REGULATIONS 2016

SYLLABUS

for Courses affiliated to the

Kerala University of Health Sciences

Thrissur 680596

Bachelor of Science in

Medical Microbiology

Course Code 019

(2016-17 Academic year onwards)

2016

2. COURSE CONTENT

2.1 Title of course:

Bachelor of Science in Medical Microbiology

2.2 Objectives of course

The B.Sc Medical Microbiology course covers a broad range of topics relating to medicine and health issues. It is a 4year course which gives particular emphasis on practical training and developing transferable skills that will be invaluable in a wide range of professional settings. The course starts with human anatomy, physiology and the foundations of chemistry and leads the students' right up to the cutting- edge research questions in the final year.

1. Acquisition of adequate theoretical and practical knowledge of foundation in the basic medical subjects.
2. Aware of the principle underlying the organization of a clinical laboratory.
3. Able to do routine and special investigative procedures pertaining to medical microbiology laboratory practice.
4. Provide a good theoretical and practical education for who plan to work within the field of medical microbiology.
5. Develop knowledge and skill in accordance with the society's demand in medical microbiology.
6. Qualify the students for official approval as medical microbiologist.
7. Able to operate and maintain all equipments used in microbiology laboratory.
8. Able to establish and manage a clinical or research laboratory.

9. Acquisition of moral and ethical codes and conduct of professional practice in a dedicated manner with the patient welfare as the primary responsibility.

2.3 Medium of instruction:

The medium of instruction for the course shall be English.

2.4 Course outline

The course consists of mainly:

Theory classes

Includes scheduled teaching in lectures, tutorials, assignments & seminars to ensure active participation of the students.

Practical classes:

Laboratory based practical work is an integral part of the course which is inevitable for the careers in hospital clinical laboratories and research field.

Clinical Laboratory Posting:

Clinical laboratory is the place where materials of human origin and/or human healthcare environment are collected, stored, processed and/or analyzed and reported for the purpose of screening, diagnosis, prognosis, treatment or prevention of diseases and for clinical research. Regular clinical posting is unavoidable for developing qualified laboratory personnel who is competent for interpreting and reporting.

Project:

A laboratory based project work is included in the final year which gives the students an idea to document the work and its results in a thesis like report. The principal aim is to make the students independent as a future graduate in the research field. The supervising teacher gives guidance for carrying out project work

2.5 Duration

The duration of the course shall be four academic years.

2.6 Syllabus

I BSc. Medical Microbiology

- Paper I- Anatomy
- Paper II- Physiology
- Paper III- General Biochemistry
- Paper IV- Special English, Health Education, Community Medicine, Biostatistics and Computer Application
- Paper V- General Methodology

II BSc. Medical Microbiology

- Paper VI- General Microbiology
- Paper VII- Parasitology and Entomology
- Paper VIII- Methodology and Instrumentation

III BSc. Medical Microbiology

- Paper IX- Systematic Bacteriology
- Paper X- Immunology, Immunochemistry and Serology – I

IV BSc. Medical Microbiology

- Paper XI- Virology and Mycology
- Paper XII- Immunology, Immunochemistry and Serology – II
- Paper XIII- Clinical Microbiology
  Paper XIV-Project

The concept of health care counseling shall be incorporated in all relevant areas.

2.7 Total number of hours

The student have to attend a minimum of 240 working days in an academic year. No. of hours is as mentioned in the syllabus

2.8 Branches if any with definition

See clause 2.10

2.9 Teaching learning methods

Lecture and practical classes, Regular clinical laboratory posting to pick up practical skill and practice techniques on laboratory responsibility and supervision.Students should present seminars in various clinical subjects in Medical Microbiology to attain presentation skill.

2.10 Content of each subject in each year

SYLLABUS

1. Content of each subject in each year

I BSc. Medical Microbiology

Paper I –Anatomy

- **Introduction**: to the course and the subject of anatomy.
- **Orientation to**: the systems of the body; anatomical terminologies; learning methodologies in anatomy; embryology.
- **Microscopic Anatomy**: structure of cell, types of tissues, cell cycle and division, introduction to genetics.
- **Respiratory system**: embryology, parts of the system, gross and microscopic structures of the lungs, applied aspects.
- **Circulatory system**: embryology with emphasis on foetal circulation, parts, microscopic anatomy of vessels, gross and microscopic structure of heart, blood vessels- both arteries and veins in relation, attachment and relations of major vessels to the heart, distribution and tributaries of major arteries and veins, applied aspects.
- **Digestive system**: embryology, location, parts and functions of the system, gross and microscopic structure, location of digestive glands- gross and microscopic structure, applied aspects.

- **Urogenital system**: a) Reproductive system: developmental considerations of the male and female systems, gross and microscopic parts of both male and female systems, primary and secondary sexual organs and function, applied aspects.

  b) Urinary system: developmental considerations, parts- gross: kidney in detail- gross and microscopic structure, applied aspects.

- **Musculoskeletal systems**: classification, location of the bones and muscles in the body, muscle attachment to bones – only brief description, gross features of bones and parts, microscopic features of muscle and bone, joints, classification, bones involved, movements and muscles that produce movements, applied aspects.

- **Nervous systems**: developmental considerations, parts and division into central nervous system, peripheral nervous system, autonomic nervous system, gross and microscopy of brain and spinal cord, naming of cranial nerves, functions served by each of them, brief account of degeneration and regeneration of nerves, applied aspects.

- **Endocrinology**: brief outline of location and function of the endocrine glands.

- **Special senses**: eye, ear, nose, tongue.

- **Miscellaneous topics**: skin and appendages, microscopic structure, general considerations of upper limb, lower limb, head and neck, thoracic and abdominal cavities, pelvic cavity.

Practical

- Demonstration of systems of the body.
- Microscopic demonstration for histology
- Osteology demonstration

- Practical and applied anatomy demonstration depending on the topic.

Recommended books

- B.D. Chaurasia's Human Anatomy (vol 1- 3)

  Regional and Applied

- Gray's Anatomy for students

  Richard. L. Drake, A. Wayne Vogl, Adam W.M. Mitchell (reference)

- Text book of Human Histology with colour Atlas

  Inderbir Singh

PAPER II- PHYSIOLOGY

1. **BLOOD** : Composition of blood; Structure and function of RBC; WBC and platelets; blood coagulation; blood groups; Reticuloendothelial system; Structure and function of spleen; Jaundice and Anaemia

2. **CARDIOVASCULAR SYSTEM**: Structure and properties of cardiac muscles; nerve supply to heart; Structure and function of blood vessel; Cardiac cycle and pressure changes; heart sounds; cardiac output; heart rate; cardiovascular reflexes; Blood pressure; haemorrhage; ECG; changes in muscular exercises

3. **RESPIRATORY SYSTEM** : Physiological anatomy; mechanism of respiration; lung volume and capacities; breath sound; types of respiration; artificial respiration; transport of blood gases; regulation of respiration; hypoxia; effects of exercise

4**. DIGESTIVE SYSTEM**: Digestion in mouth, stomach and intestine; digestion of carbohydrates, fats and protein; control of secretion; absorption; structure and function of liver

5. **EXCRETORY SYSTEM**: Gross and minute structure of kidney; OTR; formation of urine; tubular function, renal function test, micturition

6**. MUSCLE**: Structure of muscles; muscle contraction

7. **NERVOUS SYSTEM**: Structure of neurons; nerve impulse; structure and function of spinal cord; spinal reflexes and pathways; structure and functions of different parts of brain; autonomic nervous system; neurohumoral transmission; CSF; Physiology of touch , smell, taste, hearing and vision; reflexes

8. **ENDOCRINE SYSTEM**: Structure and functions of pituitary, thyroid, adrenal glands; Thymus and pancreas

9. **REPRODUCTIVE SYSTEM**: Sex determination and development; puberty; structure and function of male and female reproductive system; pregnancy; parturition; lactation; foetal circulation

10. **SKIN AND TEMPERATURE REGULATION**.

PRACTICALS

1. RBC count

2. WBC count

3. Differential count

4. Haemoglobin estimation

5. ESR determination

6. Blood grouping

7. Bleeding and clotting time

8. Osmotic fragility test

9. PCV, Red cell indices

10. Measurement of blood pressure in man

RECOMMENDED BOOKS

1. Essentials of Medical Physiology

K. Sembulingam, Prema sembulingam

2. Concise Medical Physiology

Sujith K chaudari

3. Ganong's Review of Medical Physiology(reference)

4. Textbook of Medical Physiology : Arthur C Guyton, John E Hall

Paper III- General Biochemistry

- **Introduction**: chemistry of living things and cell- eukaryotic and prokaryotic cell structure, cell organelles and biological membranes- its structure and functions.
- **Carbohydrates**: Classification, Chemistry, Properties of mono- , di- and polysaccharides.
- **Proteins:** Classification of proteins and amino acids, their properties, structure of proteins and amino acids, plasma proteins, general reactions of amino acids.
- **Lipids:** classification of lipids, properties of fatty acids, phospholipids and sterols, lipoproteins- characterisation, classification
- **Enzymes**: general properties and classification.
- **Vitamins and minerals:** fat soluble and water soluble, chemistry, functions, dietary sources, daily requirements, deficiency manifestations, minerals and trace elements.
- **Nucleic acids**: chemistry of purines and pyrimidines, nucleosides, nucleotides, nucleic acids- DNA, RNA, difference between DNA and RNA types of RNA, DNA
- **Physical chemistry**: methods of expressing concentration, law of mass action and chemical equilibrium, solubility products, colloidal state and Donnan membrane equilibrium, diffusion, dialysis, osmosis, reverse osmosis, surface tension, viscosity and absorption, indicators

- **Acids and bases**: definition, ionization of acids, ionic product of water, H^+ concentration, strong acids and bases, weak acids and bases, strength of acids, titration curves of acids and bases, Properties of commonly used acids and bases- sulphuric acid, nitric acid, phosphoric acid, HCl, acetic acid, KOH, NaOH, sodium carbonate,ammonia
- **P^H** – definition, P^H scale, calculation of P^H, Hendreson- Hasselback equations, P^H measurement
- **Buffers**- definition, components, mechanism of action, buffer capacity, pK of buffers, preparation of buffers, buffers in biological system, commonly used buffers in lab
- **Properties of commonly used salts**- ammonium chloride, ammonium sulphate, sodium sulphate, sodium chloride, zinc sulphate.
- **Properties of chloroform, formalin**
    - **Properties of commonly used solvents**- methanol, ethanol, xylene, benzene, acetone

Practical

- Reactions of carbohydrates
- Monosaccharide-glucose, fructose, galactose
- Disaccharides- maltose, lactose, sucrose
- Polysaccharides- starch, dextrin
- Qualitative analysis of unknown carbohydrate solution
- Reactions of proteins: colour reaction and precipitation reaction,
- reaction of albumin, peptones, gelatine and casein.

- Qualitative analysis of unknown protein solution

- Reactions of lipids
    - Qualitative tests- solubility tests

      Acrolein test

      Test for fatty acids

      Tests for unsaturation of fatty acids

Recommended books:

- Text book of Biochemistry for medical students

  D M Vasudevan, S Sreekumari & Vaidyanathan Kannan

- Biochemistry by U. Satyanarayana

  U. Satyanarayana and U. Chakrapani

Harper's Illustrated Biochemistry(reference)

- Robert Murray, Victor Rodwell, David Bender, Kathleen M Botham, P. Anthony Weil, Peter J Kennelly

Paper IV: Special English, Health Education, Community Medicine, Biostatistics and Computer Application

SPECIAL ENGLISH:

Students of professional courses have a tendency to neglect the language content. The paper 'Special English' is introduced with a view to developing the communication skill of the participants in written and spoken English. The emphasis will be fully on the practical aspects of language use, and not on literature. The course content may also help the students to take up overseas examinations in English proficiency.

Writing skills

Composition- Writing effective paragraphs, ability to describe objects, people, process and ideas and narrating incidents- note taking / making summaries. Writing advertisements, preparing laboratory reports.

Letter writing- business letters- applying for a job, for higher studies, preparing curriculum vitae, subscribing to a journal, requesting for information, ordering equipments, letters to the editor.

Foundation English

Revision of basic grammar, common errors in English, language functions in medical writing- use of passive voice particularly in scientific and official writing, expressing obligation- use of must, should, ought; expression of possibility, likelihood, certainty; degrees of comparison, expression of necessity-must, have to, need to; expression of generalisation and emphasis

Vocabulary

The language of doctor and patient. General description and medical description; medical terminology- roots, prefixes and suffixes, medical abbreviations.

Spoken English

A course in speech in conversation with focus not on phonetics and grammar but on developing their ability to talk about object and experiences around them.

Fixing appointments- getting information- Managing medical representatives- telephoning in hospital. The object is to provide practice in fluent conversation. Focus is on specific expression, typical of familiar situations in medical practice. Technique of discussion at medical meeting, making presentation.

COMMUNITY MEDICINE

- General concepts of health and diseases with reference to natural history of diseases with pre pathogenic and pathogenic phases. The role of socio economic and cultural environment in health and diseases. Epidemiology and scope.
- Public health administration-an overall view of the health administration setup-central and state level
- The national health programme. Highlighting the role of social, economic and cultural factors in the implementation of the national programme.
- Health problems of vulnerable groups-pregnant and lactating women, infants and school going children, occupational groups, geriatrics.
- Occupational health- definition, scope, occupational diseases, prevention of occupational diseases and hazards.
- Social security and other measures for the protection of occupational hazards accidents and diseases. Details of compensation acts.
- Family planning- objectives of national family planning methods – a general idea of advantages and disadvantages of the method.
- Mental health- community aspects, role of physiotherapists, therapists in mental health problems such as mental retardation.
- Communicable diseases- an overall view, classification, principal mode of classification, role of insects and other vectors.
- International health agencies

HEALTH EDUCATION

1. Review of benefits, values, norms, habits and taboos among practices. More in human groups and their importance; learning and change process.

2. Review of concepts on perception, attitudes, socialisation process, learning and theories of learning, social change and change process, motivation, needs and drives.

3. Principles and process of communication

4. Health education philosophy- main principles and objectives. Health education vs. propagandas

5. Methods and tools of health education- individual and group method. A critical evaluation of theories, tool and health education

6. The role of profession in health education – role of other personal in health education, coordination and corporation in health education with other members of the health team.

7. Elements of planning a health education programme.

BIO STATISTICS

- Introduction
- Measures of central tendency
- Statistical surveys and representation of data.
- Measures of dispersion and variability
- Significance tests 't' test, 'z' test and χ^2 values
- Probability and statistical inference
- Application of statistical principles in biology

COMPUTER APPLICATION

- History of computers, types of computer generation, digital computer organisation, binary number system
- Algorithm flow chart

- Operating system, dos commands
- Programming in basics
- Application of computer in health education, training and administration

Additional topics

- Multi terminal operational system(UNIX/ZENIX)
- MS windows(graphical user interphase)
- DBMS (DBASE<FoxBASR etc)
- Word processing professional(word state up to ver 7/MS word)
- Spread sheet application like LOTUS 123/EXCEL
- Introduction to computer programming application software

PAPER V: GENERAL METHODOLOGY

BIOCHEMISTRY

- Units of measurements
- Laboratory glassware,- glass- composition, properties, varieties, grades of glasswares. General laboratory wares- glass and plastic- PVC, poly carbonate, Teflon etc. Advantages and disadvantages of various disposable lab ware.
- Cleaning of laboratory glassware, preparation of cleaning solution for glassware, cleaning and care of laboratory glassware and instruments.
- Reagent grades, storage and handling of chemicals and reagents
- Laboratory safety- general principles, laboratory hazards and safety measures, Universal safety precautions
- First aid in laboratory accidents

- Calibration of pipettes and other volumetric apparatuses
- Methods of measuring liquids, weighing solids
- Volumetric analysis, preparations of standard solutions and reagents
- Primary standard chemicals and secondary standard chemicals
- Preparations of normal solutions, percentage solutions, molar and molal solutions
- Dilutions of solutions- inter conversion of concentrations- normal, molar, molal and percentage solutions. Preparation of reagents for various biochemical analysis, indicators
- Familiarisation with Kipp's apparatus, blowing of glass capillary tube and pasture pipettes.
- Preparation and storage of distilled, double distilled and deionised water.

PRACTICALS

- Measurement of liquids and weighing solids
- Calibration of pipettes and other volumetric glasses
- Titration of acids and bases
- Preparation of cleaning solution
- Preparation of buffer solution, pH measurement

PATHOLOGY

- General introduction to clinical laboratory procedures
- Organisation of clinical laboratory, its layout and design
- Labelling and registering of specimens

- Analytical balance- parts, principle of use and care
- General knowledge of the principles, use and care of the hot air ovens, incubator, vortex mixer, magnetic stirrer, desiccators, water bath, refrigerators, centrifuges
- Anti-coagulants and preservatives- preparation of anti-coagulant bottles for blood collection for different parameters. urine preservatives, capillary and venous blood collection, preparation of thin blood smear and bone marrow smear, preparation of normal saline
- General introduction to quality control in different laboratory , record keeping
- Organisation of the cytopathology laboratory, design and layout of a histopathology laboratory, essential components in histopathology laboratory, their use and care
- Principle of action, use and preparation of various buffers for haematologically use

PRACTICALS

- Blood collection
- Blood smear preparation
- Urine analysis

MICROBIOLOGY

- Evolution and history of microbiology
- Classification of microorganisms, morphology of bacteria
- Bacterial growth and nutrition

- Microscopy: parts , use and care of microscopes- optical microscopy, phase contrast microscope, dark field microscope, interference microscope, polarisation microscope and electron microscope
- Staining methods
- Sterilisation and disinfection-methods of sterilisation, disinfectants- different types, methods, applications and cleaning
- Cleaning and preparation of syringes and needles for sterilisation/ autoclaving.
- Culture media- introduction, classification, preparation
- Methods of cultivation of bacteria, anaerobic culture methods
- Safety precautions in microbiology laboratory design, specifications, microbiology laboratory associated infection, safety codes of laboratory practice
- Care and managements of laboratory animals- the basic knowledge of the feeding, housing, breeding, care and immunisation of following animals- rabbit, mouse, guinea pig, rat, sheep, fowl, monkey, etc., collection of blood samples, killing of animals and post-mortem examination, different route of animal inoculation

PRACTICALS

- Students should be familiar with the use of simple autoclave, incubators, hot air oven, water bath and steamer
- Staining methods- simple and differential
- Hanging drop examination for motility.
- Preparation of culture media, demonstration of culture methods
- Handling of laboratory animals

Recommended books:

- Prescott / Harley Klein's Microbiology

  Joanne Willey, Linda Sherwood, Chris Woolverton

- Mackie and McCartney Practical Medical Microbiology

  J. Gerald Collee, Andrew G. Fraser, Barrie P Marmion, Anthony Simmons

- Microbiology: An Introduction

  Gerard J. Tortora Berdell R. Funke, Christine L. Case

- Microbiology : Principles and Exploration

  Jacquelyn G. Black

- Ananthanarayanan and Paniker's Text book of Microbiology

  R. Ananthanarayan and C. K. Jayaram Paniker

- Medical Laboratory Technology (Vol 1-3)

  Kanai L. Mukherjee

- Text book of Medical Laboratory Technology by Praful B Godkar, Darshan P Godkar

  Practical Clinical Biochemistry - Harold Varley (Author)

II BSc. Medical Microbiology

Paper VI: General Microbiology

- **Introduction**: historical review and scope of microbiology

- **Morphology of bacteria**: structure of a typical bacterial cell- size, shape, arrangement ; ultra structures- flagella, pili, cell-wall, cytoplasmic membrane, spore, capsule, prokaryotic cellular reserve materials, spherolplasts, protoplasts,

  L –forms; bacterial reproduction

- **Growth and nutrition of bacteria**: nutrient requirements- carbon, nitrogen, hydrogen, oxygen, sulphur, phosphorous and other elements; growth factor; nutritional classification; bacterial growth curve; measurement of growth- cell mass, total count, viable count; cell constituents; physical factors influencing growth- oxygen, carbon dioxide, pH, osmotic pressure, light, mechanical and sonic stress

- **Microbial metabolism:** oxidation reduction reactions, the respiratory chain, energy production by anaerobic process, energy production by aerobic process, the mechanism of ATP synthesis.

- **Culture media**- common ingredients, classification, preparation, important culture media used in microbiology

- **Cultivation of micro organisms**- Different types of culture methods - streak, stroke, lawn, stab, pour plate etc. Anaerobic culture methods

- **Control of micro organisms**: sterilization and disinfection- definition, physical methods, different methods of sterilization by dry heat and moist heat; factors influencing, mechanism of killing, radiations used- ionising and non ionising, mode of action, filtration- types of filters- techniques of filtration, Chemical methods- definitions- characteristics of an ideal chemical agent, examples and modes of action of important disinfectants, Testing of disinfectants- In- use test, Rideal- walker test or Chick- Martin test for phenol co- efficient determination, antiseptics and sterilants.

- **Antibiotics**- characteristics, mechanism of action of commonly used antibiotics, methods of testing antibiotic sensitivity, evaluation of anti microbial potency, , drug resistance

- **Identification of bacteria**- depending upon morphology of bacteria, staining reactions, cultural characters, fermentation and other biochemical reactions. Principle of biochemical tests

- **Bacterial taxonomy**- nomenclature, systems of classification, phylogenetic, adansonian, genetic and intra species classification: Bergey's manual

- **Microbial genetics**: prokaryotic genome, brief account of DNA replication, transcription, translation, bacterial variation- mutation and mutants, transmission of genetic material- transformation, transduction, conjugation, transposable genetic elements, extra chromosomal genetic elements, molecular genetics

- **Role of micro organisms in industry**- vinegar production, alcohol fermentation, antibiotic production

- **Micro organisms in soil and their role in agriculture**: nitrogen cycle, carbon cycle , sulphur cycle

Practical

- Staining methods- simple staining, grams staining, capsule staining, volutin granule staining, spore staining, spirochete staining, AFB staining
- Methods of motility testing: hanging drop preparation
- Preparation of common culture media
- Sterilization methods
- Culture methods
- Study of culture characters of bacteria
- Biochemical test used for identification of bacteria
- Anaerobic culture methods

Recommended books

- Prescott / Harley Klein's Microbiology

Joanne Willey, Linda Sherwood, Chris Woolverton

- Mackie and McCartney Practical Medical Microbiology

  J. Gerald Collee, Andrew G. Fraser, Barrie P Marmion, Anthony Simmons

- Microbiology: An Introduction

  Gerard J. Tortora Berdell R. Funke, Christine L. Case

- Microbiology : Principles and Exploration :

  Jacquelyn G. Black

- General Microbiology :

  Roger Y. Stanier

- Microbiology :

  Michael J Pelczar

- Ananthanarayanan and Paniker's Text book of Microbiology

  R. Ananthanarayan and C. K. Jayaram Paniker

Paper VII- Parasitology and Entomology

<u>Parasitology</u>

- An elementary study of types of animal associations- types of parasites, classification of protozoa and helminthes
- An elementary knowledge of the structure , life history of parasites belonging to the following genera with reference to forms seen in human pathological material, and the methods used to identify them
  - Protozoa: Entamoeba, Dientamoeba, Iodamoeba, Acaanthamoeba and Naegleria

- Flagellates- Giardia, Trichomonas, Chilomastix, Enteromonas, Trypanosome, Leishmania
- Sporozoa- Plasmodium, Isospora, Eimeria, Balantidium, Toxoplasma, Pneumocystis, Cryptosporidium, Babesia
- Platyhelminthes- Diphyllobothrium, sparganum, Taenia, Echinococcus, Hymenolepis, Schistosoma, Fasciola, Fasciolopsis, Clonorchis, Paragonimus.
- Nemathelminthes- Ascaris, Ancylostoma, Necator, Strongyloides, Trichinella, Trichuris, Enterobius, Wuchereria, Brugia, Loa loa, Onchocerca, Dracunculus

- Collection and preservation of specimens for parasitological examinations, preservation of specimens of parasitic egg and embryos, preserving fluids, transport of specimen
- Detection of intestinal parasites- detection and identification of amoeba and other intestinal protozoans and parasites
- Examination of blood parasites: thick and thin smear preparations for malaria and filarial, other parasites and concentration methods
- Examination of biopsy material and other body fluid s: brief account of spleen puncture for diagnosis of kala azar, bone marrow biopsy, lymph node puncture, and skin biopsy, for parasites, examination of vaginal swabs

Entomology

- Introduction: classification of arthropods of public health importance
- Role of arthropods in the transmission of diseases
- Mosquito: morphology, life cycle, binomics and public health importance of anopheles, culex, aedes, and mansonia
- Insecticides used for the control of arthropods of public health importance

- Mosquito borne diseases and their control
- Phebotomus (sand fly)- morphology, life history, public health importance and control
- House fly: morphology, life history, disease relationship, public health importance and control
- Black fly (Simulium)- morphology, life history, public health importance and control
- Tse –tse fly (Glossina)- morphology, life cycle and public health importance
- Fleas- morphology, life cycle, disease transmitted and control
- Louse: morphology, life cycle, disease transmitted and control
- Bed bug- morphology, life cycle, disease transmitted and control
- Ticks- morphology, life cycle, disease transmitted and control
- Sarcoptes scabei- morphology, life cycle, disease transmitted and control
- Cyclops- morphology, life cycle, disease transmitted and control

Practical

- Identification of parasites: microscopic and macroscopic
- Identification of parasitic cysts, ova, larva etc.
- Laboratory diagnostic procedures in parasitic diseases
- Collection ,transport and processing of specimens
- Microscopy, macroscopy and cultivation procedures
- Identification of arthropods of medical importance dealt in theory

- Collection and preservation of arthropods

Recommended Books

1. Medical Parasitology

R L Ichhpujani, Rajesh Bhatia

2. Medical Parasitology

C. K Jayaram Paniker

3. Text Book of Medical Parasitology

P Chakraborty

4. Parasitology :

K.D. Chatterjee

5. Topley and Wilson's Microbiology and Microbial infections, Parasitology

6. District Laboratory Practice in Tropical Countries, Part I

MonicaCheesbrough

PAPER VIII - METHODOLOGY AND INSTRUMENTATION

- **Study of common equipments used in microbiology lab**: Incubators, Hot air oven, Autoclave and other sterilizers, Cold room ,anaerobic cultivation apparatus, Refrigerator and Biological safety Cabinet.
- **Microscopy** : Principle, resolving power, magnification, types of microscope, staining and specimen preparation for electron microscope
- **Centrifugation** : Principle, RCF, RPM, types of centrifuges, different types of rotors, ultra centrifugation, Density gradient centrifugation, determination of molecular weight using centrifugation, cell fractionation by differential

centrifugation, isopycnic centrifugation or equilibrium isodensity centrifugation, density gradient materials, applications of centrifugation

- **Chromatography** : general principle, partition and adsorption principle- Paper, column, Thin layer, Gas- liquid, Ion – exchange, molecular exclusion, Affinity, HPLC, Two dimensional and Reverse phase chromatography
- **Electrophoresis:** Theory, factors affecting electrophoretic mobility, principle, technique and application of paper electrophoresis, gel electrophoresis- types of gels, solubilizers, tracking dyes, PAGE, applications of gel electrophoresis, immune electrophoresis and iso electric focussing
- **Enzyme Linked Immunosorbent Assay**: Principle, different methods- competitive and non competitive, common enzyme labels and substrates, application
- **Radioisotopic techniques**- Radio Immuno Assay: Principle, different methods labelled probes and applications
- **Colorimetry and spectrophotometry :** properties of light, electro magnetic spectrum, mono and poly chromatic light, absorption and transmission of light, Principle of colorimetry, Beer- Lamberts law, selection of filters, atomic absorption spectrophotometer, flourimeter, nephelometry and turbidometry.
- **pH meters and pH measurements:** parts , technique and application

Practical

- Familiarisation of common equipments used in microbiology lab
- Familiarisation of microscopes
- Familiarisation of centrifuges
- Demonstration of chromatography

- Demonstration of Electrophoresis
- Demonstration of ELISA
- Demonstration of RIA
- Use of colorimeter, spectrophotometer, pH meter
- Use of automated machines

Recommended books:

- Text book of Biochemistry for medical students

  D M Vasudevan, S Sreekumari & Vaidyanathan Kannan
- Biochemistry by U. Satyanarayana :

  U. Satyanarayana and U. Chakrapani
- Harper's Illustrated Biochemistry :

  Robert Murray, Victor Rodwell, David Bender, Kathleen M Botham, P. Anthony Weil, Peter J Kennelly
- Practical Clinial Biochemistry :

  Harold Varley

III BSc. Medical Microbiology

PAPER IX- SYSTEMATIC BACTERIOLOGY

Systematic study of different bacterial species of medical importance: their morphology, staining reaction, cultural characters, biochemical reaction, antigenic characters and toxins, pathogenecity and pathogenesis, methods of isolation and identification of

1. Staphylococci
2. Streptococci

3. Pneumococci

4. Neisseria

5. Anaerobic cocci

6. Corynaebacterium

7. Bacillus

8. Clostridium

9. Nonsporing anaerobes

10. Enterobacteriaceae : E.coli, Klebsiella, Proteus, Salmonella, Shigella etc.

11. Vibrio

12. Pseudomonas

13. Yersinia, Pasturella, Francisella

14. Haemophilus

15. Bordetella

16. Brucella

17. Mycobacterium tuberculosis,

18. Non tuberculous mycobacteria

19. M. leprae

20. Spirochaete: Treponema, Borrelia and Leptospira

21. Mycoplasma

22. Actinomycetes, Nocardia

23. Miscellaneous bacteria : Listeria, Alcaligenes faecalis ,Erisephalothrix, Campylobacter, Helicobacter, Legionella

24. Rickettsiae

25. Chlamydiae

PRACTICALS

Study of cultural characters and biochemical characters of common bacteria

Recommended books

- Ananathanarayan and Paniker's Text Book of Microbiology

R. Ananthanarayan & C.K. Jayaram Paniker

2. Jawetz, Melnick & adelberg's Medical Microbiology

Geo. Brooks, Karen C. Caroll, Janet Butel, Stephen Morse

3. Medical Microbiology

David Greenwood, Richard C. B. Slack, John F. Peutherer, Michael R. Barer

4. Mackie & McCartney Practical Medical Microbiology

J. Gerald Collee, Andrew G. Fraser, Barrie P. Marmion, Anthony Simmons

5. Topley and Wilson's Microbiology and Microbial infections

S. Peter Borriello, Patrick R. Murray, Guido Funke

6. Infectious diseases

Sherwood L. Gorbach, John G. Bartlett, Neil R. Blacklow

- Bergey's Manual of Systematic Bacteriology

PAPER X- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY I

- **Introduction to immunology**, Infection: definition, classification, sources, methods of transmission, factors predisposing to microbial pathogenicity, types of infectious diseases

- **Immunity** : Mechanisms of innate immunity , acquired immunity, Measurement of immunity, Herd immunity
- **Vaccines** : types, properties of good vaccine, complications associated with vaccination
- **Antigens :** Determinants of antigenicity, biological classes
- **Antibodies :** Structure, classes, abnormal immunoglobulins, immunoglobulin specificities
- **Antigen- Antibody reaction**: General features, measurement, serological reactions
- **Complement system**: General properties, components, complement activation; classical,alternative and lectin pathways; Regulation, Biological effects, quantitation, biosynthesis and deficiency of complement system
- **Structure and functions of the immune system**: Central and peripheral lymphoid organs, Cells of the lympho reticular system, T and B cell maturation, Null cells, MHC and MHC restriction
- **Immune response** : Humoral immune response, production of antibody, Monoclonal antibodies, Factors influencing, Cellular immune response, Cytokines, Transfer fator, Immunological tolerance, Theories of immune response

PRACTICALS

- Serological reactions
- Precipitation reaction
- Agglutination reaction
- Coombs test
- ELISA

- Immunochromatographic tests

Recommended Books

- Kuby Immunology :

  Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis Kuby

- Immunology :

  David Male, Jonathan Brostoff, David Roth and Ivan Roitt

- Medical Immunology :

  Tristram G. Parslow, Daniel P. Stites, Abba I. Terr, John B. Imboden

- Ananathanarayan and Paniker's Text Book of Microbiology

  R. Ananthanarayan & C.K. Jayaram Paniker

- Roitt's Essential Immunology

  Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt

PAPER XI- VIROLOGY AND MYCOLOGY

VIROLOGY

- **General properties of viruses** : Morphology, chemical properties, viral multiplication, viral haemagglutination, cultivation and detection of growth, Viral assay, viral genetics, classification and nomenclature

- **Viral infection**: pathogenesis, lab diagnosis, immunoprophylaxis and chemoprophylaxis of viral infections

- **Bacteriophages** : morphology, life cycle, phage assay and typing, Bacteriocins

- Systematic study of important viruses, their biological properties, pathogenecity, techniques for isolation and identification from clinical specimens, antiviral agents and immunoprophylaxis of

- Pox virus
- Herpes virus
- Adenovirus
- Picorna virus
- Orthomyxo virus
- Paramyxovirus
- Arbovirus
- Rhabdovirus
- Hepatitis virus
- Oncogenic virus
- HIV-AIDS
- Miscellaneous virus – Papova,Parvo,Rubella ,Slow virus diseases,Viral haemorrhagic fever,corona virus –SARS

13.Emerging viral infections in Kerala

MYCOLOGY

- **Introduction to mycology**: Taxonomy of fungi, Classification of fungi, general properties, techniques used in examination of fungal cultures, maintenance of fungal cultures
- **Morphological features** : Cell structures, reproduction, growth and nutrition, fungal dimorphism
- Superficial mycoses- Malassezia infections, Tinea nigra, Piedra, Dermatophytoses

2. Cutaneous and subcutaneous mycoses- Mycetoma, Sporotrichosis, Chromoblastomycosis, Rhinosporidiosis, Lobomycosis

3. Yeast of medical importance: Candida, Cryptococcus, Geotrichum, Trichosporon, Torulopsis

4. Systemic mycoses- Histoplasmosis, Blastomycosis, Coccidioidomycosis, Paracoccidioidomycosis

5. Opportunistic mycoses- Candidiasis, Cryptococcosis, Pneumocystosis, Penicilliosis, Aspergillosis,

6. Mycotoxins –mycotoxicoses and Mycetismus

PRACTICALS

- Egg inoculation methods
- Serological techniques
- Culture and study of common fungal pathogens

Recommended Books

1.Ananathanarayan and Paniker's Text Book of Microbiology

R. Ananthanarayan & C.K. Jayaram Paniker

2.Field's Virology :

Bernard N. Fields, David M. Knipe, Peter M. Howley, Robert M. Chanock, Thomas P. Monath, Joseph L. Melnick, Bernard Roizman, Stephen E. Straus

3.Topley & Wilson's Microbiology and Microbial infections: Virology

4. Medical Microbiology :

Greenwood, Richard C. B. Slack, John F. Peutherer, Michael R. Barer

5. Jawetz, Melnick & adelberg's Medical Microbiology

Geo. Brooks, Karen C. Caroll, Janet Butel, Stephen Mors

6. Medical Virology : D. E. White, Frank J. Fenner

7. Infectious diseases : Sherwood L. Gorbach, John G. Bartlett, Neil R. Blacklow

8. Text Book of Medical Mycology : Jagdish Chander

9. Topley & Wilson's Microbiology and Microbial infections: Medical Mycology

10. Medical Mycology : John Willard Rippon

PAPER XII- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY -II

- **Immunodeficiency diseases** : Primary and secondary immunodeficiencies
- **Hypersensitivity** : Classification

  Type I: Mechanism, types, components, mediators, detection and treatment

  Type II: Mechanism and types

  Type III: Mechanism and types

  Type IV: mechanism, Types and Detection
- **Autoimmunity** : Mechanism, classification and pathogenesis of autoimmune diseases
- **Immunology of transplantation and malignancy** : Classification of transplant, allograft reaction, histocompatibility antigens, graft versus host reaction, Tumor antigen , Immune response, immunological surveillance and immunotherapy of cancer
- **Immunohaematology** : ABO, Rh and other blood group systems; medical application, Complication following transfusion, prevention of Rh isoimmunisation, blood component therapy, blood groups and diseases.
- **Immunology of AIDS**
- **Immunity to bacterial, viral, fungal and parasitic infections**

PRACTICALS

- Screening and diagnostic serological tests for bacterial, viral and fungal infection

- Test for demonstration of auto antibodies
- Delayed hypersensitivity test

Recommended Books

1. Kuby Immunology :

   Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis Kuby

2. Immunology :

   David Male, Jonathan Brostoff, David Roth and Ivan Roitt

3. Medical Immunology :

   Tristram G. Parslow, Daniel P. Stites, Abba I. Terr, John B. Imboden

4. Ananathanarayan and Paniker's Text Book of Microbiology

   R. Ananthanarayan & C.K. Jayaram Paniker

5. Roitt's Essential Immunology:

   Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt

PAPER XIII -CLINICAL MICROBIOLOGY

1. Normal microbial flora of the human body

2. Epidemiology of communicable diseases: host, reservoir, carrier, vector; Infective agents- modes and routes of infection, pathogenesis and symptoms, control and eradications of infectious diseases

3. Laboratory safety in microbiology: general principle, level of safety cabinets

4. General principle in specimen collection, transport, storage and isolation of pathogen

5. Detailed procedure in laboratory diagnosis of diseases of multiple microbial etiology and anitimicrobial agents used in the cases of

- Urinary Tract Infection

- Upper and Lower respiratory tract infection
- Gastrointestinal tract infection and food poisoning
- Genital tract infection
- Infections of the eye and ear
- PUO
- Meningitis
- Skin and soft tissue infection
- Pyogenic infection
- Septicemia
- Nosocomial infection
- Diagnosis of Body fluids

6. Laboratory procedures in the diagnosis of viral infections

7. Laboratory diagnosis of fungal infections

8. Quality control in microbiology laboratory

9. Molecular techniques in microbiology

10. Bacteriology of air, water and milk

11. Sterility test

12. Automation in microbiology

PRACTICALS

- Laboratory investigation on clinical specimens
- Tests for detection of coliforms in water sample

Recommended Books

- Koneman's Color Atlas and text book of Diagnostic Microbiology
- Bailey & Scott's Daignostic Microbiology
- Mackie & McCartney practical Medical Microbiology
- Microbiology in Clinical Practice- D. C. Shanson

No. of hours per subject

Paper	Subject	Hours of instruction
I	**Anatomy**	
	Theory	160
	Practical	120
	Tutorial	20
	Total	300
II	**Physiology**	
	Theory	160
	Practical	120
	Tutorial	20
	Total	300
III	**General Biochemistry**	
	Theory	160
	Practical	120
	Tutorial	20
	Total	300
IV	**Special English, Health Education, Community Medicine, Biostatistics and**	

	Computer Application	
	Internal assessment	
	Theory	200
	Practical	40
	Total	240
V	**General Methodology**	
	Theory	160
	Practical	120
	Tutorial	20
	Total	300

- **II BSc. Medical Microbiology**

Paper	**Subject**	**Hours of instruction**
VI	**General Microbiology**	
	Theory	240
	Practical	240
	Tutorial	40
	Total	520
VII	**Parasitology and Entomology**	
	Theory	240
	Practical	120
	Tutorial	40
	Total	400
VIII	**Methodology and Instrumentation**	
	Theory	240
	Practical	120

	Tutorial	10
	Total	370
	Hospital posting	150

- **III BSc. Medical Microbiology**

Paper	Subject	Hours of instruction
IX	**Systematic Bacteriology**	
	Theory	300
	Practical	360
	Tutorial	40
	Total	700
X	**Immunology, Immunochemistry and Serology - I**	
	Theory	280
	Practical	120
	Tutorial	40
	Total	440
	Hospital posting	300

- **IV BSc. Medical Microbiology**

Paper	Subject	Duration
XI	**Virology and Mycology**	
	Theory	160
	Practical	120
	Tutorial	20
	Total	300

XII	**Immunology, Immunochemistry and Serology - II** Theory Practical Tutorial Total	 160 120 20 300
XIII	**Clinical Microbiology** Theory Practical Tutorial Total	 160 210 20 390
	Hospital posting & Project	450

Practical training given in labs

- **I BSc. Medical Microbiology**

Paper	Subject	Hours of instruction
I	**Anatomy** Practical	 120
II	**Physiology** Practical	 120
III	**General Biochemistry** Practical	 120
IV	**Special English, Health Education, Community Medicine, Biostatistics and Computer Application** Internal assessment	

	Practical	40
V	**General Methodology** Practical	120

II BSc. Medical Microbiology

Paper	Subject	Hours of instruction
VI	**General Microbiology** Practical	240
VII	**Parasitology and Entomology** Practical	120
VIII	**Methodology and Instrumentation** Practical	120
	Hospital posting	150

- **III BSc. Medical Microbiology**

Paper	Subject	Hours of instruction
IX	**Systematic Bacteriology** Practical	360
X	**Immunology, Immunochemistry and Serology - I** Practical	120
	Hospital posting	300

- **IV BSc. Medical Microbiology**

Paper	Subject	Duration
XI	**Virology and Mycology** Practical	120
XII	**Immunology, Immunochemistry and Serology - II** Practical	120
XIII	**Clinical Microbiology** Practical	210
	Hospital posting & Project	450

2.11 No: of hours per subject

As given in curriculum

2.12 Practical training

As given in curriculum

2.13 Records

Records should be maintained for each exercise done in the practical laboratory for every subject and duly signed by the supervising teacher should be submitted at the time of University practical examination.

2.14 Dissertation:

Not Applicable

2.15 Speciality training if any

Not Applicable

2.16 Project work to be done if any

As stipulated by HOD from time to time

2.17 Any other requirements [CME, Paper Publishing etc.]

To present at least one paper in state/national conference [desirable]

2.18 Prescribed/recommended textbooks for each subject

As given under clause "Content of eachsubject in each year "

2.19 Reference books

Paper I –Anatomy

- B.D. Chaurasia's Human Anatomy (vol 1- 3)- Regional and Applied
- Text book of Human Histology with colour Atlas- Inderbir Singh

PAPER II- PHYSIOLOGY

- Essentials of Medical Physiology

  K. Sembulingam, Prema sembulingam

- Concise Medical Physiology

  Sujith K chaudari

Paper III- General Biochemistry

- Text book of Biochemistry for medical students

  D M Vasudevan, S Sreekumari & Vaidyanathan Kannan

- Biochemistry by U. Satyanarayana

  U. Satyanarayana and U. Chakrapani

PAPER V: GENERAL METHODOLOGY

- Ananthanarayanan and Paniker's Text book of Microbiology

  R. Ananthanarayan and C. K. Jayaram Paniker

- Medical Laboratory Technology (Vol 1-3) Kanai L. Mukherjee
- Practical Clinical Biochemistry - Harold Varley (Author)

Paper VI: General Microbiology

- Microbiology -Michael J Pelczar :
- Ananthanarayanan and Paniker's Text book of Microbiology

  R. Ananthanarayan and C. K. Jayaram Paniker

Paper VII- Parasitology and Entomology

- Medical Parasitology - C. K Jayaram Paniker
- Parasitology - K.D. Chatterjee

PAPER VIII - METHODOLOGY AND INSTRUMENTATION

- Practical Clinial Biochemistry : Harold Varley

PAPER IX- SYSTEMATIC BACTERIOLOGY

- Ananathanarayan and Paniker's Text Book of Microbiology

R. Ananthanarayan & C.K. Jayaram Paniker

- Jawetz, Melnick & adelberg's Medical Microbiology

  Geo. Brooks, Karen C. Caroll, Janet Butel, Stephen Morse

- Medical Microbiology

  David Greenwood, Richard C. B. Slack, John F. Peutherer, Michael R. Barer

PAPER X- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY I

- Kuby Immunology :

  Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis Kuby

- Ananathanarayan and Paniker's Text Book of Microbiology

  R. Ananthanarayan & C.K. Jayaram Paniker

PAPER XI- VIROLOGY AND MYCOLOGY

- Ananathanarayan and Paniker's Text Book of Microbiology

R. Ananthanarayan & C.K. Jayaram Paniker

- Jawetz, Melnick & adelberg's Medical Microbiology

Geo. Brooks, Karen C. Caroll, Janet Butel, Stephen Mors

- 3. Text Book of Medical Mycology :

Jagdish Chander

PAPER XII- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY –II

- Kuby Immunology :

Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis Kuby

- Ananathanarayan and Paniker's Text Book of Microbiology

R. Ananthanarayan & C.K. Jayaram Paniker

PAPER XIII -CLINICAL MICROBIOLOGY

- Bailey & Scott's Daignostic Microbiology
- Mackie & McCartney practical Medical Microbiology
- Microbiology in Clinical Practice- D. C. Shanson

Reference books

Paper I –Anatomy

- Gray's Anatomy for students

Richard. L. Drake, A. Wayne Vogl, Adam W.M. Mitchell

PAPER II- PHYSIOLOGY

- Ganong's Review of Medical Physiology
- Textbook of Medical Physiology : Arthur C Guyton, John E Hall

Paper III- General Biochemistry

- Harper's Illustrated Biochemistry

Robert Murray, Victor Rodwell, David Bender, Kathleen M Botham, P. Anthony Weil, Peter J Kennelly

PAPER V: GENERAL METHODOLOGY

- Mackie and McCartney Practical Medical Microbiology

  J. Gerald Collee, Andrew G. Fraser, Barrie P Marmion, Anthony Simmons

- Microbiology: An Introduction

  Gerard J. Tortora Berdell R. Funke, Christine L. Case

- Microbiology : Principles and Exploration

  Jacquelyn G. Black

Paper VI: General Microbiology

- Prescott / Harley Klein's Microbiology

  Joanne Willey, Linda Sherwood, Chris Woolverton

- Mackie and McCartney Practical Medical Microbiology

  J. Gerald Collee, Andrew G. Fraser, Barrie P Marmion, Anthony Simmons

- Microbiology: An Introduction

  Gerard J. Tortora Berdell R. Funke, Christine L. Case

- Microbiology : Principles and Exploration :

  Jacquelyn G. Black

Paper VII- Parasitology and Entomology

- Topley and Wilson's Microbiology and Microbial infections, Parasitology
- District Laboratory Practice in Tropical Countries, Part I

  MonicaCheesbrough

PAPER VIII - METHODOLOGY AND INSTRUMENTATION

- Harper's Illustrated Biochemistry :

  Robert Murray, Victor Rodwell, David Bender, Kathleen M Botham, P. Anthony Weil, Peter J Kennelly

PAPER IX- SYSTEMATIC BACTERIOLOGY

- Topley and Wilson's Microbiology and Microbial infections

  S. Peter Borriello, Patrick R. Murray, Guido Funke

- Infectious diseases- Sherwood L. Gorbach, John G. Bartlett, Neil R. Blacklow
- Bergey's Manual of Systematic Bacteriology

PAPER X- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY I

- Roitt's Essential Immunology

  Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt

PAPER XI- VIROLOGY AND MYCOLOGY

- Topley & Wilson's Microbiology and Microbial infections: Virology
- Medical Microbiology :

  Greenwood, Richard C. B. Slack, John F. Peutherer, Michael R. Barer

- Topley & Wilson's Microbiology and Microbial infections: Medical Mycology
- Medical Mycology : John Willard Rippon

PAPER XII- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY –II

- Roitt's Essential Immunology:

Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt

PAPER XIII -CLINICAL MICROBIOLOGY

- Koneman's Color Atlas and text book of Diagnostic Microbiology

2.20 Journals

As decided by the concerned faculties/HoD

2.21 Logbook

To be maintained for all academic work which shall be counter signed by concerned HOD

3. EXAMINATIONS

3.1 Eligibility to appear for exams [including Supplementary]

The minimum requirement of internal assessment for appearing University examination shall be 50% for theory and practical separaterly.

No candidates shall be admitted to any year of BSc. Medical Microbiology Examinations unless he/she has a minimum of 80% attendance

3.2 Schedule of Regular/Supplementary exams

Regular university examinations will be conducted at the end of each academic year and supplementary examinations will be conducted within six months after the publication of the result of regular examination.

3.3 Scheme of examination showing maximum marks and minimum marks

Scheme of examination

I BSc. Medical Microbiology Examination

Paper	Subject	Duration	Maximum	Min. for pass
I	**Anatomy**			
	Theory	3 hrs	50	25
	Practical	3 hrs	50	25
	Oral		50	-

	Internal assessment (theory)		25	12.5
	Internal assessment (practical)		25	12.5
	Total Marks		200	100
II	**Physiology**			
	Theory	3 hrs	50	25
	Practical	3 hrs	50	25
	Oral		50	-
	Internal assessment (theory)		25	12.5
	Internal assessment (practical)		25	12.5
	Total Marks		200	100
III	**General Biochemistry**			
	Theory	3 hrs	50	25
	Practical	3 hrs	50	25
	Oral		50	-
	Internal assessment (theory)		25	12.5
	Internal assessment (practical)		25	12.5
	Total Marks		200	100
IV	**Special English, Health Education, Community Medicine, Biostatistics and Computer Application**			
	Internal assessment (Theory and practical)		100	50
V	**General Methodology**			
	Theory	3 hrs	100	50
	Internal assessment		50	25
	Total Marks		150	75

II BSc. Medical Microbiology Examination

Paper	Subject	Duration	Maximum	Min. for pass
VI	**General Microbiology**			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3days	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	25	12.5
	Internal assessment (practical)	-	25	12.5
	Total Marks		300	150
VII	**Parasitology and Entomology**			
	Theory	3 hrs	100	50
	Practical	6 hrs	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	25	12.5
	Internal assessment (practical)	-	25	12.5
	Total Marks		300	150
VIII	**Methodology and Instrumentation**			
	Theory	3 hrs	100	50
	Internal assessment	-	50	25
	Total Marks	-	150	75

Practical examination for papers VI & VII shall be conducted simultaneously during single 6 hrs x 3days span by a single team of examiners.

III BSc. Medical Microbiology Examination

Paper	Subject	Duration	Maximum	Min. for pass
IX	**Systematic Bacteriology**			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	25	12.5
	Internal assessment (practical)	-	25	12.5
	Total Marks		300	150
X	**Immunology, Immunochemistry and Serology - I**			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	25	12.5
	Internal assessment (practical)	-	25	12.5
	Total Marks		300	150

Practical examination for papers IX & X shall be conducted simultaneously during single 6 hrs x 3 days span of time by a single team of examiners.

IV BSc. Medical Microbiology Examination

Paper	Subject	Duration	Maximum	Min. for pass
XI	**Virology and Mycology**			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	50	25
	Internal assessment (practical)	-	300	150
	Total Marks			
XII	**Immunology, Immunochemistry and Serology - II**			
	Theory	3 hrs	100	50
	Practical	6 hrs	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	25	12.5
	Internal assessment (practical)	-	25	12.5
	Total Marks		300	150
XIII	**Clinical Microbiology**			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	50	-
	Internal assessment (theory)	-	25	12.5
	Internal assessment (practical)	-	25	12.5
	Total Marks		300	150
XIV	Project (Internal Assessment)		50	25

Practical examination for papers XI & XIII shall be conducted simultaneously during single 6 hrs x 3 days span of time by a single team of examiners.

3.4 Papers in each year

Papers in each year

I BSc. Medical Microbiology

- Paper I- Anatomy
- Paper II- Physiology
- Paper III- General Biochemistry
- Paper IV- Special English, Health Education, Community Medicine, Biostatistics and Computer Application
- Paper V- General Methodology

II BSc. Medical Microbiology

- Paper VI- General Microbiology
- Paper VII- Parasitology and Entomology
- Paper VIII- Methodology and Instrumentation

III BSc. Medical Microbiology

- Paper IX- Systematic Bacteriology
- Paper X- Immunology, Immunochemistry and Serology – I

IV BSc. Medical Microbiology

- Paper XI- Virology and Mycology
- Paper XII- Immunology, Immunochemistry and Serology – II
- Paper XIII- Clinical Microbiology

Paper XIV-Project

Details of theory exams

- **Question paper setters**

  Question paper setters shall be posted from among the qualified teachers as per norms of Kerala University of Health and Allied Sciences.

- **Question paper pattern**
- **Total marks- 100 Time- 3 hrs**

Q1. Essay- 2 no. s x 15 marks = 30 marks

Q2. Brief essay- 2 no. s x 10 marks = 20 marks

Q3. Short answers- 6 no. s x 5 marks = 30 marks

Q4. comment on-10 nos x 2 marks= 20 marks

- **Total marks- 50 Time- 3 hrs**

Q1. Essay- 2 no. x 10 marks = 20 marks

Q2. - Short answers 2 no. x 5 marks = 10 marks

Q3. -comment on 10no. s x 2marks = 20 marks

Theory paper valuation

As per KUHS norms

3.5 Details of theory exams

As given in clause 3.3 "scheme of examination"

3.6 Model question paper for each subject with question paper pattern

I BSc. Medical Microbiology

Paper I- Anatomy

- **Total marks- 50 Time- 3 hrs**

QI. Essay- 2 no. x 10 marks = 20 marks

1. Define epithelium. Describe its functions and structure . Classify epithelium giving suitable examples.
2. Name the parts of the Urinary system and describe in detail the kidney

QII. - Short answers 2 no. x 5 marks = 10 marks

3. Name the parts of female reproductive system. Describe in detail the uterus.

4. Name the endocrine glands. Describe in detail the pituitary gland and thyroid gland.

QIII. -comment on 10no. s x 2marks = 20 marks

5. Sessmoid bones
6. Connective tissue cells
7. Islets of Langerhans
8. Spermatic cord
9. Parts of Respiratory system
10. Structure of heart
11. Location of Digestive glands
12. Peripheral Nervous system
13. Tongue
14. Microscopic structure of skin

Paper II- Physiology

Total marks- 50 **Time- 3 hrs**

QI. Essay- 2 no. x 10 marks = 20 marks

1. Define Cardiac cycle. Give the normal value of duration of one Cardiac cycle . Explain the events occurring during the cardiac cycle.
2. Define Spermatogenesis. Explain the steps of spermatogenesis. Add a note on factors influencing Spermatogenesis.

QII. - Short answers 2 no. x 5 marks = 10 marks

3. Explain neural regulation of respiration.
4. Explain the steps of urine formation

QIII. -comment on 10no. s x 2marks = 20 marks

5. Properties of Cardiac Muscle
6. Endocrine functions of kidney

7. Sarcomere
8. Chloride shift
9. Webers test
10. Functions of saliva
11. Erythroblastosis foetalis
12. Muscle contraction
13. Structure of neurons
14. Temperature Regulation

Paper III- General Biochemistry

- **Total marks- 50** **Time- 3 hrs**

QI. Essay- 2 no. x 10 marks = 20 marks

1. Define Lipids. Classify lipids giving examples of each class
2. Write in detail about the sources, RDA, functions and deficiency of iron. Add a note on iron absorption.

QII. - Short answers 2 no. x 5 marks = 10 marks

3. Essential amino acids
4. Law of mass action

QIII. -comment on 10no. s x 2marks = 20 marks

5. Bicarbonate buffer
6. Structure of eukaryotic cell
7. Disaccharides
8. Hendreson- Hasselback equation
9. Zinc sulphate
10. Nyctalopia
11. Structure of t RNA

12. Formaline
13. Xylene
14. Indicators

Paper V- General Methodology

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Define culture media. Write an essay on different culture media.
2. Organisation and essential components of Clinical laboratory.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Calibration of Pipettes and volumetric apparatuses
4. Write in detail on cleaning and care of laboratory glassware.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Autoclave
6. Preparation of standard solution
7. First aid in laboratory accidents
8. Analytical balance
9. Bacterial Growth Curve
10. Different routes of animal inoculation

QIV. comment on- 10 nos x 2 marks= 20 marks

11. Thin blood smear
12. Gram staining
13. Universal safety precautions
14. Labelling and registering of specimens
15. Anticoagulants

16. properties of buffer
17. Capillary blood collection
18. Quality Control
19. Volumteric Analysis
20. Phase contrast Microscope

II BSc. Medical Microbiology

Paper VI- General Microbiology

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Describe the structure of a typical bacterial cell.
2. Define sterilization. Discuss the methods of sterlization by heat.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Write briefly about the anaerobic culture methods.
4. Describe briefly about phylogenetic classification of bacteria.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Transduction
6. Differential stain
7. Koch's postulates
8. Kirby- bauer method
9. Testing of disinfectants
10. Demonstration of motility

QIV. comment on- 10 nos x 2 marks= 20 marks

11. phototrophs
12. enrichment media

13. catalase test

14. streak culture

15. vinegar production
16. Nitrogen cycle
17. juping gene
18. Electron transport chain
19. Cellwall synthesis inhibitors
20. Codons

Paper VII- Parasitology and Entomology

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Define the morphology and life cycle of Wuchereria bancrofti. Discuss the clinical manifestations and laboratory diagnosis of lymphatic fiariasis.
2. Discuss on the morphology and life cycle of mosquito. Enumerate mosquito borne diseases and their control.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Explain briefly on different techniques used for preservation of stool for parasitic examinations.
4. Explain the role of arthropods in transmission of diseases.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Echinococcosis
6. Enterobius vermicularis
7. Morphology and public health significance of Xenopsylla cheopis

8. Fasciola hepatica
9. Amoebic dysentery
10. Ancylostoma duodenale

QIV. comment on- 10 nos x 2 marks= 20 marks

11. LD bodies
12. Louse
13. Hermaphrodite
14. Life cycle of Plasmodium
15. Commensalism
16. Insecticides
17. Mechanical transmission
18. Cyclops
19. Auto infection
20. NIH swab

Paper VIII- Methodology and Instrumentation

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Describe the principle, types and application of ELISA.
2. What is the principle of electrophoresis? Discuss on factors influencing electrophoretic mobility. Add a note on PAGE.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Describe on the principle and application of spectrophotometry.

4. Give an account of different types of centrifuges.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. RIA
6. Anaerobic cultivation apparatus
7. Ion exchange chromatography
8. Iso electric focussing
9. HPLC
10. Immuno electrophoresis

QIV. comment on- 10 nos x 2 marks= 20 marks

11. Application of centrifuges
12. rotors
13. Types of gels
14. Solubilizers
15. Errors in paper chromatography
16. Beer –Lambert's Law
17. Partition coefficient
18. Resolving power
19. Cold room
20. pH meter

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Paper IX- Systematic Bacteriology

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Describe the morphology, pathogenesis, clinical features and laboratory diagnosis of Corynebacterium diphtheriae.
2. Explain the pathogenesis, clinical features and laboratory diagnosis of gonorrhea.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Enumerate the medically important spirochetes. Explain the laboratory diagnosis of syphilis.
4. Explain the pathogenesis and laboratory diagnosis of enteric fever.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. satellitism
6. Botulism
7. Bacillary dysentery
8. Q fever
9. Halophilic vibrios
10. Travellers diarrhea

QIV. comment on- 10 nos x 2 marks= 20 marks

11. psittacosis
12. Coagulase test
13. Bacitracin sensitivity test
14. Photochromogens

15. Milk ring test
16. Lepromin test
17. BCG
18. Wool sorters disease
19. Whooping cough
20. Blue pus

Paper X- Immunology, Immunochemistry and Serology – I

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Define immune response. Discuss on primary and secondary immune response. Add a note on production of antibodies.
2. Define immunity. Mention different types of immunity and explain in detail about mechanism of innate immunity.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Define antibody and explain the structure of immunoglobulins.
4. Define agglutination reaction. Discuss the principle and application of agglutination reactions.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Vaccines
6. Sources of transmission of infections
7. Cytokines
8. ELISA
9. MHC

10. T cell maturation

QIV. comment on- 10 nos x 2 marks= 20 marks

11. Monoclonal antibodies
12. Macrophages
13. Side chain theory
14. NK cells
15. T independent antigens
16. Zoonotic diseases
17. CIE
18. Adjuvant
19. Lectin Pathway
20. Lymph node

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Paper XI- Virology and Mycology

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Discuss the structure, antigenic variation, pathogenesis and clinical features of influenza virus.
2. Classify Dermatophytes. Give an account of infections caused by them. Add a note on laboratory diagnosis.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Draw diagram and explain the structure of HIV. Explain in detail the method used for diagnosis of HIV infection.

4. Enumerate opportunistic mycoses. Describe the clinical features and laboratory identification of candidiasis.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Define bacteriophage and explain lytic cycle
6. Arboviral infections in India
7. Mycetoma
8. Morphological classification of fungi
9. Histoplasmosis capsulati
10. Viral multiplication

QIV. comment on- 10 nos x 2 marks= 20 marks

11. Polio vaccine
12. Mycotoxins
13. Kopliks spots
14. Infectious hepatitis
15. Piedra
16. Oncogenic viruses
17. Penicilliosis marneffei
18. Prions
19. Woods lamp examination
20. Thermal dimorphism

Paper XII- Immunology, Immunochemistry and Serology – II

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Define Hypersensitivity. Discuss the mechanism of delayed type hypersensitivity. Add a note on the diagnostic tests based on delayed type hypersensitivity.
2. What are immunodeficiency diseases? Classify them with examples. Discuss the diseases due to humoral immune deficiency.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Define transplantation. Describe the different types of grafts. Discuss the mechanism of host versus graft reaction.
4. Define AIDS. Discuss in detail the modes of transmission, immunopathology, and stages of AIDS.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Auto immune disorders of Thyroid gland
6. Hemolytic disease of new born
7. Immunity to fungal infections
8. Types of transplants
9. Type I hypersensitivity
10. Immunotherapy of cancer

QIV. comment on- 10 nos x 2 marks= 20 marks

11. Di George syndrome
12. Serum sickness
13. Blood component therapy
14. SLE
15. Tumor antigens
16. Blood groups and diseases
17. Western Blot

18. ABO blood group system
19. MLR
20. Complications following transfusion

Paper XIII- Clinical Microbiology

- **Total marks- 100** **Time- 3 hrs**

QI. Essay- 2 no. s x 15 marks = 30 marks

1. Enumerate the organisms causing acute diarrhoeal diseases. Write briefly on the laboratory diagnosis of cholera.
2. Define nosocomial infections. Write briefly on the factors which contribute to post operative wound infections, common organisms causing it and its laboratory diagnosis.

QII. Brief essay- 2 no. s x 10 marks = 20 marks

3. Mention the organism causing diphtheria. Describe the laboratory diagnosis of diphtheria.
4. Enumerate the organisms causing urinary tract infection. Describe the collection, transport and processing of urine samples in a routine bacteriology laboratory.

QIII. Short answers- 6 no. s x 5 marks = 30 marks

5. Primary cell culture
6. VDRL test
7. Neonatal meningitis
8. Serological tests used in HIV infection
9. Presumptive coliform test
10. Quality control in antibiotic sensitivity test

QIV. comment on- 10 nos x 2 marks= 20 marks

11. Normal flora of skin
12. Vectors
13. safety cabinets
14. Concentration methods for sputum sample
15. PUO
16. Slide culture
17. PCR
18. Air sampling methods
19. Sterility test
20. Automation in Microbiology

3.7 Internal assessment component

Internal assessment marks shall be awarded to the candidates in each paper as detailed in the scheme of examinations. The award shall be on the basis of the assessment made by the teachers from the candidate's performances in the

- Three sessional examinations evenly placed and conducted by the department of which the third one is university model and is mandatory and average of two best performances shall be taken into consideration,
- Seminars, assignments, attendance, laboratory work and record work during the course of study.
- The marks secured by the candidates in each paper shall be forwarded to the University at the end of the course for the University examinations. The candidates who failed in the University Examinations will be allowed a separate internal assessment for both theory and practical

- The class average of internal assessment marks of the whole class should not exceed 75% of maximum marks for regular examination and 80% for supplementary examination both in theory and practical examination.

3.8 Details of practical/clinical practicum exams

I BS.c Medical Microbilogy Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
I	**Anatomy**			
	Practical	3 hrs	50	25
	Oral		50	--
II	**Physiology**			
	Practical	3 hrs	50	25
	Oral		50	--
III	**General Biochemistry**			
	Practical	3 hrs	50	25
	Oral		50	--

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Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
VI	**General Microbiology**			
	Practical	6 hrs x 3days	100	50
	Oral		50	--

VII	**Paracytology and Entomology** Practical Oral	6 hrs	100 50	50 --

III. B.Sc Medical Microbiology Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
IX	**Systematic Bacteriology** Practical Oral	6 hrsx 3days	100 50	50 --
X	**Immunology, Immunochemistry and serology-I** Practical Oral	6 hrsx3days	100 50	50 --

IV. B.Sc Medical Microbiology Examination

Paper	Subject	Duration	Max. Marks	Min for Pass
XI	**Virology and Mycology**			
	Practical	6 hrsx 3days	100	50
	Oral		50	--
XII	**Immunology, Immuno Chemistry and Serology-II**			
	Practical	6 hrs	100	50
	Oral		50	--
XIII	Clinical Microbiology			
	Practical	6hrsx3days	100	50
	Oral		50	--

3.9 Number of examiners needed (Internal & External) and their qualifications

The examiner should be an Assistant Professor or above with MSc. Medical Microbiology and minimum 5 years Post PG teaching experience in the concerned subject. The evaluator should be an Assistant Professor or above with MSc. Medical Microbiology and minimum 5 years Post PG teaching experience.

Details of viva: division of marks

Details of viva: division of marks

I BSc. Medical Microbiology Examination

Paper	Subject	Maximum	Min. for pass
I	**Anatomy** Oral	50	-
II	**Physiology** Oral	50	-
III	**General Biochemistry** Oral	50	-

II BSc. Medical Microbiology Examination

Paper	Subject	Maximum	Min. for pass
VI	**General Microbiology** Oral	50	-
VII	**Parasitology and Entomology** Oral	50	-

Practical examination for papers VI & VII shall be conducted simultaneously during single 6 hrsx3days span by a single team of examiners.

III BSc. Medical Microbiology Examination

Paper	Subject	Maximum	Min. for pass
IX	**Systematic Bacteriology** Oral	50	-
X	**Immunology, Immunochemistry and Serology - I** Oral	50	-

Practical examination for papers IX & X shall be conducted simultaneously during single 6 hrs x 3 days span of time by a single team of examiners.

IV BSc. Medical Microbiology Examination

Paper	Subject	Maximum	Min. for pass
XI	**Virology and Mycology** Oral	50	-
XII	**Immunology, Immunochemistry and Serology - II** Oral	50	-
XIII	**Clinical Microbiology** Oral	50	-

4. INTERNSHIP

Not applicable

5. ANNEXURES

5.1 Check Lists for Monitoring: Log Book, Seminar Assessment etc. to be formulated by the curriculum committee of the concerned Institution