation work.
- Attend seminars ,present seminars as per schedule.

IIIrd Year

- Completion & submission of dissertation 6 months before the examination.
- To teach selected UG practical to the students in presence of senior faculty.
- To conduct microteaching session to the Ist year student in presence of senior faculty.

Core subject syllabus Theory and Practical (Must know)

❖ **SEMESTER-I:-**

A) Paper – I

a) Theory – 45 Hrs (Credits –03)

- **GENERAL MICROBIOLOGY:**
  - History and Pioneers in Microbiology
  - Microscopy
  - Nomenclature and classification of microbes

- **IMMUNOLOGY :**
  - Innate and acquired immunity
  - Antigens
  - Immunoglobulins

b) Practical- 60 Hrs (Credits – 02)

- **GENERALMICROBIOLOGY:**
  - Microscopy for unstained preparations/ wet mount
  - Microscopy for stained preparation
  - Preparation of direct smears from clinical specimens
  - Hanging drop preparation

- **IMMUNOLOGY**:
  - Phlebotomy & separation of serum
  - Operation & maintenance of ELISA reader & washer

B) Paper – II

a) Theory - 45 Hrs (Credits –03)

- **SYSTEMATIC BACTERIOLOGY - *GPC***
  - *Streptococcus*

- **SYSTEMATIC BACTERIOLOGY- GPB**
  - *Bacillus:* the aerobic spore bearing bacilli
  - *Clostridium:* the spore-bearing anaerobic bacilli

b) Practical- 60 Hrs (Credits – 02)

- **SYSTEMATIC BACTERIOLOGY-**
  - Specimen collection for Blood Culture
  - Inoculation of liquid & solid media

– Identification test
– Antimicrobial sensitivity testing- modified Kirby-bauer technique

B) Paper – III

a) Theory - 45 Hrs (Credits –03)

- **Mycology-**
  – Morphology and reproduction in fungi
  – Classification of fungi

- **Virology-**
  – The nature of viruses
  – Classification of viruses
  – Morphology: virus structure
  – Virus replication
  – The genetics of viruses

b) Practical- 60 Hrs (Credits – 02)

- **Mycology**
  – KOH Wet mount
  – Germ tube test

- **Virology-**
  – ELISA

D) Paper – IV

a) Theory – 45 Hrs (Credits – 03)

- **Parasitology (Protozoology) -**
  – General Parasitology

- **Parasitology (Helminthology)-**

  – **Helminthology:** All those medically important helminthes belonging to Cestoda, Trematoda and Nematoda.

b) Practical- 60 Hrs (Credits – 02)

- **Parasitology (Protozoology)**
  – Giemsa staining for thick & thin peripheral blood smear

श्रृ Generic electives-(Hrs 120; Theory 30, Practical 90 , Credits – 05)

a) Theory

- Bioethics.
  - –Confidentiality and Disclosure Issues
  - –Genetic research,
  - –Neuroethics (ethical issues around brain imaging and testing)
  - –Nanotechnologies (using small particles to deliver medicine or other medical treatments).

  –ृएुेसरचए अल्लेचर्तोनि

- Biosafety
  - –Biohazards.
  - –Infection control.
  - –International Health Regulations.

- ानि्फेरमर्तोनि टएच्होनेल्ेग्य ह्यीटह
  - –Technology As A Service.
  - –Cybersecurity.
  - – Internet of Things (IoT) .

b) Practical

- **Bioethics Practical**
  - –Genetic testing and screening
  - –Environmental ethics
  - –Clinical research ethics
  - –Consent, vulnerability, and/or coercion
  - –Ethical treatment of research subjects in clinical trials
  - –Ethical treatment of animals

- **Biosafety Practical**
  - – Blood safety, laboratory and imaging.
  - – Centers for Disease Control (CDC)
  - – National Institutes of Health.

- **Trending topics in IT Management Practical**
  - – OEM and ODM Development.
  - – DevOps for software and hardware.
  - – Application Containers.
  - – Artificial Intelligence.

फ्ह डस्सिएरतार्तोन्–ह्यउरस ६0. छरएदतिस – 0२ ह

- Selection of research topic
- Preparation of protocol
- प्रेतेच्ल रएवएिद्ध ान्द एतहचिल चेम्ततिएए रएवएिद्ध

Semester I

Course Code	Course title	Teaching hours per week		Clinical Posting	No. of hours per semester	Credits
		Lecture/ Tutorial	Practical			
Paper-I	General Microbiology	2	-	-	30	2
Paper-I	Immunology	1	-	-	15	1
Paper-I	General Microbiology	-	1	-	30	1
Paper-I	Immunology	-	1	-	30	1
Paper-II	Systematic Bacteriology- (Gram positive cocci)	2	-	-	30	2
Paper-II	Systematic Bacteriology- (Gram positive bacilli)	1	-	-	15	1
Paper-II	Systematic Bacteriology- (Gram positive cocci)	-	4	-	60	2
Paper-III	Mycology	1	-	-	15	1
Paper-III	Virology	2	-	-	30	2
Paper-III	Mycology	-	2	-	30	1
Paper-III	Virology	-	2	-	30	1
Paper-IV	Parasitology- Protozoology	2	-	-	30	2

Paper-IV	**Parasitology-Helminthology**	**1**	**-**	**-**	**15**	**1**
Paper-IV	**Parasitology-Protozoology**	**-**	**2**	**-**	**30**	**1**
Paper-IV	**Parasitology-Helminthology**	**-**	**2**	**-**	**30**	**1**
GE	**Generic -Theory (Elective)**	**2**	**-**	**-**	**30**	**2**
GE	**Generic -Practical (Elective)**	**-**	**3**	**-**	**90**	**3**
	Dissertation	**-**	**1**	**-**	**30**	**1**
	Total	**210**	**360**	**-**	**570**	**26**

- **SEMESTER-II:-**

A) Paper - I

a) Theory - 45 Hrs (Credits – 03)

- **GENERAL MICROBIOLOGY:**
  - –Morphology of bacteria and other micro-organisms
  - –Growth and Nutrition of bacteria
  - –Bacterial metabolism

- **IMMUNOLOGY :**
  - – Antigen and antibody Reactions
  - – Complement System
  - – The normal immune system: structure and function

b) Practical- 60 Hrs (Credits – 02)

- **GENERAL MICROBIOLOGY:**
  - – Washing, sterilization and packing of glassware
  - – Infection control activities- environmental sampling
  - – Identification of HAI
  - – Calculation of HAI quality indicators

- **IMMUNOLOGY**
  - – **Performance of serological tests**
  - – Latex agglutination test (RA, ASO)
  - – RPR card test

B) Paper – II

a) Theory - 45 Hrs (Credits – 03)

- **SYSTEMATIC BACTERIOLOGY - *GPC***
  - –*Staphylococcus*
  - –*Coagulase negative Staphylococcus*

- **SYSTEMATIC BACTERIOLOGY- GNC**
  - – *Neisseria,*
  - – *Branhamella*
  - – *Moraxella*

- **SYSTEMATIC BACTERIOLOGY- *MYCOBACTERIA*-**
  - – *Mycobacteria tuberculosis*

ब्ह प्राक्तचिर्ल 60 Hrs (Credits – 02)

- **SYSTEMATIC BACTERIOLOGY- GNC**
  - – *Acinetobacter,*

- *Neisseria,*
- *Branhamella*
- *Moraxella*

- **SYSTEMATIC BACTERIOLOGY- *MYCOBACTERIA*-**
  - Petroff's concentration technique

C) Paper - III

a) Theory - 45 Hrs (Credits – 03)

- **MYCOLOGY-**
  - *Dermatophytes*
  - *Candida*

- **VIROLOGY-**
  - The pathogenicity & lab diagnosis of viruses
  - Epidemiology of viral infections
  - Anti-viral drugs
  - Bacteriophages
  - *Herpesviruses*

b) Practical- 60 Hrs (Credits – 02)

- **MYCOLOGY**
  - Slide culture
  - Negative staining for fungus

- **VIROLOGY-**
  - ृापदि तएस्तस

D) Paper - IV

a) Theory - 45 Hrs (Credits – 03)

- **PARASITOLOGY (PROTOZOOLOGY) -**
  - **Protozoan parasites of medical importance:**
    - *Entamoeba*
    - *Giardia*
    - *Trichomonas*

- **PARASITOLOGY (HELMINTHOLOGY)-**
  - **Cestodes:**
    - *Diphyllobothrium,*
    - *Taenia,*
    - *Echinococcus,*
    - *Hymenolepis,*
    - *Dipyllidium,*
    - *Multiceps*etc.

b) Practical- <u>60 Hrs (Credits –02)</u>

- **PARASITOLOGY (PROTOZOOLOGY)**
  –Modified ZN staining for *C. parvum*

E) Discipline specific electives-(Hrs Theory60; Practical 90, Credits –7)

i) Syllabus for Anatomy

a) Theory

Gross anatomy of Respiratory System.
Gross anatomy of Central Nervous System
Gross anatomy of Cardiovascular System
Gross anatomy of Gastrointestinal System
Gross anatomy of Genitourinary

b) Practical

Demonstration of structure of various systems

ii) Syllabus for Pharmacology

a) Theory

- Classification Of Antimicrobial Drugs
  – Antimicrobial drugs can be classified on the basis of many characteristics:

  – Chemical structure
    - *Sulfonamides and related drugs*: Sulfadiazine and others, Sulfones—Dapsone (DDS), Paraaminosalicylic acid (PAS).
    - *Diaminopyrimidines:* Trimethoprim, Pyrimethamine.
    - *Quinolones:* Nalidixic acid, Norfloxacin,Ciprofloxacin, Prulifloxacin, etc.
    - β-*Lactam antibiotics:* Penicillins, Cephalosporins,Monobactams, Carbapenems.
    - *Tetracyclines:* Oxytetracycline, Doxycycline,etc.
    - *Nitrobenzene derivative:* Chloramphenicol.
    - *Aminoglycosides:* Streptomycin, Gentamicin,Amikacin, Neomycin, etc.
    - *Macrolide antibiotics:* Erythromycin, Clarithromycin,Azithromycin, etc.
    - *Lincosamide antibiotics:* Lincomycin,Clindamycin.
    - *Glycopeptide antibiotics:* Vancomycin,Teicoplanin.
    - *Oxazolidinone:* Linezolid.
    - *Polypeptide antibiotics:* Polymyxin-B,Colistin, Bacitracin, Tyrothricin.
    - *Nitrofuran derivatives:* Nitrofurantoin, Furazolidone.
    - *Nitroimidazoles:* Metronidazole, Tinidazole,etc.

- *Nicotinic acid derivatives:* Isoniazid, Pyrazinamide,Ethionamide.
- *Polyene antibiotics:* Nystatin, Amphotericin-B, Hamycin.
- *Azole derivatives:* Miconazole, Clotrimazole,Ketoconazole,Fluconazole.
- *Others:* Rifampin, Spectinomycin, Sod.fusidate, Cycloserine, Viomycin, Ethambutol, Clofazimine, Griseofulvin.

- **Type of organisms against which primarily active**
  - *Antibacterial:* Penicillins, Aminoglycosides, Erythromycin, Fluoroquinolones, etc.
  - *Antifungal*: Griseofulvin, Amphotericin B, Ketoconazole, etc.
  - *Antiviral:* Acyclovir, Amantadine, Zidovudine, etc.
  - *Antiprotozoal:* Chloroquine, Pyrimethamine, Metronidazole, Diloxanide, etc.
  - *Anthelmintic:* Mebendazole, Pyrantel, Niclosamide, Diethyl carbamazine, etc.

- **Spectrum of activity**
  - *Narrow-spectrum*
    - Penicillin G Streptomycin
    - Erythromycin
  - *Broad-spectrum*
    - Tetracyclines
    - Chloramphenicol

- **Type of action**

  - *Primarily bacteriostatic*
    - Sulfonamides, Erythromycin, Tetracyclines Clindamycin, Chloramphenicol Linezolid
    - Ethambutol
    - *Primarily bactericidal*
    - Penicillins, Cephalosporins Aminoglycosides Vancomycin, Polypeptides Fluoroquinolones Rifampin, Metronidazole, Isoniazid Cotrimoxazole, Pyrazinamide
    - Some primarily static drugs may become cidal at higher concentrations (as attained in the urinary tract), e.g. erythromycin, nitrofurantoin. On the other hand, some cidal drugs, e.g. cotrimoxazole, streptomycin may just be static under certain circumstances.

- **Natural sources of antibiotics**

  - *Fungi*
    - Penicillin, Griseofulvin, Cephalosporin

  - *Bacteria*
    - Polymyxin B, Tyrothricin, Colistin, Aztreonam,Bacitracin

- *Actinomycetes*
  - Aminoglycosides, Macrolides,Tetracyclines, Polyenes,Chloramphenicol

b) Practical

- Prescription writing
- Pharmacovigilance
- Adverse drug reaction reporting
- Laboratory animals and their uses

Semester II

Course Code	Course title	Teaching hours per week		Clinical Posting	No. of hours per semester	Credits
		Lecture/ Tutorial	Practical			
Paper-I	General Microbiology	2	-	-	30	2
Paper-I	Immunology	1	-	-	15	1
Paper-I	General Microbiology	-	2	-	30	1
Paper-I	Immunology	-	2	-	30	1
Paper-II	Systematic Bacteriology- (Gram positive cocci)	1	-	-	15	1
Paper-II	Systematic Bacteriology- (Gram negative cocci)	1	-	-	15	1
Paper-II	Mycobacteriology	1	-	-	15	1
Paper-II	Bacteriology exercise –II (Gram negative cocci)	-	2	-	30	1
Paper-II	Mycobacteriology	-	2	-	30	1
Paper-III	Mycology	2	-	-	30	2
Paper-III	Virology	1	-	-	15	1
Paper-III	Mycology	-	2	-	30	1
Paper-III	Virology	-	2	-	30	1
Paper-IV	Parasitology-	1	-	-	15	1

	Protozoology					
Paper-IV	**Parasitology-Helminthology**	**2**	**-**	**-**	**30**	**2**
Paper-IV	**Parasitology-Protozoology**	**-**	**2**	**-**	**30**	**1**
Paper-IV	**Parasitology-Helminthology**	**-**	**2**	**-**	**30**	**1**
DSE	**Discipline Specific Elective** • **Anatomy** • **Pharmacology**	**4**	**-**	**-**	**60**	**4**
DSE	**Discipline Specific Elective** • **Anatomy** • **Pharmacology**	**-**	**6**	**-**	**90**	**3**
	Total	**240**	**330**		**570**	**27**

❖ **SEMESTER-III:-**

A) Paper – I

a) Theory - 30 Hrs (Credits – 02)

- **GENERAL MICROBIOLOGY:**
  - Sterilization and disinfection
  - Culture media and culture methods
  - Identification of bacteria

- **IMMUNOLOGY :**
  - Immune Response
  - Hypersensitivity
  - Immunodeficiency

b) Practical- 60 Hrs (Credits – 02)

- **GENERALMICROBIOLOGY:**
  - Bacteriology of water
  - Bacteriology of air
  - Antibiotic disc preparation

- **IMMUNOLOGY**:
  - Tube agglutination test
  - Rapid card test
  - IQC-serology

B) Paper – II

a) Theory - 30 Hrs (Credits – 02)

- **SYSTEMATIC BACTERIOLOGY- GPB**
  - Non-sporing anaerobe bacilli

- **SYSTEMATIC BACTERIOLOGY- GNB**
  - *Enterobacteriaceae- Vibrios, Aeromonas, Plesiomonas, Campylobacter & Spirillum Actinomycetes, Nocardia and Actinobacillus*
  - *Erysipelothrix and Listeria*
  - *Bacteroidaceae*: *Bacteroides, Fusobacterium and Leptotrichia*

b) Practical- 60 Hrs (Credits – 02)

- **SYSTEMATIC BACTERIOLOGY- GPB**
  - *Corynebacterium* and other Coryneform bacteria *Bacillus:* the aerobic spore bearing bacilli,
  - *Clostridium:* thespore-bearing anaerobic bacilli
  - Non-sporing anaerobe

- **SYSTEMATIC BACTERIOLOGY-GNB**
  - Specimen collection for
  - Blood Culture
  - Inoculation of liquid & solid media

C) Paper – III

a) Theory - <u>30 Hrs (Credits – 02)</u>

- **MYCOLOGY-**
  - *Aspergillus* Contaminant and opportunistic fungi
  - Fungi causing superficial mycoses

- **VIROLOGY-**
  - *Paramyxoviruses*
  - *Influenza virus*
  - *Hepatitis viruses*
  - *Rabies virus*
  - *Human immunodeficiency viruses*

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **MYCOLOGY**
  - LPCB mount

- **VIROLOGY-**
  - ELISA

D) Paper – IV

a) Theory - <u>30 Hrs (Credits – 02)</u>

- **PARASITOLOGY (PROTOZOOLOGY) -75 HOURS, CREDITS-05**
  - **Protozoan parasites of medical importance:**
    - *Leishmania,*
    - *Trypanosoma,*
    - *Plasmodia*

- **APPLIED MICROBIOLOGY-**
  - Normal Microbial flora
  - Epidemiology of infectious diseases
  - Hospital acquired infections & Hospital waste disposal
  - Bacteriology of water milk and air
  - Infections of various organs and systems of human body

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **PARASITOLOGY (HELMINTHOLOGY)**
  –Stool wet mount for R/M

E) Dissertation--(Hrs Practical 180, Credits –06)

- **Data collection**

Semester III

Course Code	Course title	Teaching hours per week		Clinical Posting	No. of hours per semester	Credits
		Lecture/ Tutorial	Practical			
Paper-I	General Microbiology	1	-	-	15	1
Paper-I	Immunology	1	-	-	15	1
Paper-I	General Microbiology	-	2	-	30	1
Paper-I	Immunology	-	2	-	30	1
Paper-II	Systematic Bacteriology- (Gram positive bacilli)	1	-	-	15	1
Paper-II	Gram negative bacilli	1	-	-	15	1
Paper-II	Gram positive bacilli	-	2	-	30	1
Paper-II	Gram negative bacilli	-	2	-	30	1
Paper-III	Mycology	1	-	-	15	1
Paper-III	Virology	1	-	-	15	1
Paper-III	Mycology	-	2	-	30	1
Paper-III	Virology	-	2	-	30	1

Paper-IV	**Parasitology- Protozoology**	**1**	**-**	**-**	**15**	**1**
Paper-IV	**Applied Microbiological aspects**	**1**	**-**	**-**	**15**	**1**
Paper-IV	**Parasitology- Protozoology**	**-**	**2**	**-**	**30**	**1**
Paper-IV	**Parasitology- Helminthology**	**-**	**2**	**-**	**30**	**1**
	Dissertation	**-**	**12**	**-**	**180**	**6**
	Total	**120**	**420**		**540**	**22**

- **SEMESTER-IV:-**

A) Paper – I

a) Theory - <u>30 Hrs (Credits – 02)</u>

- **GENERAL MICROBIOLOGY:**
  - Bacterial Toxins
  - Bacterial antagonism: Bacteriocins
  - Bacterial ecology

- **IMMUNOLOGY :**
  - Auto-immunity
  - Immune tolerance
  - Transplantation immunity

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **GENERALMICROBIOLOGY:**
  - Handling of laboratory animal
  - Methods for preservation of bacteria
  - Maintenance of stock cultures
  - Gram staining
  - Acid fast staining (Ziehl- Neelsen method)

B) Paper – II

a) Theory - <u>30 Hrs (Credits – 02)</u>

- **SYSTEMATIC BACTERIOLOGY - *GPC***
  - *Pneumococcus*

- **SYSTEMATIC BACTERIOLOGY- GNC**
  - *Haemophilus*
  - *Bordetella*

- **SYSTEMATIC BACTERIOLOGY-**
  - *Bacteroidaceae*: *Bacteroides, Fusobacterium andLeptotrichia*
  - *Chromobacterium,*
  - *Flavobacterium, Acinetobacter and Alkaligenes*
  - *Pasteurella, Francisella*

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **SYSTEMATIC BACTERIOLOGY- GPC**
  - IQC- Antibiotic disc potency
  - Operation of BacT/ALERT
  - Operation of Vitek 2 compact
  - *Streptococcus*

- *Staphylococcus*

- **SYSTEMATIC BACTERIOLOGY- GNB**
  - Identification test
  - Antimicrobial sensitivitytesting- modified Kirby- Bauer technique
  - IQC- Antibiotic disc potency

C) Paper – III

a) Theory - 30 Hrs (Credits – 02)

- **MYCOLOGY-**
  - Fungi causing subcutaneous mycoses
  - Fungi causing systemic infections

- **VIROLOGY-**
  - *Human immunodeficiency viruses*
  - Vaccines
  - *Pox viruses*
  - *Vesicular viruses*
  - *Toga viruses*
  - *Bunya viruses*

b) Practical- 60 Hrs (Credits – 02)

- **VIROLOGY-**
  - Rapid tests

D) Paper – IV

a) Theory - 30 Hrs (Credits – 02)

- **PARASITOLOGY (PROTOZOOLOGY) -**
  - **Protozoan parasites of medical importance:**
    - *Toxoplasma,*
    - *Sarcocystis,*
    - *Cryptosporidium,*
    - *Babesia,*
    - *Balantidium* etc.

- **PARASITOLOGY (HELMINTHOLOGY)-**

  - **Trematodes:**
    - *Schistosomes,*
    - *Fasciola,*
    - *Gastrodiscoides,*
    - *Paragonimus,*
    - *Clonorchis,*

- *Opisthorchis*etc.

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **PARASITOLOGY (HELMINTHOLOGY)**
  - Stool concentration techniques

E) **Discipline specific electives-(Hrs Theory60;Practical 90, Credits –7)**

i) **Syllabus for Pathology**

a) Theory

- Pathophysiology of Malaria
- Pathophysiology of HIV
- Pathophysiology of Tuberculosis
- Pathophysiology of Leprosy
- Pathophysiology of Acid Peptic Disease
- Pathophysiology of Dengue

b) Practical

- Clinical pathology-
- Urine routine microscopy
- PS for Malarial parasite
- Cell cytology
- Special stains for Fungus

ii) **Syllabus for Laboratory medicine**

a) **Theory**

- Presentation of clinical features in various infectious disease.
- Correlation of clinical symptoms with sample collection.
- Sample collection based on clinical symptoms.
- Interpretation of Antimicrobial Susceptibility Testing.
- Hospital infections.

b) Practical

- Biomedical Waste Management.
- Antimicrobial Susceptibility Testing and its surveillance.
- Infection control policy.
- Universal safety precautions.

- Needle stick injury.
- Post Exposure Prophylaxis

F) Dissertation --(Hrs Practical 60, Credits –02)

- डाता फएएदनि

Semester IV

Course Code	Course title	Teaching hours per week		Clinical Posting	No. of hours per semester	Credits
		Lecture/ Tutorial	Practical			
Paper-I	**General Microbiology**	**1**	**-**	**-**	**15**	**1**
Paper-I	**Immunology**	**1**	**-**	**-**	**15**	**1**
Paper-I	**General Microbiology**	**-**	**4**	**-**	**60**	**2**
Paper-II	**Systematic Bacteriology- (Gram positive cocci)**	**1**	**-**	**-**	**15**	**1**
Paper-II	**Gram negative bacilli**	**1**	**-**	**-**	**15**	**1**
Paper-II	**Systematic Bacteriology- (Gram positive cocci)**	**-**	**2**	**-**	**30**	**1**
Paper-II	**Gram negative bacilli**	**-**	**2**	**-**	**30**	**1**
Paper-III	**Mycology**	**1**	**-**	**-**	**15**	**1**
Paper-III	**Virology**	**1**	**-**	**-**	**15**	**1**

Paper-III	**Virology**	**-**	**4**	**-**	**60**	**2**
Paper-IV	**Parasitology-Protozoology**	**1**	**-**	**-**	**15**	**1**
Paper-IV	**Parasitology-Helminthology**	**1**	**-**	**-**	**15**	**1**
Paper-IV	**Parasitology-Protozoology**	**-**	**2**	**-**	**30**	**1**
Paper-IV	**Parasitology-Helminthology**	**-**	**2**	**-**	**30**	**1**
DSE	**Discipline Specific Elective** • **Pathology** • **Laboratory Medicine**	**4**	**-**	**-**	**60**	**4**
DSE	**Discipline Specific Elective** • **Pathology** • **Laboratory Medicine**	**-**	**6**	**-**	**90**	**3**
	Dissertation	**-**	**4**	**-**	**60**	**2**
	Total	**180**	**390**		**570**	**25**

❖ **SEMESTER-V:-**

A) Paper – I

a) Theory - 30 Hrs (Credits – 02)

- **GENERAL MICROBIOLOGY:**
  - Normal flora of human body, Hospital environment, Air, Water and Milk
  - Host-parasite relationship

- **IMMUNOLOGY :**
  - Tumour immunity
  - Immunoprophylaxis and immunotherapy
  - Measurement of immunity

b) Practical- 60 Hrs (Credits – 02)

- **GENERALMICROBIOLOGY: 210 hours, credits- 07**
  - Albert staining
  - Modified ZN staining for *M. leprae*
  - Modified ZN staining for *Nocardia*
  - IQC-staining

B) Paper – II

a) Theory - 30 Hrs (Credits – 02)

- **SYSTEMATIC BACTERIOLOGY- GNB**
  - *Brucella*
  - *Chlamydia*
  - *Rickettsiae*

b) Practical- 60 Hrs (Credits – 02)

- **SYSTEMATIC BACTERIOLOGY- *MYCOBACTERIA*-**
  - AFB culture & sensitivity

- **SYSTEMATIC BACTERIOLOGY- GNB**
  - Operation of BacT/ALERT
  - Operation of Vitek 2compact
  - *EnterobacteriaceaeVibrios, Aeromonas, Plesiomonas, Campylobacter &Spirillum*

C) Paper – III

a) Theory - 30 Hrs (Credits – 02)

- **VIROLOGY-**
  - *Arena viruses*
  - *Marburg and Ebolaviruses*
  - *Rubella virus*
  - *Orbi viruses*
  - Respiratory diseases : *Rhinoviruses, adenoviruses* and *corona viruses*

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **VIROLOGY-**
  - ELISA

D) Paper – IV

a) Theory - <u>30 Hrs (Credits – 02)</u>

- **PARASITOLOGY (HELMINTHOLOGY)- 75 HOURS, CREDITS-05**

  - **Nematodes:**
    - *Trichuris,*
    - *Trichinella,*
    - *Strongyloides,*
    - *Ancylostoma,*
    - *Necator,*
    - *Ascaris,*
    - *Toxocara,*
    - *Enterobius,*
    - *Filarial worms,*
    - *Dracunculus,*etc.

b) Practical- <u>60 Hrs (Credits – 02)</u>

- **PARASITOLOGY (PROTOZOOLOGY)**
  - Giemsa staining for thick & thin peripheral blood smear
  - Modified ZN staining for *C. parvum*

E) Dissertation --(Hrs Practical 150, Credits –05)

- डाता नल्प्सिस

Semester V

Course Code	Course title	Teaching hours per week		Clinical Posting	No. of hours per semester	Credits
		Lecture/ Tutorial	Practical			
Paper-I	General Microbiology	2	-	-	30	2
Paper-I	General Microbiology	-	4	-	60	2
Paper-II	Systematic Bacteriology- (Gram negative cocci)	1	-	-	15	1
Paper-II	Gram negative bacilli	1	-	-	15	1
Paper-II	Mycobacteriology	-	2	-	30	1
Paper-II	Gram negative bacilli	-	2	-	30	1
Paper-III	Virology	2	-	-	30	2
Paper-III	Virology	-	4	-	60	2
Paper-IV	Parasitology- Helminthology	2	-	-	30	2
Paper-IV	Parasitology- Protozoology	-	2	-	30	1
Paper-IV	Parasitology- Helminthology	-	2	-	30	1
	Dissertation	-	10	-	150	5
	Total	120	390		510	21

- **SEMESTER-VI:-**

A) Paper – I

a) Theory - 45 Hrs (Credits – 03)

- **BACTERIAL GENETICS**
  - Gene cloning
  - Antibacterial substances used in the treatment of infections and drug resistance in bacteria

b) Practical- 30 Hrs (Credits – 01)

- **GENERALMICROBIOLOGY:**
  - Preparation of stains
  - Preparation of reagents
  - Preparation, plugging, pouring & Quality Control (QC) of culture media
  - Operation & maintenance of autoclave

B) Paper – II

a) Theory - 45 Hrs (Credits – 03)

- **SYSTEMATIC BACTERIOLOGY - *GPC***

– *Enterococcus*
– *Micrococcus*

- **SYSTEMATIC BACTERIOLOGY- *MYCOBACTERIA***

– *Mycobacteria leprae,*
– *Atypical Mycobacteria*

- **SYSTEMATIC BACTERIOLOGY- GNB**
  - *Mycoplasmatales: Mycoplasma, Ureaplasma and Acholeplasma*
  - Miscellaneous bacteria
  - *Spirochaetes*

b) Practical- 30 Hrs (Credits – 01)

- **SYSTEMATIC BACTERIOLOGY- GPC**
  - *Coagulase negative Staphylococcus*
  - *Pneumococcus*
  - *Enterococcus*
  - *Micrococcus Neisseria, Branhamella& Moraxella*
  - *Haemophilus and Bordetella*

C) Paper – III

a) Theory - 45 Hrs (Credits – 03)

- **MYCOLOGY-**

– Anti-mycotic agents

- **VIROLOGY-**
  - Enteroviruses; *Polio, Echo, and Coxsackie viruses*
  - Other enteric viruses
  - Slow viruses
  - Oncogenic viruses
  - Teratogenic viruses

b) Practical- <u>30 Hrs (Credits – 01)</u>

- **VIROLOGY-**
  - Rapid tests

D) Paper – IV

a) Theory - <u>45 Hrs (Credits – 03)</u>

- **PARASITOLOGY (HELMINTHOLOGY)-**

  - **Ecto-parasites:**
    - Common arthropods and other vectors viz., Mosquito, Sand fly, Ticks ,Mite,Cyclops

- **APPLIED MICROBIOLOGICAL ASPECTS**
  - Molecular genetics as applicable to microbiology
  - Vaccinology: principle, methods of preparation, administration of vaccines.
  - Bio-terrorism

b) Practical- <u>30 Hrs (Credits – 01)</u>

- **PARASITOLOGY (HELMINTHOLOGY)**
  - Stool wet mount for R/M
  - Stool concentration techniques

E) **Discipline specific electives-(Hrs Theory 60; Practical 120, Credits –08)**

i) Molecular Biology

a) Theory

- PCR and its types
- Molecular biology
- Structure of DNA
- Structure of RNA and types

- Transcription and Translation
- Restriction fragment length polymorphism

b) Practical

- Estimation of DNA
- Estimation of RNA
- Gel Electrophoresis
- छेलुम्न छहरेमतेग्रापहट

ii) Biotechnology

a) Theory

- Base composition of nucleic acids.
- Bacterial conjugation
- Purification, storage and concentration of DNA.
- Restriction enzyme digestion of DNA.
- DNA Ligation.
- Northern Blotting
- Sourthen blotting

b) Practical

- Electrophoretic separation of serum proteins by Agarose and Polyacrylamide gel electrophoresis (PAGE).
- Electrophoretic separation of nucleic acids by Agarose and Polyacrylamide gel electrophoresis
- Estimation of DNA of the sample.
- Estimation of RNA of the sample
- Isolation of DNA from Bacteria.
- Isolation of DNA from Yeast.
- Isolation of Bacterial palsmids
- Isolation of yeast palsmids.
- Isolation of RNA from yeasts.
- Northern Blotting Techniques
- Sourthen blotting techniques

F) Dissertation --(Hrs Practical 60, Credits –02)

- **Dissertation presentation and viva voce**

Semester VI

Course Code	Course title	Teaching hours per week		Clinical Posting	No. of hours per semester	Credits
		Lecture/ Tutorial	Practical			
Paper-I	General Microbiology	2	-	-	30	2
Paper-I	Immunology	1	-	-	15	1
Paper-I	General Microbiology	-	2	-	30	1
Paper-II	Systematic Bacteriology- (Gram positive cocci)	1	-	-	15	1
Paper-II	Mycobacteriology	1	-	-	15	1
Paper-II	Gram negative bacilli	1	-	-	15	1
Paper-II	Systematic Bacteriology- (Gram positive cocci)	-	2	-	30	1
Paper-III	Mycology	1	-	-	15	1
Paper-III	Virology	2	-	-	30	2
Paper-III	Virology	-	2	-	30	1
Paper-IV	Parasitology- Helminthology	2	-	-	30	2
Paper-IV	Applied Microbiological aspects	1	-	-	15	1

Paper-IV	**Parasitology- Protozoology**	**-**	**2**	**-**	**30**	**1**
DSE	**Discipline Specific Elective** • **Molecular Biology** • भैतिएच्हेन्ल्ग्ट	**4**	**-**	**-**	**60**	**4**
DSE	**Discipline Specific Elective** • **Molecular biology techniques** • टेल्स् ान्द तएच्हनथ्युएस् न् बेंतिएच्हेन्ल्ग्ट	**-**	**8**	**-**	**120**	**4**
	Dissertation	**-**	**4**	**-**	**60**	**2**
	Total	**240**	**300**		**540**	**26**

<u>Generic Electives</u> : <u>I Semester</u>

Select any one from the group

1) Bioethics.
2) Biosafety
3) Information Technology (IT).

Discipline Specific Elective courses : II Semester

Select any one

1) ANATOMY
2) PHARMACOLOGY

Discipline Specific Elective courses : IV Semester

Select any one

1) PATHOLOGY
2) LABORATORY MEDICINE

Discipline Specific Elective courses : VI Semester

Select any one

1) MOLECULAR BIOLOGY
२ह पैटश्छज्ञेलैघ

TEXT BOOK & REFERENCE BOOKS

1. Topley and Wilson's Microbiology and Microbial infections. 8 volumes .2005 10th 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. Text book 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

Examination Pattern:-

Internal assessment examination will be converted to of 20 marks theory and 20 marks practical and will be added in End semester examination.

End semester examination:

Question Paper Pattern:

Theory: 80 Marks

Answer all the questions.

I. Multiple Choice Question (MCQ) = 20 X 20 = 20
II. Essay question : 20 x1 =20
III. Long Answers(Answer 2 out of 3) = 2 X 10 = 20
IV. Short Answers (Answers 4 out of 6) = 4 x 5 = 20

Total = 80 Marks

Practical:

Oral Examination: 30 Marks
Practical Examination 50 Marks
Total Marks : 80.
Total exam marks for end semester are 100 marks theory and 100 marks practical.

1. Promotion and award ofgrades

A student shall be declared PASS and eligible for getting he/she secures at least 50% marks in that particular course including internal assessment..

2. Carry forward ofmarks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified ,then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

3. Improvement of internalassessment

A student shall have the opportunity to improve his/her performance only once in the Sessional exam component of the internal assessment. The re-conduct of the Sessional exam shall be completed before the commencement of next end semester theory examinations.

Grading ofperformances

Letter grades and grade pointsallocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in table I

Table –I Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses(Theory/Practical) in a semester with credits C1, C2, C3, C4 and C5 and the student's grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equalto:

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

SGPA = $C_1G_1 + C_2G_2 + C_3G_3 + C_4$* ZERO + C_5G_5

$C_1 + C_2 + C_3 + C_4 + C_5$

Cumulative Grade Point Average(CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s),till the course(s) is/are passed. When the course(s)is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculatedas:

$$CGPA = \frac{C1S1 + C2S2 + C3S3 + C4S4 + C5S5 + C6S6 + C7S7 + C8S8}{C1 + C2 + C3 + C4 + C5 + C6 + C7 + C8}$$

where C_1, C_2, C_3,.... is the total number of credits for semester I,II,III,….
and S_1,S_2, S_3,....is the SGPA of semester I,II,III,…. .

19. Declaration ofclass

The class shall be awarded on the basis of CGPA as follows:

First ClasswithDistinction= CGPA of. 7.50 andabove

FirstClass= CGPA of 6.00 to7.49

SecondClass= CGPA of 5.00 to5.99

20. Award ofRanks

Ranks and Medals shall be awarded on the basis of final CGPA.

21. Award ofdegree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

Final Mark list Of University Examination

Sr. No.	Semester	Internal Assessment		End Semester Examination		Total	
		Theory 20 marks	Practical 20 marks	Theory 80 marks	Practical 80 marks	Theory 100 marks	Practical 100 marks
1	**Semester I**						
2	**Semester II**						

3	**Semester III**						
4	**Semester IV**						
5	**Semester V**						
6	**Semester VI**						

CBCS FOR Microbiology

Program: M. Sc Medical **Department: KIMS** **Subject: Microbiology** **Scheme: CBCS**

Subject		Sem-I			Sem-II			Sem-III			Sem-IV			Sem-V			Sem-VI			Total		
		T	P	Total	T	P	Total	T	P	Total	T	P	Total	T	P	Total	T	P	Total	T	P	Total
Core-I	Hr	45	60	105	45	60	105	30	60	90	30	60	90	30	60	90	45	30	75	**225**	**330**	**555**
	Cr	3	2	5	3	2	5	2	2	4	2	2	4	2	2	4	3	1	4	**15**	**11**	**26**
Core-II	Hr	45	60	105	45	60	105	30	60	90	30	60	90	30	60	90	45	30	75	**225**	**330**	**555**
	Cr	3	2	5	3	2	5	2	2	4	2	2	4	2	2	4	3	1	4	**15**	**11**	**26**
Core-III	Hr	45	60	105	45	60	105	30	60	90	30	60	90	30	60	90	45	30	75	**225**	**330**	**555**
	Cr	3	2	5	3	2	5	2	2	4	2	2	4	2	2	4	3	1	4	**15**	**11**	**26**
Core-IV	Hr	45	60	105	45	60	105	30	60	90	30	60	90	30	60	90	45	30	75	**225**	**330**	**555**
	Cr	3	2	5	3	2	5	2	2	4	2	2	4	2	2	4	3	1	4	**15**	**11**	**26**
Total	**Hr**	**180**	**240**	**420**	**180**	**240**	**420**	**120**	**240**	**360**	**120**	**240**	**360**	**120**	**240**	**360**	**180**	**120**	**300**	**900**	**1320**	**2220**
	Cr	**12**	**8**	**20**	**12**	**8**	**20**	**8**	**8**	**16**	**8**	**8**	**16**	**8**	**8**	**16**	**12**	**4**	**16**	**60**	**44**	**104**

CBCS FOR Microbiology

Program: M. Sc Medical **Department: KIMS** **Subject: Microbiology** **Scheme: CBCS**

Subject		Sem-I			Sem-II			Sem-III			Sem-IV			Sem-V			Sem-VI			Total		
		T	P	Total	T	P	Total	T	P	Total	T	P	Total	T	P	Total	T	P	Total	T	P	Total
Elective DSE/ AEC	Hr	-	-	-	60	90	150	-	-	-	60	90	150	-	-	-	60	120	180	**180**	**300**	**480**
	Cr	-	-	-	4	3	7	-	-	-	4	3	7	-	-	-	4	4	8	**12**	**10**	**22**
Generic Elective	Hr	30	90	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**30**	**90**	**120**
	Cr	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**	**3**	**5**
Dissertation	Hr	0	30	30	0	0	0	0	180	180	0	60	60	0	150	150	0	60	60	**0**	**480**	**480**
	Cr	0	1	1	0	0	0	0	6	6	0	2	2	0	5	5	0	2	2	**0**	**16**	**16**
Grand Total	**Hr**	**210**	**360**	**570**	**240**	**330**	**570**	**120**	**420**	**540**	**180**	**390**	**570**	**120**	**390**	**510**	**240**	**300**	**540**	**1110**	**2190**	**3300**
	Cr	**14**	**12**	**26**	**16**	**11**	**27**	**8**	**14**	**22**	**12**	**13**	**25**	**8**	**13**	**21**	**16**	**10**	**26**	**74**	**73**	**147**

घ्एग्रदि श्ल्एच्तविए – अन्दै न्ए

1. Stress Management 2. Personality Development

डस्विपिलन्ए श्पएचफिदि श्ल्एच्तविए – अन्दै न्ए

श्एम्एस्तएर ीी १. Posting in Anatomy २. Posting in Pharmacology

श्एम्एस्तएर ीर्ध १. Parasitology (Protozoology) २. Parasitology- Helminthology

श्एम्एस्तएर र्धी १. Molecular Biology 2. Biotechnology