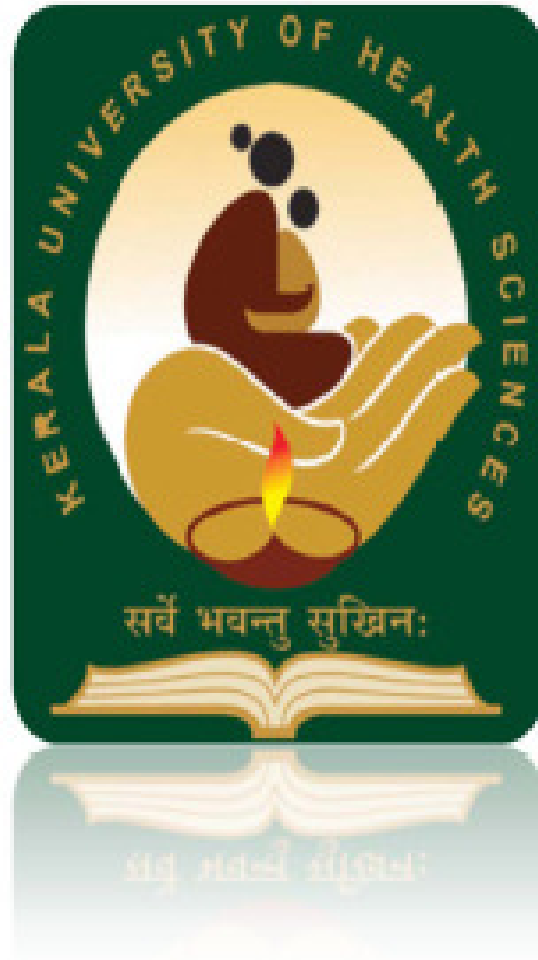


**KERALA UNIVERSITY OF HEALTH SCIENCES**

**THRISSUR – 680 596, KERALA**



***REGULATIONS, CURRICULUM AND SYLLABUS***

*of*

***B.Sc. MEDICAL MICROBIOLOGY***

# **CONTENTS**

1. Objectives of the course
2. Course description
3. Eligibility
4. Selection
5. Curriculum, Credit hours & Course Duration
6. Internal assessment marks
7. Attendance requirements:
8. University examinations:
9. Awarding degree
- 10 . Awarding rank
11. Scheme of examination
12. Criteria for pass
13. Conditions under which candidates are permitted to the next higher Class
14. Syllabus

## **1. Objectives of the course:**

At the end of the course the candidates shall be:

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

## 2. Course description:

The course of study enhances student's knowledge and skills in several major areas of medical microbiology. The degree in medical microbiology provides advanced skills to practising professionals in health administration, leadership, quality assurance and health informatics.

### Name of the course:

Name of the course shall be “**Bachelor of Science in Medical Microbiology**”.

## 3. Eligibility:

1. The candidate shall pass +2 or equivalent course recognised by the Kerala University of Health Sciences.
2. A minimum of 50% marks in Physics ,Chemistry and Biology taken together and 50% marks in Biology alone.

### 4. Selection:

The selection is based on the marks obtained for the qualifying examination and the quotas, reservation etc. shall be fixed by the Government from time to time.

### Course structure:

The course shall comprise of both theory and practical studies in different subjects of study included in the curriculum.

### Teaching /learning methods:

1. Lecture and practical classes.
2. Regular clinical laboratory posting to pick up practical skill and practice techniques on microbiology laboratory responsibility and supervision.
3. Students should present seminars in various clinical subjects in medical microbiology to attain presentation skill.

### Duration of the course:

The duration of the course shall be four academic years. Each academic year spread over a period of 240 working days. The students should undergo hospital laboratory

posting in reputed hospitals in second, third and fourth years during the period of the course.

5. Curriculum, Credit hours & Course Duration :

**I BSc. Medical Microbiology**

<b>Paper</b>	<b>Subject</b>	<b>Hours of instruction</b>
<b>I</b>	<b>Anatomy</b> Theory Practical Tutorial Total	 160 120 20 300
<b>II</b>	<b>Physiology</b> Theory Practical Tutorial Total	 160 120 20 300
<b>III</b>	<b>General Biochemistry</b> Theory Practical Tutorial Total	 160 120 20 300
<b>IV</b>	<b>Special English, Health Education, Community Medicine, Biostatistics and Computer Application</b> Internal assessment Theory Practical Total	  200 40 240
<b>V</b>	<b>General Methodology</b> Theory Practical Tutorial Total	 160 120 20 300

## II BSc. Medical Microbiology

<b>Paper</b>	<b>Subject</b>	<b>Hours of instruction</b>
<b>VI</b>	<b>General Microbiology</b>	
	Theory	240
	Practical	240
	Tutorial	40
	<b>Total</b>	<b>520</b>
<b>VII</b>	<b>Parasitology and Entomology</b>	
	Theory	240
	Practical	120
	Tutorial	40
	<b>Total</b>	<b>400</b>
<b>VIII</b>	<b>Methodology and Instrumentation</b>	
	Theory	240
	Practical	120
	Tutorial	10
	<b>Total</b>	<b>370</b>
	<b>Hospital posting</b>	<b>150</b>

## III BSc. Medical Microbiology

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

#### IV BSc. Medical Microbiology

<b>Paper</b>	<b>Subject</b>	<b>Duration</b>
<b>XI</b>	<b>Virology and Mycology</b> Theory Practical Tutorial Total	 160 120 20 300
<b>XII</b>	<b>Immunology, Immunochemistry and Serology - II</b> Theory Practical Tutorial Total	 160 120 20 300
<b>XIII</b>	<b>Clinical Microbiology</b> Theory Practical Tutorial Total	 160 210 20 390
	<b>Hospital posting &amp; Project</b>	450

#### 6. Internal assessment marks:

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 conducted by the department, 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 failed candidates will be allowed a separate internal assessment for both theory and practical.

#### 7. Attendance requirements:

It will be 80% with the onetime provision for condonation up to 10% on medical grounds. The condonation can be given by the head of the institution and should be ratified by the University.

## 8. University examinations:

There will be two examinations in a year -regular and supplementary, to be conducted by university from time to time.

There shall be University examinations at the end of every academic year as detailed in the scheme of examinations. Candidates who fail to secure a pass in any particular paper shall appear for that paper in order to secure a pass, in the supplementary examination.

The supplementary examinations shall be conducted within six months from the date of announcement of results. Candidates who fail in one or more papers in an examination need appear for only those papers for securing complete pass in the examination.

## 9. Awarding degree

Candidates who complete the course of study and secure a pass in all the papers of the four examinations shall be declared to have qualified for the degree. Candidates who qualify for the degree passing all the examinations within the course duration securing not less than 60 % to 75% marks of the aggregate shall be declared to have passed in the first class, and those who secure 75% marks or above of the aggregate of all University examinations and internal assessment taken together shall be declared to have passed in first class with distinction.

The final BSc. Medical Microbiology mark list will contain the following details

	Maximum marks	Minimum marks
Total marks awarded in the I BSc. Medical Microbiology		
Total marks awarded in the II BSc. Medical Microbiology		
Total marks awarded in the III BSc. Medical Microbiology		
Subject wise marks awarded in the IV BSc. Medical Microbiology		
Grand Total of I, II, III & IV BSc. Medical Microbiology		

## 10 . Awarding rank

The first class/ first class with distinction/ rank will be declared based on the total marks obtained for the first, second, third and fourth BSc. Medical microbiology examination provided the candidate has passed all the subjects in the first attempt.

A candidate passing a university examination in more than one attempt shall be placed in second class only irrespective of the percentage of the marks secured in the examination.

There shall be no provision for improvement of results in any examinations.

## 11. Scheme of examination

### **I BSc. Medical Microbiology Examination**

<b>Paper</b>	<b>Subject</b>	<b>Duration</b>	<b>Maximum</b>	<b>Min. for pass</b>
<b>I</b>	<b>Anatomy</b>			
	Theory	2 hrs	50	25
	Practical	3 hrs	50	25
	Oral		50	-
	Internal assessment		50	-
	Total Marks			200
<b>II</b>	<b>Physiology</b>			
	Theory	2 hrs	50	25
	Practical	3 hrs	50	25
	Oral		50	-
	Internal assessment		50	-
	Total Marks			200
<b>III</b>	<b>General Biochemistry</b>			
	Theory	2 hrs	50	25
	Practical	3 hrs	50	25
	Oral		50	-
	Internal assessment		50	-
	Total Marks			200
<b>IV</b>	<b>Special English, Health Education, Community Medicine, Biostatistics and Computer Application</b>			
	Internal assessment (Theory and practical)		100	50
	<b>General Methodology</b>			
	Theory	3 hrs	100	50
	Internal assessment		50	-
	Total Marks		150	75



## II BSc. Medical Microbiology Examination

Paper	Subject	Duration	Maximum	Min. for pass
<b>VI</b>	<b>General Microbiology</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	Total Marks	-	400	200
<b>VII</b>	<b>Parasitology and Entomology</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	Total Marks	-	400	200
<b>VIII</b>	<b>Methodology and Instrumentation</b>			
	Theory	3 hrs	100	50
	Internal assessment	-	50	-
	Total Marks	-	150	75

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

## III BSc. Medical Microbiology Examination

Paper	Subject	Duration	Maximum	Min. for pass
<b>IX</b>	<b>Systematic Bacteriology</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	Total Marks	-	400	200
<b>X</b>	<b>Immunology, Immunochemistry and Serology - I</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	Total Marks	-	400	200

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
<b>XI</b>	<b>Virology and Mycology</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	<b>Total Marks</b>	-	<b>400</b>	<b>200</b>
<b>XII</b>	<b>Immunology, Immunochemistry and Serology - II</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	<b>Total Marks</b>	-	<b>400</b>	<b>200</b>
<b>XIII</b>	<b>Clinical Microbiology</b>			
	Theory	3 hrs	100	50
	Practical	6 hrs x 3 days	100	50
	Oral	-	100	-
	Internal assessment	-	100	-
	<b>Total Marks</b>	-	<b>400</b>	<b>200</b>

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

#### Examiners

There shall be two examiners- one internal and one external. The external examiner should be a lecturer or above with MSc. Medical Microbiology and minimum three years teaching experience from other institutions in Kerala and outside Kerala.

#### Question paper setters

Question paper setters shall be posted from among the senior faculties of Kerala University of Health and Allied Sciences.

#### Question paper pattern

1. 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 no. s x 2 marks = 20 marks

2. Total marks- 50 Time- 2 hrs

Q1. Essay- 1 no. x 15 marks = 15 marks

Q2. Brief essay- 1 no. x 10 marks = 10 marks

Q3. Short answers- 3 no. s x 5 marks = 15 marks

Q4. Comment on- 5 no. s x 2 marks = 10 marks

### Theory paper valuation

The theory paper should be double valued by both external and internal examiners and there will be no revaluation.

## **12. Criteria for pass**

A candidate shall be declared as pass if he secures 50% of marks in each subject in theory and practical examinations separately. A candidate shall also secure a minimum aggregate of 50% marks in theory section which includes university theory examination and internal assessment and in the practical section a candidate shall secure 50% aggregate marks which include university practical, viva voce and internal assessments.

## **13. Conditions under which candidates are permitted to the next higher Class**

A candidate is not permitted to appear in the final year examination unless he or she clear all I<sup>st</sup>, II<sup>nd</sup>, and III<sup>rd</sup>, year B.Sc Medical Microbiology subjects. A candidate can however appear for second and third year B.Sc Medical Microbiology examination without passing previous examination.

## **14. Syllabus**

### **I BSc. Medical Microbiology**

#### **Paper I –Anatomy**

1. Introduction: to the course and the subject of anatomy.
2. Orientation to: the systems of the body; anatomical terminologies; learning methodologies in anatomy; embryology.
3. Microscopic Anatomy: structure of cell, types of tissues, cell cycle and division, introduction to genetics.
4. Respiratory system: embryology, parts of the system, gross and microscopic structures of the lungs, applied aspects.
5. 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.
6. Digestive system: embryology, location, parts and functions of the system, gross and microscopic structure, location of digestive glands- gross and microscopic structure, applied aspects.
7. 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.
8. 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.
9. 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.
10. Endocrinology: brief outline of location and function of the endocrine glands.
11. Special senses: eye, ear, nose, tongue.
12. Miscellaneous topics: skin and appendages, microscopic structure, general considerations of upper limb, lower limb, head and neck, thoracic and abdominal cavities, pelvic cavity.

### Practical

1. Demonstration of systems of the body.
2. Microscopic demonstration for histology
3. Osteology demonstration
4. Practical and applied anatomy demonstration depending on the topic.

### Recommended books

1. B.D. Chaurasia's Human Anatomy (vol 1- 3)  
Regional and Applied
2. Gray's Anatomy for students  
Richard. L. Drake, A. Wayne Vogl, Adam W.M. Mitchell
3. 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. Platelet count

5. Eosinophil count

6. Haemoglobin estimation

7. ESR determination

8. Fragility and blood groups

9. Bleeding and clotting time

10. Measurement of blood pressure in man

11. Respiratory movement

12. Methods of artificial respiration

13. TPR chart; Examination of sensory system; motor system; reflexes; cranial nerves

14. ECG

15. Cardiac efficiency test

## RECCOMENDED BOOKS

### 1. Essentials of Medical Physiology

K. Sembulingam, Prema sembulingam

### 2. Concise Medical Physiology

Sujith K chaudari

### 3. Ganong's Review of Medical Physiology

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

#### **Paper III- General Biochemistry**

1. **Introduction:** chemistry of living things and cell- eukaryotic and prokaryotic cell structure, cell organelles and biological membranes- its structure and functions.
2. Carbohydrates: Classification, Chemistry, Properties of mono- , di- and polysaccharides, Carbohydrate metabolism.
3. Proteins: Classification of proteins and amino acids, their properties, structure of proteins and amino acids, plasma proteins, general reactions of amino acids, lipoproteins- characterisation, classification.
4. Lipids: classification of lipids, properties of fatty acids, phospholipids and sterols, biosynthesis of lipids and lipid metabolism.
5. Enzymes: general properties, classification and clinical significance.
6. Vitamins and minerals: fat soluble and water soluble, chemistry, functions, dietary sources, daily requirements, deficiency manifestations, minerals and trace elements.
7. **Nucleic acids:** chemistry of purines and pyrimidines, nucleosides, nucleotides, nucleic acids- DNA, RNA, difference between DNA and RNA types of RNA, DNA
8. **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

1. Reactions of carbohydrates,: monosaccharide, disaccharides, polysaccharides, fructose, maltose, lactose, sucrose, starch, glycogen
2. Reactions of proteins: colour reaction and precipitation reaction, reaction of albumin, globulin, peptones, gelatine and casein.

#### Recommended books:

1. Text book of Biochemistry for medical students  
D M Vasudevan, S Sreekumari & Vaidyanathan Kannan
2. Biochemistry by U. Satyanarayana  
U. Satyanarayana and U. Chakrapani
3. Harper's Illustrated Biochemistry  
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 like the TOEFL.

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**

1. Introduction
2. Application of statistical principles in biology
3. Significance tests 'T' test,  $\chi^2$  to values
4. Probability and statistical inference
5. Statistical surveys and representation of data.

## **COMPUTER APPLICATION**

1. History of computers, types of computer generation, digital computer organisation, binary number system
2. Algorithm flow chart
3. Operating system, dos commands
4. Programming in basics
5. Application of computer in health education, training and administration

### **Additional topics**

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

## **PAPER V: GENERAL METHODOLOGY**

### **BIOCHEMISTRY**

1. Preparation of cleaning solution for glassware, cleaning and care of laboratory glassware and instruments.
2. Calibration of pipettes and other volumetric apparatuses
3. Methods of measuring liquids, weighing solids
4. Volumetric analysis, preparations of standard solutions and reagents
5. Familiarisation with Kipp's apparatus, blowing of glass capillary tube and pasture pipettes.
6. Storage and handling of dangerous chemicals and reagents to prevent accidents.
7. Immediate first-aid managements of minor accidents in the laboratory
8. Cleaning and preparation of syringes and needles for sterilisation, autoclaving
9. Labelling and registering of specimens
10. Anti-coagulants, preservatives and preparation of anti-coagulant bottles for blood collection for different parameters.

11. Preparation and storage of distilled, double distilled and deionised water
12. Expression of concentration solutions, properties of colloids, emulsion, partition, coefficient, absorption
13. pH and pH measurement

## **PATHOLOGY**

1. General introduction to clinical laboratory procedures
2. Organisation of clinical laboratory, its layout and design
3. Laboratory accidents and precautions, first aid in laboratory accidents
4. General laboratory glass wares, methods of production of chemically pure water
5. Analytical balance- parts, principle of use and care
6. Parts, use and care of microscope
7. General knowledge of the principles, use and care of the hot air ovens, water bath, refrigerators, centrifuges
8. Anti-Coagulants and their functions, capillary and venous blood collections, preparation of thin blood smear and bone marrow smear, preparation of normal saline
9. General introduction to quality control in different laboratory record keeping
10. Organisation of the cytopathology laboratory, design and layout of a histopathology laboratory, essential components in histopathology laboratory, their use and care
11. Principle parts and use electron microscope
12. Principle of action, use and preparation of various buffers for haematologically use

## **MICROBIOLOGY**

1. Evolution and history of microbiology
2. Classification of microorganisms, morphology of bacteria
3. Bacterial growth and nutrition
4. Microscopy: optical microscopy, phase contrast microscope, dark field microscope, interference microscope, polarisation microscope and electron microscope
5. Staining methods
6. Sterilisation and disinfection-methods of sterilisation, disinfectants- different types, methods and applications and cleaning
7. Preparation of glass wares
8. pH Measurements.
9. Culture media- introduction, classification, preparation
10. Methods of cultivation of bacteria, anaerobic culture methods

11. Safety precautions in microbiology laboratory design, specifications, microbiology laboratory associated infection, safety codes of laboratory practice

12. Care and managements of laboratory animals- the basic knowledge of the feeding, housing, breeding and care 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

13. Automation in microbiology laboratory

### PRACTICALS

1. Students should be familiar with the use of simple autoclave, incubators, hot air oven, water bath and steamer
2. Staining methods- simple and differential
3. Hanging drop examination for motility
4. Preparation of buffer solution, pH measurement.
5. Preparation of culture media, demonstration of culture methods
6. Handling of laboratory animals

### Recommended books:

1. Prescott / Harley Klein's Microbiology  
Joanne Willey, Linda Sherwood, Chris Woolverton
2. Mackie and McCartney Practical Medical Microbiology  
J. Gerald Collee, Andrew G. Fraser, Barrie P Marmion, Anthony Simmons
3. Microbiology: An Introduction  
Gerard J. Tortora Berdell R. Funke, Christine L. Case
4. Microbiology : Principles and Exploration  
Jacquelyn G. Black
5. Ananthanarayanan and Paniker's Text book of Microbiology  
R. Ananthanarayan and C. K. Jayaram Paniker
6. Medical Laboratory Technology (Vol 1-3)  
Kanai L. Mukherjee
7. Text book of Medical Laboratory Technology by Praful B Godkar, Darshan P Godkar
8. Practical Clinical Biochemistry  
Harold Varley (Author)

## II BSc. Medical Microbiology

### Paper VI: General Microbiology

1. Introduction: historical review and scope of microbiology
2. 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, spheroplasts, protoplasts, L-forms; bacterial reproduction
3. 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
4. Microbial metabolism: oxidation reduction reactions, the respiratory chain, energy production by anaerobic process, energy production by aerobic process, the mechanism of ATP synthesis.
5. Culture media- common ingredients, classification, preparation, important culture media used in microbiology
6. Cultivation of micro organisms- Different types of culture methods - streak, stroke, lawn, stab, pour plate etc. Anaerobic culture methods
7. 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.
8. Antibiotics- characteristics, mechanism of action of commonly used antibiotics, methods of testing antibiotic sensitivity, evaluation of anti microbial potency, , drug resistance
9. Identification of bacteria- depending upon morphology of bacteria, staining reactions, cultural characters, fermentation and other biochemical reactions. Principle of biochemical tests
10. Bacterial taxonomy- nomenclature, systems of classification, phylogenetic, adansonian, genetic and intra species classification: Bergey's manual

11. 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
12. Role of micro organisms in industry- vinegar production, alcohol fermentation, antibiotic production
13. 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

1. Prescott / Harley Klein's Microbiology  
Joanne Willey, Linda Sherwood, Chris Woolverton
2. Mackie and McCartney Practical Medical Microbiology  
J. Gerald Collee, Andrew G. Fraser, Barrie P Marmion, Anthony Simmons
3. Microbiology: An Introduction  
Gerard J. Tortora Berdell R. Funke, Christine L. Case
4. Microbiology : Principles and Exploration :  
Jacquelyn G. Black
5. General Microbiology :  
Roger Y. Stanier
6. Microbiology :  
Michael J Pelczar
7. Ananthanarayanan and Paniker's Text book of Microbiology  
R. Ananthanarayan and C. K. Jayaram Paniker

### **Paper VII- Parasitology and Entomology**

#### Parasitology

1. An elementary study of types of animal associations- types of parasites, classification of protozoa and helminthes

2. 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
  - a) Protozoa: Entamoeba, Dientamoeba, Iodamoeba, Acaanthamoeba and Naegleria
  - b) Flagellates- Giardia, Trichomonas, Chilomastix, Enteromonas, Trypanosome, Leishmania
  - c) Sporozoa- Plasmodium, Isospora, Eimeria, Balantidium, Toxoplasma, Pneumocystis, Cryptosporidium, Babesia
  - d) Platyhelminthes- Diphylobothrium, sparganum, Taenia, Echinococcus, Hymenolepis, Schistosoma, Fasciola, Fasciolopsis, Clonorchis, Paragonimus.
  - e) Nematelminthes- Ascaris, Ancylostoma, Necator, Strongyloides, Trichinella, Trichuris, Enterobius, Wuchereria, Brugia, Loa loa, Onchocerca, Dracunculus
3. Collection and preservation of specimens for parasitological examinations, preservation of specimens of parasitic egg and embryos, preserving fluids, transport of specimen
4. Detection of intestinal parasites- detection and identification of amoeba and other intestinal protozoans and parasites
5. Examination of blood parasites: thick and thin smear preparations for malaria and filarial, other parasites and concentration methods
6. 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

1. Introduction: classification of arthropods of public health importance
2. Role of arthropods in the transmission of diseases
3. Mosquito: morphology, life cycle, binomics and public health importance of anopheles, culex, aedes, and mansonina
4. Insecticides used for the control of arthropods of public health importance
5. Mosquito borne diseases and their control
6. Phebotomus (sand fly)- morphology, life history, public health importance and control
7. House fly: morphology, life history, disease relationship, public health importance and control
8. Black fly (Simulium)- morphology, life history, public health importance and control
9. Tse –tse fly (Glossina)- morphology, life cycle and public health importance
10. Fleas- morphology, life cycle, disease transmitted and control
11. Louse: morphology, life cycle, disease transmitted and control
12. Bed bug- morphology, life cycle, disease transmitted and control
13. Ticks- morphology, life cycle, disease transmitted and control
14. Sarcoptes scabei- morphology, life cycle, disease transmitted and control



## 15. Cyclops- morphology, life cycle, disease transmitted and control

### Practical

1. Identification of parasites: microscopic and macroscopic
2. Identification of parasitic cysts, ova, larva etc.
3. Laboratory diagnostic procedures in parasitic diseases
4. Collection ,transport and processing of specimens
5. Microscopy, macroscopy and cultivation procedures
6. Identification of arthropods of medical importance dealt in theory
7. 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

Monica Cheesbrough

## **PAPER VIII - METHODOLOGY AND INSTRUMENTATION**

1. Microbiology laboratory design, specification and safety precaution
2. Study of common equipments used in microbiology lab: Incubators, Hot air oven, Autoclave and other sterilizers, Cold room ,anaerobic cultivation apparatus
3. Microscopy : Principle, resolving power, magnification, types of microscope, staining and specimen preparation for electron microscope

4. Centrifugation : Principle, RCF, RPM, Differential centrifugation, Rate- Zonal centrifugation, Isopycnic centrifugation, Equilibrium, Isodensity centrifugation, Density gradient materials, Rotors- Fixed angle and swing out, zonal rotors, types of centrifuge- General purpose, high speed, ultra centrifuge, applications of centrifugation
5. Chromatography : Theory, partition coefficient, adsorption, Paper, Thin layer, Gas- liquid, Gel, Ion – exchange, Affinity, HPLC, Two dimensional and Reverse phase chromatography
6. Electrophoresis: Theory, factors affecting electrophoretic mobility, types of electrophoresis, isoelectric focussing, two dimensional electrophoresis
7. Enzyme Linked Immunosorbent Assay: Principle, competitive and non competitive, common enzyme labels and substrates, application
8. Radioisotopic techniques- Radio Immuno Assay: Principle and applications
9. Colorimetry and spectrophotometry : Principle and application
10. pH meters and pH measurements
11. Care and management of lab animals, common lab animals, methods of handling, immunisation and bleeding of animals
12. Automation in laboratory techniques

#### Practical

1. Familiarisation of common equipments used in microbiology lab
2. Familiarisation of microscopes
3. Familiarisation of centrifuges
4. Demonstration of chromatography
5. Demonstration of Electrophoresis
6. Demonstration of ELISA
7. Demonstration of RIA
8. Use of colorimeter, spectrophotometer, pH meter
9. Care and handling of lab animals
10. Use of automated machines

#### Recommended books:

1. Text book of Biochemistry for medical students

D M Vasudevan, S Sreekumari & Vaidyanathan Kannan

2. Biochemistry by U. Satyanarayana :  
U. Satyanarayana and U. Chakrapani
3. Harper's Illustrated Biochemistry :  
Robert Murray, Victor Rodwell, David Bender, Kathleen M Botham, P. Anthony Weil,  
Peter J Kennelly
4. Practical Clinical 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, pathogenicity 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

1. 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

8. Bergey's Manual of Systematic Bacteriology

**PAPER X- IMMUNOLOGY, IMMUNOCHEMISTRY AND SEROLOGY I**

1. Introduction to immunology, Infection: definition, classification, sources, methods of transmission, factors predisposing to microbial pathogenicity, types of infectious diseases
2. Immunity : Mechanisms of innate immunity , acquired immunity, Measurement of immunity, Herd immunity
3. Vaccines : types, properties of good vaccine, complications associated with vaccination
4. Antigens : Determinants of antigenicity, biological classes
5. Antibodies : Structure, classes, abnormal immunoglobulins, immunoglobulin specificities
6. Antigen- Antibody reaction: General features, measurement, serological reactions
7. Complement system: General properties, components, complement activation; classical, alternative and lectin pathways; Regulation, Biological effects, quantitation, biosynthesis and deficiency of complement system
8. 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

9. Immune response : Humoral immune response, production of antibody, Monoclonal antibodies, Factors influencing, Cellular immune response, Cytokines, Transfer factor, Immunological tolerance, Theories of immune response

### PRACTICALS

1. Serological reactions
2. Precipitation reaction
3. Agglutination reaction
4. Coombs test
5. ELISA
6. Immunochromatographic tests

### 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. Ananthanarayan 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 XI- VIROLOGY AND MYCOLOGY**

### VIROLOGY

1. General properties of viruses : Morphology, chemical properties, viral multiplication, viral haemagglutination, cultivation and detection of growth, Viral assay, viral genetics, classification and nomenclature
2. Viral infection: pathogenesis, lab diagnosis, immunoprophylaxis and chemoprophylaxis of viral infections
3. Bacteriophages : morphology, life cycle, phage assay and typing, Bacteriocins

4. Systematic study of important viruses, their biological properties, pathogenicity, techniques for isolation and identification from clinical specimens, antiviral agents and immunoprophylaxis of
  1. Pox virus
  2. Herpes virus
  3. Adenovirus
  4. Picorna virus
  5. Orthomyxo virus
  6. Paramyxovirus
  7. Arbovirus
  8. Rhabdovirus
  9. Hepatitis virus
  10. Oncogenic virus
  11. HIV-AIDS
  12. Miscellaneous virus – Papova, Parvo, Rubella, Slow virus diseases, Viral haemorrhagic fever, corona virus –SARS
13. Emerging viral infections in Kerala

## MYCOLOGY

1. Introduction to mycology: Taxonomy of fungi, Classification of fungi, general properties, techniques used in examination of fungal cultures, maintenance of fungal cultures
2. Morphological features : Cell structures, reproduction, growth and nutrition, fungal dimorphism
  1. 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

1. Egg inoculation methods
2. Serological techniques
3. 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. Carroll, 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**

1. Immunodeficiency diseases : Primary and secondary immunodeficiencies
2. 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

3. Autoimmunity : Mechanism, classification and pathogenesis of autoimmune diseases
4. 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
5. Immunohaematology : ABO, Rh and other blood group systems; medical application, Complication following transfusion, prevention of Rh isoimmunisation, blood component therapy, blood groups and diseases.
6. Immunology of AIDS
7. 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
  - 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

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