

**SYLLABUS**

**for Courses affiliated to the  
Kerala University of Health Sciences**

**Thrissur 680596**



**BACHELOR OF SCIENCE IN  
MEDICAL BIOCHEMISTRY**

**Course Code 020**

**(2016-17 Academic year onwards)**

**2016**

## 2. COURSE CONTENT

### 2.1. Title of course:

Bachelor of Science in Medical Biochemistry

### 2.2. Objectives of course

The BSc Medical Biochemistry course offers a good opportunity to explore human beings from a molecular and cellular perspective and 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, cell biology and genetics and leads the students right up to the cutting- edge research questions in the final year.

### 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**

4 years

**2.6. Subjects**

**I Year BSc Medical Biochemistry**

Paper I: Anatomy

Paper II: Physiology

Paper III: General Biochemistry

Paper IV: Special English, Health education, Community Medicine,  
Biostatistics & Computer Application

Paper V: General Methodology

**II Year BSc Medical Biochemistry**

Paper VI: Metabolism I (Carbohydrate, Lipid&Amino acid metabolism)

Paper VII: Analytical methods & Instrumentation

Paper VIII: Enzymology

**III Year BSc Medical Biochemistry**

Paper IX: Metabolism II (Nutrition, Heme, Vitamins Minerals&  
Hormones)

Paper X: Clinical Biochemistry

Paper XI: Metabolism – III (Nucleic acid metabolism and Recombinant  
DNA technology

**IV Year BSc Medical Biochemistry**

Paper XII: Immunology& Immunochemistry

Paper XIII: Diagnostic Biochemistry and Laboratory management

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.The number of hours is as mentioned in the syllabus.

**2.8. Branches if any with definition**

Not Applicable

**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 Biochemistry to attain presentation skill.

**2.10. Content of each subject in each year**

**SYLLABUS**

**I BSc Medical Biochemistry**

**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.

### Reference

- 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
- Text book of Human Histology with colour Atlas Inderbir Singh

### Paper II- Physiology

**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

**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

**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

**Digestive system:** Digestion in mouth, stomach and intestine; digestion of carbohydrates, fats and protein; control of secretion; absorption; structure and function of liver

**Excretory system:** Gross and minute structure of kidney; OTR; formation of urine; tubular function, renal function test, micturition.

**Muscle:** Structure of muscles; muscle contraction

**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; neuro humoral transmission; CSF; Physiology of touch , smell, taste, hearing and vision; reflexes

**Endocrine system:** Structure and functions of pituitary, thyroid, adrenal glands; Thymus and pancreas

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

**Skin and temperature regulation.**

**Practical**

RBC count

WBC count

Differential count

Haemoglobin estimation

ESR determination

Blood grouping

Bleeding time

Osmotic fragility test

PCV, Red cell indices

Clotting time

Measurement of blood pressure in man

**Paper III- General Biochemistry**

**Introduction:** Chemistry of living things, 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- characterization, classification.

**Enzymes:** General properties, classification

**Vitamins and minerals:** (brief description) 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, adsorption and 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  $P^H$ , Henderson- Hasselbalch equation,  $P^H$  measurement.

**Buffers-** definition, components, mechanism of action, buffer capacity,  $pK$  of buffers, preparation of buffers, buffers in biological system, commonly used buffers in laboratory.

**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:

Monosaccharides- glucose, fructose, galactose

Disaccharides- maltose, lactose, sucrose

Polysaccharides- starch, dextrin



Qualitative analysis of unknown carbohydrate solution

- Reactions of proteins:

Colour reactions and precipitation reactions of albumin, Peptone, gelatine and casein.

Qualitative analysis of unknown protein solution

- Reactions of lipids

Qualitative tests – solubility test

Acrolein test

Tests for fatty acids

Tests for unsaturation of fatty acids

**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**

- Review of benefits, values, norms, habits and taboos among practices. More in human groups and their importance; learning and change process.
- Review of concepts on perception, attitudes, socialisation process, learning and theories of learning, social change and change process, motivation, needs and drives.
  - Principles and process of communication
  - Health education philosophy- main principles and objectives. Health education vs. propagandas
  - Methods and tools of health education- individual and group method. A critical evaluation of theories, tool and health education
  - 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.

- 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  $\chi^2$  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
- Multi terminal operational system (UNIX/ZENIX)
- MS windows (graphical user interface)
- 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**

### **1. 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.
- **Practical**
  - 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

## **2.Pathology**

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

### **Practical**

- Blood collection
- Blood smear preparation
- Urine analysis

### **3. 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

### Practical

- 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

## II Year

### Paper VI- Metabolism - I

#### **(Carbohydrate, Lipid & Amino Acid Metabolism)**

- **Metabolism of carbohydrates**

Digestion and absorption of carbohydrates

Major metabolic pathways of glucose- metabolic steps, energetics, functions and regulation of following pathways:

Glycolysis, Fate of pyruvate.

Gluconeogenesis.

Glycogen metabolism, cori's cycle, Pasteur Effect HMP shunt pathway, Uronic acid pathway, metabolism of fructose and galactose, Glyoxylate cycle

Inborn errors of metabolism of carbohydrates, glycogen storage diseases, essential fructosuria, pentosuria lactose intolerance, galactosuria, G6PD deficiency.



TCA cycle- reaction and significance

Bioenergetics: Gibbs free energy, enthalpy, entropy, redox potential coupled reactions, reducing equivalents

Electron transport chain- shuttle system, mechanism of oxidative phosphorylation, activators and inhibitors.

- **Metabolism of lipids**

Digestion and absorption of Lipids

Oxidation of Fatty acids- Beta, Alpha, Omega and peroxisomal Oxidation of unsaturated Fatty acids, Odd chain Fatty acids

De novo synthesis of Fatty acids, chain elongation, synthesis of unsaturated Fatty acids, PUFA and their importance, Eicosanoids classification and biological functions.

Metabolism of adipose tissue, synthesis and break down of TAG, Fatty liver and lipotropic factors, lipid storage diseases

Synthesis of cholesterol, regulation, functions of cholesterol, bile acids- synthesis

Ketone bodies- synthesis and utilization, ketosis

- **Metabolism of aminoacids**

Digestion and absorption of proteins

General reactions of amino acids-transamination, oxidative deamination, transdeamination

Removal of ammonia- sources and utilization of ammonia, Urea cycle , hyperammonemias

Glucogenic and ketogenic aminoacids.

Overall metabolism of different aminoacids- Detailed metabolism of glycine, phenyl alanine, tyrosine, tryptophan and histidine, sulphur metabolism.

Creatinine, glutathione, catecholamines, polyamines, nitric oxide metabolism,

One carbon metabolism

Inborn errors of amino acid metabolism

**Practicals:**

1. Estimation of following parameters in blood / plasma/ serum/ urine/CSF by different methods:

- Glucose
- Cholesterol – total and HDL
- Triglycerides
- Total protein Albumin, A/G ratio
- Urea,
- Creatine, Creatinine,
- Uric acid

### **Paper VII- Analytical Methods and Instrumentation**

#### **Colorimetry:**

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, Flame photometer, Atomic absorption spectrophotometer, Fluorimeter, Nephelometry and Turbidimetry

#### **Chromatography:**

General principles, partition and adsorption principles

Paper chromatography, column chromatography, TLC, ion exchange chromatography, molecular exclusion chromatography, affinity chromatography, HPLC and GLC – two dimensional and reverse phase chromatography

#### **Electrophoresis:**

Theory and factors affecting electrophoresis. Principle, technique and applications of paper electrophoresis. Gel electrophoresis- types of gels, solubilizers, tracking dyes PAGE Applications of gel electrophoresis. Immuno electrophoresis and Iso electric focusing

#### **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

### **ELISA**

Different methods, substrates and enzymes used Applications of ELISA

### **Radio activity**

Isotopes, different types of radiations, measurement of radioactivity- scintillation and GM counter. Use of radioactive isotopes in biochemistry and medicine, Biological effects of radiation, General laboratory rules for handling RA isotopes, Radiation protection and disposal of radioactive wastes

**RIA** : different methods, labeled probes. Applications of RIA

**pH meter** – Principle, technique and applications.

### **PRACTICALS**

Colorimetry

Verifications of Beer- Lamberts law

Determination of  $\lambda_{max}$  and selection of wavelength Estimation of concentration of unknown solution

Spectrophotometry

Flame photometry

Chromatography- paper, TLC

Electrophoresis

P<sup>H</sup> meter

Buffer preparation

ELISA

### **Paper VIII- Enzymology**

Properties, classification, nomenclature of enzymes Oxidoreductases

Specificity of enzymes, factors influencing enzyme action,  
Active site and catalytic groups, prosthetic group, co-enzyme, co- factors, metallo- enzymes and metal activated enzymes.Iso-enzymes, multi enzyme complex, ribozymes, immobilised enzymes  
Enzyme units and turn over number ,Reaction rate and equilibria of enzyme catalyzed reactions,Mechanism of enzyme action ,Action of chymotrypsin and lysozyme , Enzyme kinetics, Michaeli's Menten's law, Lineweaver Burke plot. Enzyme inhibition-various types with examples,application in clinical medicine ,Regulation of enzyme action.

Isolation and purification of enzymes

Clinical enzymology:

Functional and non functional serum enzymes

Clinical importance and methods for the estimations of AST, ALT, ALP, CK, LDH, ACP,5'nucleotidase, amylase, lipase, GGT, ceruloplasmin, G6PDH, aldolase, leucine amino peptidase, isocitrate dehydrogenase, enolase, choline esterase.

Plasma enzyme pattern in various disease conditions like MI, Liver diseases, bone disorders, pancreatic disease and malignancies

Therapeutic enzymes

### **Practicals**

1. Determination of  $K_m$  value
2. Estimation of clinically important enzymes:  
AST,ALT, ALP,GGT,ACP, Amylase, LDH, CPK

### **III Year**

### **Paper IX- Metabolism II- (Nutrition , Heme , Vitamins,Minerals And Hormones)**

**Vitamins** – classification, sources, daily requirement, structure, functions and deficiency diseases of Fat soluble - A, D, E & K. water soluble vitamins Vitamin C-. B complex vitamins-Anti-vitamins

**Minerals** : classification, sources, daily requirements, functions and disorders of various minerals

**Nutrition and dietetics:** respiratory quotient, Basal metabolic rate, specific dynamic action, nitrogen balance, protein quality, biological value, dietary fiber, balanced diet.

Preservatives and adulterants in food.

Obesity, Protein – energy malnutrition, Starvation

Diet therapy for DM, Atherosclerosis and hyper tension.

Glycemic index

**Heme metabolism-** chemistry and properties of hemoglobin and myoglobin, transport of gases, oxygen dissociation curve, isohydric transport of carbon dioxide,

Biosynthesis of Hb, catabolism of heme.

Porphyrias- Chemistry of porphyrins, porphyrias- primary and secondary porphyrias and its analytical procedures.

Bile pigments- bilirubin and related chromoproteins

Hb derivatives, hemoglobin variants,

Jaundice

**Hormones:** - Endocrine organs – hormones, classification of hormones, hormone receptors- insulin receptor, secondary and tertiary messengers.

Mechanism of action of hormones.

Hypothalamic hormones- chemistry, functions and disorders.

Pituitary hormones- chemistry, functions and disorders.

Thyroid and parathyroid hormones-chemistry, synthesis, functions and disorders

Pancreatic hormones- insulin and glucagon –chemistry, formation, functions and disorders.

Adrenal hormones- classification, chemistry, synthesis, functions and disorders

Gonadal hormones- classification, chemistry, functions, disorders. GIT hormones- their functions.

Other hormones.

## **PRACTICALS**

Estimation of calcium, phosphorous

Estimation of serum electrolytes- sodium, potassium, chloride, bicarbonate

Estimation of iron and TIBC

Estimation of vitamin A, C, E and metabolites of vitamins in urine (B-complex)

Hormone assays

T<sub>3</sub>, T<sub>4</sub>, TSH

Estimation of 17 – keto steroids

Estimation of VMA

## **Paper X- Clinical Biochemistry**

- Clinical conditions related to carbohydrate metabolism- blood glucose regulation
  - Hyperglycemia- Diabetes mellitus, Hypoglycemia
  - Methods of estimation of blood glucose
- Clinical conditions related to lipid metabolism
  - Diagnosis and treatment of lipid disorders
  - Lipo proteinemia disorders ,Atherosclerosis and CHD
  - Lipid profile- methods of estimation of cholesterol and TG
- Clinical conditions related to protein metabolism
  - Plasma proteins- separation, classification, functions and clinical significance,
  - Acute phase proteins
  - Methods of estimation of urea, creatinine and uric acid
- Xenobiotics- biological effects of pollutants- pesticides and toxins. Adulterants in food, food preservatives, Detoxification- phase 1 and phase II reactions, metabolism of ethanol, toxic effects of ethanol

- Water and electrolyte balance and imbalance- water intake and loss, regulatory mechanisms, blood osmolarity and osmolality, extra cellular and intracellular cations and anions, electrolyte balance
- Acid base balance- blood buffers, mechanism of action acidosis and alkalosis, compensatory mechanisms, assessment of acid base status.
- Therapeutic drug monitoring
- Ageing

### **Practical**

Urine analysis – normal and abnormal constituents

GTT, glycated heamoglobin, fructosamine, micro albumin

Lipid profile

Acute phase proteins

Plasma proteins

Estimation of plasma alkali reserve

Estimation of titrable acidity and urinary ammonia

### **Paper XI- Metabolism – III (Nucleic acid metabolism and Recombinant DNA Technology)**

- Nucleotide metabolism- structure of purines and pyrimidines.  
De-novo synthesis of nucleotides and degradation. Salvage pathway for the synthesis of nucleotides.  
Disorders- gout and inborn errors.
- Chromosomes- structure, genes- chemical nature, Organization of chromatin in nucleus
- DNA replication and repair
- Transcription and post-transcriptional modifications, inhibitors
- Genetic code, translation and post translational modifications, inhibitors
- Protein targeting
- Regulation of gene expression- in prokaryotes and eukaryotes
- Mutation – Different types of mutation and mutagens.
- Recombinant DNA technology

Tools- restriction endonuclease, Vectors

Steps

Techniques- Blot techniques, RFLP, PCR, DNA finger printing

Applications: gene therapy, transgenic

#### IV Year

### Paper XII- Immunology and Immunochemistry

**Infection:** source, methods of transmission and routes of infection.

**Immunity:** innate immunity- mechanism of innate immunity, acquired immunity- active and passive immunity, natural and artificial immunity, vaccination

**Structure and functions of immune system:** lymphoid organs- primary and secondary lymphoid organs, cells involved in immune system- lymphocytes, APC- functions, surface receptors

**Antigens:** characteristics, determinants of antigenicity, antigenic specificity-epitope-characteristics- haptens, adjuvants.

**Antibodies:** classification, structure and function of immunoglobulins, theories of antibody formation, monoclonal antibodies- their synthesis and significance.

**Immune response:** humoral and cell mediated-mechanism

**Antigen-antibody reaction:** general features, precipitation reactions, immuno diffusion, agglutination, CFTs, neutralisation, RIA, ELISA, immuno fluorescence, immuno electrophoresis

**Complement system:** general properties, components, complement activation, classical, alternate pathway, biological effects of complements, quantification of complements and its importance. Deficiency diseases.

**Immuno hematology:** ABO blood group system, Rh blood group system, medical application of blood groups, hemolytic disease of newborn, identification of Rh incompatibility, Rh immunization

**Immuno deficiency diseases:** humoral and cellular immuno deficiency, AIDS, disorders of specific immunity, disorders of complement, disorders of Phagocytosis



**Hypersensitivity** :- classification, basic mechanism.

**Autoimmunity**- mechanism of autoimmunization

**Immunology of transplantation:** allograft rejection, histocompatibility, MHC classification, location, its importance.

**Biochemistry of cancer:** cell cycle, mutagens, oncogenes, tumor markers, Immuno therapy of cancer.

**Vaccines**

**Practical:**

Immuno electrophoresis (Demonstration)

Serological reactions

Precipitation reactions

Agglutination reaction

Coombs test

ELISA

**Paper XIII- Diagnostic Biochemistry and Laboratory Management**

**Organization of a clinical laboratory**- basic requirement in heamatology, pathology, microbiology, serology and biochemistry departments in a lab

**Automation in clinical biochemistry lab**- definition, principle, different parts and functions, merits and demerits of different auto analysers.

Continuous flow analysers, Discrete analysers

Batch analysers - a) semi auto analysers

b) Fully automated analysers

Stat analysers - Centrifugal analyser

Dry chemistry analyser

Recent trends in automation of clinical chemistry

**Biochemical specimens-** specimen collection, transport, preservation and storage

Scientific practice of handling specimens.

Laboratory management and planning,

Receiving and recording of specimens, indexing and maintaining records.

Disposal of wastes.

Diagnostic importance of CSF, pleural fluid, seminal fluid, amniotic fluid, saliva and sweat in clinical biochemistry.

**Tumor markers:** classification, their importance in differential diagnosis – Bence- Jones proteins, AFP, serotonin, PSA, TPA, MCA, CA, CEA, beta HCG, VMA.

**Quality Control-** precision, accuracy, sensitivity, specificity, standard deviation

Pre analytical and analytical variables, Quality control charts, control serum, Quality control programme a) Internal quality control and b) external quality control.

Establishment and use of reference values, analytical and statistical procedures used in establishing reference values, Use of biochemical investigations in diagnosis and prognosis of diseases, Interpretation of results.

### **Organ Function Tests.**

Liver function tests

Renal function tests

Gastric function tests

Cardiac function tests

Thyroid function tests

Pancreatic function tests

### **Practical:**

LFT

RFT

TFT

CFT

PFT

Preparation of QC chart.

**No. of hours per subject.**

### **I BSc Medical Biochemistry**

<b>Paper</b>	<b>Subject</b>	<b>Theory (hrs)</b>	<b>Practical (hrs)</b>	<b>Tutorial (hrs)</b>	<b>Total (hrs)</b>
I	Anatomy	160	120	20	300
II	Physiology	160	120	20	300
III	General biochemistry	160	120	20	300
IV	Special English, Health education, Community Medicine, Biostatistics & Computer Application	200	40		240
V	General Methodology	160	120	20	300

### **II BSc Medical Biochemistry**

<b>Paper</b>	<b>Subject</b>	<b>Theory (hrs)</b>	<b>Practical (hrs)</b>	<b>Tutorial (hrs)</b>	<b>Total (hrs)</b>
VI	Metabolism I (Carbohydrate, Lipid & Amino acid metabolism)	200	210	40	450

VII	Analytical methods & Instrumentation	200	150	40	390
VIII	Enzymology	200	210	40	450
Clinical posting					150

### III BSc Medical Biochemistry

Paper	Subject	Theory (hrs)	Practical (hrs)	Tutorial (hrs)	Total (hrs)
IX	Metabolism II (Nutrition, Heme, Vitamins Minerals & Hormones)	200	210	40	450
X	Clinical Biochemistry	200	210	40	450
XI	Metabolism – III (Nucleic acid metabolism and Recombinant DNA technology)	200	---	40	240
Clinical posting					300

#### IV BSc Medical Biochemistry

Paper	Subject	Theory (hrs)	Practical (hrs)	Tutorial (hrs)	Total (hrs)
XII	Immunology & Immunochemistry	200	210	40	450
XIII	Diagnostic Biochemistry and Laboratory management	200	300	40	540
XIV	Project and hospital laboratory posting				450

#### 1. Practical training given in labs.

##### I Year BSc Medical Biochemistry

Paper	Subject	Practical (hrs)
I	Anatomy	120
II	Physiology	120
III	General biochemistry	120
IV	Special English, Health education, Community Medicine, Biostatistics & Computer Application	40
V	General Methodology	120

## II BSc Medical Biochemistry

Paper	Subject	Practical (hrs)
VI	Metabolism I (Carbohydrate, Lipid & Amino acid metabolism)	210
VII	Analytical methods & Instrumentation	150
VIII	Enzymology	210
	Clinical Postings	150

## III BSc Medical Biochemistry

Paper	Subject	Practical (hrs)
IX	Metabolism II (Nutrition, Heme, Vitamins Minerals & Hormones)	210

X	Clinical Biochemistry	210
XI	Metabolism – III (Nucleic acid metabolism and Recombinant DNA technology)	---
Clinical Posting		300

#### IV BSc Medical Biochemistry

Paper	Subject	Practical (hrs)
XII	Immunology & Immunochemistry	210
XIII	Diagnostic Biochemistry and Laboratory management	300
XIV	Clinical Postings	450

Every candidate admitted to BSc. Medical Biochemistry course should undergo six months of compulsory hospital posting as detailed in the curriculum.

A mini project may also be done during the fourth year hospital posting. Student can choose a topic for the project in any one of the subject (from the syllabus) which would be approved by his or her supervising teacher.

Supervising teacher should have minimum 3 years full time teaching experience. The students should be under the guidance of the supervising teacher, carry out the work on the topic selected and prepare a project report .The project report shall be duly certified by the supervising teacher, Head of the Department of Medical Biochemistry and Principal one month prior to the fourth year university practical examination.

2. Any other requirements- not applicable

3. Prescribed/ recommended textbooks for each subjects.

#### **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**

- Textbook of biochemistry- Author: Vasudevan and Sreekumari.S
- Biochemistry-U.Sathyanarayana,U.Chakrapani

#### **Paper V- General Methodology**

- Ananthanarayanan and Paniker's text book of microbiology
- Medical laboratory technology (vol 1-3) - Author: Kanai L. Mukherjee
- Practical clinical biochemistry – Author: Harold Varley

#### **Paper VI- Metabolism – I**

- Lehninger Principles of biochemistry- david L Nelson,Michael M .Cox
- Textbook of biochemistry- Author: Vasudevan and Sreekumari.S

#### **Paper VII- Analytical Methods and Instrumentation**

- Biophysical Chemistry-Principles and Techniques-Upadhyaya and Nath
- Biomedical Instrumentation-R.S Khandpur
- Practical Biochemistry(Principles and Techniques)-Keith Wilson And John Walker



### **Paper VIII- Enzymology**

- Enzymes – Author: Zubay
- Biochemistry- Jeremy M Berg,John L Tumoczko, Lubert Stryer
- Enzymes-Trevor Parmer- Philip Bonner

### **Paper IX- Metabolism II- (Nutrition , Heme , Vitamins,Minerals And Hormones)**

- Biochemistry – Author: Deba Jyothi Das
- Textbook of medical biochemistry- Author: M N Chaterjae
- Textbook of biochemistry- Author: Vasudevan and Sreekumari.S

### **Paper X- Clinical Biochemistry**

- Clinical chemistry- Michel L Bishop,Edward P Fody,Larry E Schoeff
- Clinical biochemistry metabolic and clinical aspects- Author: William J.Marshal
- Biochemistry in clinical practice- Author: Williams and Marks
- Text book of clinical biochemistry- Author: Nobert W. Teitz

### **Paper XI- Metabolism – III (Nucleic acid metabolism and Recombinant DNA Technology)**

- Cell Biology – Gerald Karp
- Genetics- D.Peter Snustad, Michael J. Simmons.

### **Paper XII- Immunology and Immunochemistry**

- Kuby's textbook of immunology- Thomas J Kindt, Richard Goldsby, Barbara A Osborne
- Essential immunology – Ivan Roitt, Jonathan Brostaff, David Male

### **Paper XIII- Diagnostic Biochemistry and Laboratory Management**

- Clinical diagnosis and management by laboratory methods- Author: John Bernard Henry

#### **2.11. No: of hours per subject (lecture-tutorial-seminar-group discussion)**

As given under clause “Content of each subject in each year “

#### **2.12. Practical training**

As given under clause “Content of each subject in each year “

### **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.]**

As stipulated by HOD from time to time

### **2.18. Prescribed/recommended textbooks for each subject**

As given under clause “Content of each subject in each year “

### **2.19. Reference books**

- 1.** Practical clinical biochemistry – Author: Harold Varley
- 2.** Text book of clinical biochemistry- Author: Nobert W. Teitz
- 3.** Clinical biochemistry- Author: Kaplan
- 4.** Biochemistry in clinical practice- Author: Williams and Marks
- 5.** Clinical chemistry in diagnosis and treatment- Author: Philip D.Mayne
- 6.** Biochemistry- Author: Trehan
- 7.** Clinical chemistry- Michel L Bishop,Edward P Fody,Larry E Schoeff

- 8.** Clinical biochemistry metabolic and clinical aspects- Author: William J.Marshal
- 9.** Lecture notes on clinical biochemistry- Author : L.J. Whitby
- 10.**Biochemistry- a care oriented approach- Author: Montogomiry
- 11.**Practical clinical biochemistry- Author: Harolod Varley
- 12.**Practical biochemistry- Author: Wilson and Walker
- 13.**Harper's illustrated biochemistry- Author: R K Murray and Granner
- 14.**Clinical biochemistry principles and practice- Author: Praful B Godkar
- 15.**Lehninger Principles of biochemistry- david L Nelson,Michael M .Cox
- 16.**Biochemistry- Jeremy M Berg,John L Tumoczko, Lubert Stryer
- 17.**Enzymes – Author: Zubay
- 18.**Biochemistry with clinical correlation- Author : Devlin
- 19.**Harrison's internal medicine
- 20.**Clinical diagnosis and management by laboratory methods- Author: John Bernard Henry

**21.**Textbook of biochemistry- Author: Vasudevan and Sreekumari.S

**22.**Biochemistry – Author: Deba Jyothi Das

**23.**Textbook of medical biochemistry- Author: M N Chaterjaj

**24.**Biochemistry – Mathews, Van Holde, Ahern

**25.**Biochemistry-Dushyant Kumar Sharma

**26.**Biochemistry-U.Sathyanarayana,U.Chakrapani

**27.**A Textbook of Biochemistry-S.S Randhawa

**28.**Biophysical Chemistry-Principles and Techniques-Upadhyaya and Nath

**29.**Fundamentals of Biochemistry-Dr.A.C Deb

**30.**Biochemistry-C.B Powar,G.R Chatwal

**31.**Biochemistry-Campbell,Farrell

**32.**Principles of Biochemistry-Donald Voet,Judith G Voet,Charlotte W Pratt

**33.**Medical biochemistry-D.S Sheriff

**34.**A textbook of organic chemistry-Arun Bahl and B.S Bahl

- 35.**Textbook of organic chemistry-P.L Soni,H.M Chawla
- 36.**Biochemistry by Pankaja Naik
- 37.**Textbook of Biochemistry-Dr.A.V.S.S.Rama Rao
- 38.**Biochemistry- Mathews, Van Holde, Ahern
- 39.**Physical Chemistry-Gordon M.Barrow
- 40.**Physical Chemistry-Puri, Sharma, Pathania
- 41.**Medical Biochemistry-Sucheta.P Dandekar
- 42.**Clinical Chemistry William J Marshall, Stephen Bangert
- 43.**Fundamentals of Clinical Chemistry-Karl A.Burtis, Edward R  
Ashwood, David E Bruns
- 44.**Practical Clinical Biochemistry-Ranjana Chawla
- 45.**Manipal Manual of Clinical Biochemistry-Sivananda Naik B
- 46.**Clinical biochemistry-Nanda Maheswari
- 47.**Biochemistry for nurses-Jacob Anthikad
- 48.**Practical Manual of Biochemistry-S.P Singh
- 49.**Practical Biochemistry(Principles and Techniques)-Keith  
Wilson And John Walker

- 50.**Varley's Practical Clinical Biochemistry-Alan H.Gowenlock
- 51.**practical Biochemistry for students-V.K.Malhotra
- 52.**MCQs Clinical Biochemistry-S.Nagini
- 53.**Lecture Notes-Clinical biochemistry-Geoffrey Beckett,Simon Walker,Peter Rae,Peter Ashby
- 54.**Practical cell analysis-Dimitri Pappas
- 55.**Experimental Biochemistry-A student companion-Beedu Sasidhar Rao,Vijay Deshpande
- 56.**Modern Experimental Biochemistry-RodneyBoyer
- 57.**Medical Laboratory Technology- Volume I,II,III-Kanai Mukherjee
- 58.**de Gruchy's Clinical Haematology in Medical Practice-Frank Firkin,Cholin chesterman,David Penington,Bryan Rush
- 59.**Dacie and Lewis Practical Haematology-S.Mitchell Lewis,Barbara JBaln,Imelda Butes
- 60.**Medical Laboratory Technology-Methods and Interpretation Volume I&II-Ramnik Sood
- 61.**Textbook of Medical Lab Technology-Godkar
- 62.**Biomedical Instrumentation-R.S Khandpur

- 63.** Wintrobe's Clinical Haematology –John P.Greer,John Foerster,George M.Rodgers,Frixos Paraskevas,Bertil Glader,Daniel A.Arber,Robert T.Means Jr.
- 64.** Practical Biochemistry-Geetha Damodaran
- 65.** A Text Book of Genetics- S.S. Randhawa.
- 66.** Gene Cloning and DNA analysis- T A Brown
- 67.** Lewin's Cells- Lynne Cassimeris, Viswanath. R. Lingappa, George Plopper
- 68.** Molecular Genetics of Bacteria- Jeremy W Dale, Simon.F.Park
- 69.** Biochemistry illustrated – Biochemistry and Molecular Biology in the post genomic era- Peter.N.Campbell, Anthony. D. Smith, Timothy.J.Peter
- 70.** Medical immunology- Tristram G Parslow, Daniel P Stites , Abba I Terr, John B Imboden.
- 71.** Basic Immunology- Function and disorders of immune system-Abdul.K.Abbas, Andrew.H.Lichtman
- 72.** Janeway's Immuno Biology- Kenneth.Morphy, Paul Travers, Mark Walport
- 73.** Immunology A Short Course- Richard Caico, Geoffrey Sunshine
- 74.** Immunology – Peter Lydyard, Alex Whelan, Michael Fanger
- 75.** Fundamental Immunology- William E Paul

**2.20. Journals**

As decided by the concerned faculties/HoD

**2.21. Logbook**

To be maintained and counter signed by the concerned HOD.

### 3. EXAMINATIONS

#### 3.1 Eligibility to appear for exams

The minimum requirement of internal assessment for appearing University examination shall be 50%. A candidate not securing minimum internal assessment should appear for next University Examination after securing minimum internal assessment.

No candidates shall be admitted to any year of B.Sc Medical Biochemistry university examination unless he or she has a minimum of 80% of attendance. There is one time provision for condonation up to 10% on Medical grounds.

#### 3.2 Schedule of Regular/Supplementary exams

Regular university examination will be conducted at the end of each academic year and supplementary examination 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

##### I BSc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
I	<b>Anatomy</b>	3 hrs	50	25
	Theory			
	Internal assessment		25	12.5



	Practical	3 hrs	50	25
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>200</b>	<b>100</b>
<b>II</b>	<b>Physiology</b>			
	Theory	3 hrs	50	25
	Internal assessment		25	12.5
	Practical	3 hrs	50	25
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>200</b>	<b>100</b>
<b>III</b>	<b>General Biochemistry</b>			
	Theory	3 hrs	50	25
	Internal assessment		25	12.5
	Practical	3 hrs	50	25
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>200</b>	<b>100</b>
<b>IV</b>	<b>Special English, Health education, community</b>			

	<b>medicine, Biostatistics and computer application</b> Internal assessment (Theory and practical)		100	50
<b>V</b>	<b>General methodology</b>  Theory Internal assessment  Total	3 hrs	100 50 150	50 25 75

### II Year B Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
<b>VI</b>	<b>Metabolism -I</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	Total		300	150

<b>VII</b>	<b>Analytical methods and Instrumentation</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>300</b>	<b>150</b>
<b>VIII</b>	<b>Enzymology</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>300</b>	<b>150</b>

### III. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
IX	<b>Metabolism -II</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>300</b>	<b>150</b>
X	<b>Clinical Biochemistry</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	<b>Total</b>		<b>300</b>	<b>150</b>
XI	<b>Metabolism – III (Nucleic acid metabolism and Recombinant DNA technology)</b>			

	Theory	3 hrs	100	50
	Internal assessment		50	25
	Total		150	75

#### IV. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min for Pass
XII	<b>Immunology and Immunochemistry</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	Total		300	150

<b>XIII</b>	<b>Diagnostic Biochemistry and Laboratory Management</b>			
	Theory	3 hrs	100	50
	Internal assessment		25	12.5
	Practical	6 hrs	100	50
	Internal assessment		25	12.5
	Oral		50	--
	Total		300	150
<b>XIV</b>	<b>Project</b>			
	Internal assessment		50	25

### 3.4 Papers in each year

#### I Year BSc Medical Biochemistry

Paper I: Anatomy

Paper II: Physiology

Paper III: General Biochemistry

Paper IV: Special English, Health education, Community Medicine, Biostatistics & Computer Application

Paper V: General Methodology

#### II Year BSc Medical Biochemistry

Paper VI: Metabolism I (Carbohydrate, Lipid & Amino acid metabolism)

Paper VII: Analytical methods & Instrumentation

Paper VIII: Enzymology

### **III Year BSc Medical Biochemistry**

Paper IX: Metabolism II(Nutrition, Heme, Vitamins Minerals& Hormones)

Paper X: Clinical Biochemistry

Paper XI: Metabolism – III (Nucleic acid metabolism and Recombinant DNA technology)

### **IV Year BSc Medical Biochemistry**

Paper XII: Immunology& Immunochemistry

Paper XIII: Diagnostic Biochemistry and Laboratory management

paper XIV: Project

### **3.5 Details of theory exams(include number of papers, Duration,Type of questions and number of questions and marks**

#### **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

#### **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

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

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

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

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

#### **Theory paper valuation**

The theory paper should be double valued by both external and internal examiners. If the variation in total marks obtained in two valuations is more than 15%, the paper should undergo a third valuation and there will be no revaluation. The average of marks obtained for double valuation is taken as the final mark of the student. In the case of answer papers going for third valuation, the average of nearest two marks is taken as final mark.

### 3.6 Model question paper for each subject with question paper pattern

#### I BSc Medical Biochemistry

#### Paper I- Anatomy

Total Marks: 50

Time: 3 hrs

#### ESSAY

1. Describe the cerebrum under the following headings
  - a) Sulci
  - b) gyri
  - c) functional areas
2. Enumerate the parts of the urinary system. Discuss the external features and internal features of kidney. (2×10=20)

#### SHORT ESSAY

3. Duodenum
4. Internal ear (2×5=10)

#### ANSWER BRIEFLY

5. Right atrium
6. Suprarenal gland
7. Palatine tonsil
8. Trigone of bladder
9. Types of ossification



10. Layers of retina

11. Neurons

12. Pericardium

13. Pancreas

14. Synovial joint

(10×2=20)

### Paper II- Physiology

Total Marks: 50

Time: 3 hrs

#### ESSAY

1. Explain transport of carbon dioxide in the blood. Add a note on Haldane effect.
2. Define cardiac cycle. Describe the events during cardiac cycle with the help of diagram

(2×10=20)

#### SHORT NOTES

3. Functions of WBC
4. Functions of stomach

(2×5=10)

#### ANSWER BRIEFLY

5. Draw and label normal ECG
6. Test for colour vision
7. Testes buds
8. Sertoli cells
9. Difference between diabetes insipidus and diabetes mellitus
10. Functions of middle ear
11. Name respiratory centers
12. Neuro-endocrine reflex
13. Anaemia
14. Reflex arc

(10×2=20)

### Paper III- General Biochemistry

Total Marks: 50

Time: 3 hrs

ESSAY

1. Describe the dietary sources, functions and deficiency manifestations of vitamin D
2. Classify proteins. Add a note on functions of plasma proteins  
(2×10=20)

SHORT NOTES

3. Classification of lipoproteins
4. Functions of phospholipids (2×5=10)

ANSWER BRIEFLY

5. Strong base
6. Zwitter ion
7. Types of DNA
8. Scurvy
9. Pyrimidine
10. Golgi body
11. Pk of buffers
12. Properties of ethanol
13. Starch
14. Peptide bond (10×2=20)

**Paper V- General Methodology**

Total Marks: 100

Time: 3 hrs

ESSAY

1. What is a buffer? Describe the principles, preparation and uses of buffers in heamatology.
2. What is pH? What are the methods of measuring pH in the laboratory  
(2×15=30)

SHORT ESSAY

3. Describe methods of staining used in microbiology
4. List the laboratory associated infections in microbiology. How will you prevent the laboratory associated infections (2×10=20)

#### SHORT NOTES

5. Feeding of laboratory animals
6. Classification of bacteria
7. Waterbath
8. Accidents in laboratory
9. Pasteur pipettes
10. Labelling of specimens (6×5=30)

#### ANSWER BRIEFLY

11. Spillage
12. EDTA
13. De-ionised water
14. Autoclaving
15. Spherical aberration
16. Resolving power of objectives in microscopes
17. Lyophilisation
18. Enrichment media
19. Fixative in histopathology
20. Care of common balance (10×2=20)

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### II BSc Medical Biochemistry

#### Paper VI- Metabolism I

Total Marks: 100

Time: 3 hrs

#### ESSAY

1. Discuss reaction, regulation, energetics and significance of TCA cycle.

2. Explain the steps involved in cholesterol biosynthesis, add a note on its regulation.

(2×15=30)

**BRIEF ESSAY**

3. Describe in detail steps involved in glycolysis

4. Urea cycle

(2×10=20)

**SHORT ANSWER**

5. Add a note on Transamination reaction

6. Digestion and absorption of carbohydrate

7. Synthesis of catecholamines

8. Glycogenolysis

9. Add a note on the synthesis of serotonin and melatonin and its functions

10. Ketone bodies

(6×5=30)

**COMMENT ON**

11. Gluconeogenesis

12. Deamination reaction

13. Cori's cycle

14. Redox potential

15. Alpha oxidation

16. Phenyl ketonurea

17. Lipoprotein

18. Entropy

19. Lactose intolerance

20. Sorbitol pathway

(10×2=20)

**Paper VII- Analytical Methods and Instrumentation**

Total Marks: 100

Time: 3 hrs

**ESSAY**

1. Describe the principle, types and application of ELISA

2. What is principle of electrophoresis, discuss on factors influencing electrophoretic mobility. enumerate on PAGE (2×15=30)

**BRIEF ESSAY**

3. Describe on the principles and application of spectrophotometry  
4. Give an account of different types of centrifuges (2×10=20)

**SHORT ANSWERS**

5. RIA  
6. Flame photometry  
7. Ion exchange chromatography  
8. Iso-electric foccusing  
9. HPLC  
10. Immuno electrofocussing (6×5=30)

**COMMENT ON**

11. Application of centrifugation  
12. Nebulizer  
13. Turbidimetry  
14. Rotors  
15. Types of gels  
16. Solubilizers  
17. Errors in paper chromatography  
18. Column preparation  
19. Beer -Lamberts law  
20. Partition coefficient (10×2=20)

**Paper VIII- Enzymology**

Total Marks: 100

Time: 3 hrs

**ESSAY**

1. Explain in detail the clinicql significance of any five enzymes. Add a note on their estimation

2. Describe in detail methods of regulations of enzyme activity (2×15=30)

**BRIEF ESSAY**

3. What do you mean by enzyme inhibition? Explain in detail about competitive and non competitive inhibition

4. Enzyme purification (2×10=20)

**SHORT ANSWERS**

5. Classification of enzymes

6. Enzyme specificity

7. Iso-enzymes of LDH

8. LB plot

9. Ribozymes

10. Functional and non functional enzymes (6×5=30)

**COMMENT ON**

11. Km value

12. Suicide inhibition

13. Active site

14. Co-enzymes

15. Lock and key model method

16. Multi enzyme complex

17. Pancreatic amylase

18. Turn over number

19. M-M equation

20. Metallo enzymes (10×2=30)

**III B.Sc Medical Biochemistry**

**Paper IX- METABOLISM II**

Total Marks: 100

Time: 3 hrs

**ESSAY**

1. Give an account of chemistry, sources, RDA, function and deficiency symptoms of vitamin D
2. Explain the mechanism of action of hormones. Add a note on second messengers  
(2×15=30)

**BRIEF ESSAY**

3. Define BMR. What are the factors affecting BMR
4. Explain the metabolism of sodium and potassium. Explain their deficiency disorders  
(2×10=20)

**SHORT ANSWERS**

5. Folic acid
6. PEM
7. Catecholamines
8. Porphyrias
9. Dietary fibers
10. Biotin (6×5=30)

**COMMENT ON**

11. Hormone receptors
12. Jaundice
13. Glycemic index
14. SDA
15. Positive nitrogen balance
16. Scurvy
17. Insulin
18. Diabetes mellitus
19. Pellagra
20. RQ (10×2=20)

**Paper X- CLINICAL BIOCHEMISTRY**

Total Marks: 100

Time: 3 hrs

ESSAY

1. What are plasma proteins? Explain their functions and clinical significance
2. What is the normal blood pH.? How is it regulated? Add a note on acid base balance

(2×15=30)

SHORT ESSAY

3. Blood glucose regulation
4. Metabolism of xenobiotics

(2×10=20)

SHORT ANSWERS

5. TDM
6. Theories of ageing
7. Diabetes mellitus
8. Blood buffers
9. Acute phase proteins
10. Atherosclerosis

(6×5=30)

COMMENT ON

11. Hypoglycemia
12. Anti oxidants
13. Metabolic alkalosis
14. Toxic effect of ethanol
15. Anion gap
16. Hypokalemia
17. Glycated hemoglobin
18. Fatty liver
19. Osmolality
20. Microalbuminuria

(10×2=20)

**Paper XI- METABOLISM III**

Total Marks: 100

Time: 3 hrs

ESSAY



1. Describe in detail steps, enzymes and inborn errors associated with purine metabolism.  
Add a note on its regulation
2. Describe in detail steps involved in translation. Add a note on the post translational modifications and inhibitors of protein synthesis (2×15=30)

#### SHORT ESSAY

3. Describe in detail steps, enzymes and inborn errors associated with pyrimidine metabolism.
4. DNA replication (2×10=20)

#### SHORT ANSWERS

5. Mutation
6. Gout
7. Genetic code
8. DNA repair
9. PCR
10. Restriction endonuclease (6×5=30)

#### COMMENT ON

11. Mutagens
12. Southern blotting
13. RNA polymerase
14. Chromosomes
15. HGPRT
16. Orotic acidurias
17. Operon
18. Vector
19. Gene therapy
20. Down's syndrome (10×2=20)

**IV B.Sc Medical Biochemistry**

**Paper XII- IMMUNOLOGY AND IMMUNOCHEMISTRY**

Total Marks: 100

Time: 3 hrs

**ESSAY**

1. What are immunoglobulins? Classify and describe the structure of IgG in detail
2. List the cells and organs of immune system. Write in detail about primary lymphoid organs. (2×15=30)

**BRIEF ESSAY**

3. Define monoclonal antibodies. Explain the production of monoclonal antibodies and their uses.
4. Define hypersensitivity. Write in detail about immediate type of hypersensitivity reactions. (2×10=20)

**SHORT ANSWERS**

5. Tumor markers
6. Vaccines
7. HDN
8. CFT
9. Autoimmunity
10. AIDS (6×5=30)

**COMMENT ON**

11. Epitopes
12. APC
13. Haptens
14. Precipitation reactions
15. Rh blood group systems
16. Phagocytosis
17. Oncogenes
18. Neutralisation

19. Adjuvants

20. Agglutination reactions

(10x2=20)

**Paper XIII- DIAGNOSTIC BIOCHEMISTRY AND LABORATORY MANAGEMENT**

Total Marks: 100

Time: 3 hrs

**ESSAY**

1. What are the different biological functions of liver? Describe briefly on laboratory tests to assess liver function
2. What are the different types of errors occurring in laboratory? Discuss briefly on QC systems used in clinical chemistry labs (2x15=30)

**BRIEF ESSAY**

3. Discuss automation in clinical biochemistry lab.
4. Describe briefly on laboratory tests to assess thyroid functions. (2x10=20)

**SHORT ANSWER**

5. Biochemistry of CSF
6. Preservation and storage of clinical chemistry samples
7. Gastric stimulation tests
8. PFT
9. Disposal of wastes
10. Dry chemistry analyser (6x5=30)

**COMMENT ON**

11. Bence jones proteins
12. VMA
13. PSA
14. Seminal fluid
15. Beta HCG

16. Centrifugal analyser

17. Clearance tests

18. Histamine stimulation tests

19. Reference values

(10x2=20)

### 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 (3) internal 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, projects, Laboratory work etc. should also be added in the finalized internal marks.
- 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 mark in each subject should not exceed 75%(regular examination) and 80%(supplementary examination,both in theory and practical)

### 3.8 Details of practical/clinical practicum exams

#### I BS.c Medical Biochemistry Examination

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

#### II. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
VI	<b>Metabolism -I</b>			
	Practical	6 hrs	100	50
	Oral		50	--

<b>VII</b>	<b>Analytical methods and Instrumentation</b>			
	Practical	6 hrs	100	50
	Oral		50	--
<b>VIII</b>	<b>Enzymology</b>			
	Practical	6 hrs	100	50
	Oral		50	--

### III. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
<b>IX</b>	<b>Metabolism -II</b>			
	Practical	6 hrs	100	50
	Oral		50	--
<b>X</b>	<b>Clinical Biochemistry</b>			
	Practical	6 hrs	100	50
	Oral		50	--

#### IV. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min for Pass
XII	<b>Immunology and Immunochemistry</b>	6 hrs	100	50
	Practical			
XIII	<b>Diagnostic Biochemistry and Laboratory Management</b>	6 hrs	100	50
	Practical			
	Oral		50	--

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

There shall be two examiners- one internal and one external. The external examiner should be an Assistant Professor or above with MSc. Medical Biochemistry and minimum 5 years post PG teaching experience from other institutions in Kerala.

#### 3.10 Details of viva: division of marks

##### I B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
I	<b>Anatomy</b>			
	Oral		50	--

<b>II</b>	<b>Physiology</b>  Oral		50	--
<b>III</b>	<b>General Biochemistry</b>  Oral		50	--

### II. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
<b>VI</b>	<b>Metabolism -I</b>  Oral		50	--
<b>VII</b>	<b>Analytical methods and Instrumentation</b>  Oral		50	--
<b>VIII</b>	<b>Enzymology</b>  Oral		50	--

### III. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min. for Pass
<b>IX</b>	<b>Metabolism -II</b>  Oral		50	--
<b>X</b>	<b>Clinical Biochemistry</b>  Oral		50	--



#### IV. B.Sc Medical Biochemistry Examination

Paper	Subject	Duration	Max. Marks	Min for Pass
XII	Immunology and Immunochemistry  Oral		50	--
XIII	Diagnostic Biochemistry and Laboratory Management  Oral		50	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