BLDE
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Choice Based Credit System (CBCS)

Revised Curriculum

M.Sc. Medical Programme in Biochemistry

2025-26

Published by
BLDE
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Declared as Deemed to be University u/s 3 of UGC Act, 1956, vide notification No. F.9-37/2007-U.3 (A)
The Constituent College

SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA
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BLDE

(DEEMED TO BE UNIVERSITY)

Declared as Deemed to be University u/s 3 of UGC Act, 1956
Accredited A Grade by NAAC (Cycle-2)

BLDE(DU)/REG/M.Sc. Med. Curri./2025-26/ 5322 December 24, 2025

NOTIFICATION

Sub: Revision of Curriculum of M.Sc. Medical Programme in Anatomy, Physiology, Biochemistry, Microbiology & Pharmacology.

Ref: Approval of Hon'ble Vice-Chancellor vide no. 2245 dtd. 24.12.2025

On approval of the Hon'ble Vice-Chancellor, the revised curriculum for M.Sc. Medical Programme in Anatomy, Physiology, Biochemistry, Microbiology & Pharmacology by following the Choice Based Credit System (CBCS) offered under the Faculty of Medicine has been approved and is hereby notified.

The Curriculum shall be effective from the Academic Session 2025-26 onwards, for the M.Sc. Medical Programmes offered under the Shri. B. M. Patil Medical College Hospital & Research Centre.

REGISTRAR

REGISTRAR
BLDE(Deemed to be University)
Vijayapura-586103. Karnataka

Copy to:

- The Secretary, NMC, New Delhi
- The Secretary, UGC, New Delhi
- The Controller of Examinations
- The Principal, SBMPMCH&RC
- The Dean, Faculty of Medicine
- The HoD of Pre & Para Clinical Departments
- The Coordinator, M.Sc. Medical Programmes
- The Co-ordinator/ Director, IQAC
- The Assistant Registrar

Copy respectfully submitted to:

- The Hon'ble Pro-Chancellor
- The Hon'ble Vice-Chancellor

M.Sc. Medical Biochemistry

PREAMBLE

M.Sc. Medical Biochemistry will be a course that will be spread across six semesters/three years and is designed primarily for graduates in the biological sciences. This course will intensively train them for achieving proficiency in teaching and research in health education sciences and also prime them to be able to use and interpret the biochemistry laboratory services. The focus will be on the training to impart the necessary competencies for a productive research career and to inspire and induct them into the Ph.D programme.

OBJECTIVES:

1. Teaching and working in the field of medical biochemistry with an understanding of both subject content and laboratory practices – knowledge and skills.
2. Understand the physiological and pathological processes affecting biochemical investigations.
3. Have the initiative to, systematically conduct research and to solve problems based on scientific processes.
4. Understand the principles of the analytical techniques used in a Clinical Biochemistry department.
5. Understand the procedures used to set up, assess and maintain the quality of laboratory analysis.
6. Understanding the use of clinical biochemistry results in the diagnosis and management of common medical disorders.
7. Be able to communicate/discuss and help colleagues and clinicians interpret and understand the biochemical basis of the disease process.
8. Appropriately putting knowledge of biochemistry into use in the field of medicine and public health.
9. Publicizing new knowledge and findings, and giving an opinion about medical biochemistry with acceptable accuracy.

QUALIFICATION FOR ADMISSION

A candidate for admission to M.Sc (Medical Biochemistry) Course should have attended (full time) and passed – B.Sc. Chemistry/ B.Sc / (MLT)/B. Sc. Life Sciences degree from any recognized University.

DURATION OF THE COURSE

The M.Sc. (Medical Biochemistry) is a full-time course of **6 semesters (3 years)**

1st Semester and 2nd Semester – **a) Anatomy b) Physiology c) Biochemistry**

3rd to 6th Semester **– Biochemistry.**

COURSE CONTENT UNIT WISE

The course consists of lectures, tutorials and practical classes for the 1st and 2nd semester mainly on Anatomy, Physiology and Basic Biochemistry.

At the end of each semester, the students should take up a University Exam of Theory, Viva and Practical. The third to sixth semester will be dedicated to proper Biochemistry at Dept. of Biochemistry and are encouraged for seminars, journal club and practical classes in addition to advanced topics as theory classes. Every candidate is required to carry out work on a select research project under the guidance of a recognized post-graduate teacher. The results of such work shall be submitted in the form of a Dissertation in the 5th semester.

SEMESTER I								
Course Code	**Course Name Medical Anatomy**	**Credits**	**Teaching Hours pe week**			**Marks**		
			L	**SDL**	**P**	**Internal Assessment**	**Semester Exam**	**Total**
Theory								
MANA 1.1 T	Medical Anatomy	4	4	1		20	80	100
MPHY 1.2 T	Medical Physiology	4	4	1		20	80	100
MBCHM 1.3 T	Medical Biochemistry	4	4	1		20	80	100
Practical								
MANA 1.1 P	Medical Anatomy	3			6	20	80	100
MPHY1.2 P	Medical Physiology	3			6	20	80	100
MBCHM 1.3 P	Medical Biochemistry	3			6	20	80	100
Elective Course (Any One)								
1.4 GE	Introduction to Quality Patient & Safety	3	3			100	--	100
1.5 GE	Computer Application					100	--	100
Total		**24**	**36**			**220**	**480**	**700**

Semester I
M.Sc. Medical Biochemistry

Theory: BCHM 1.3 T General Biochemistry (60 hrs)

1. Introduction and Scope of Biochemistry (4 hrs)
2. Biomolecules (4 hrs)

   Biomolecules and forces that stabilize the biomolecules, Principles of Thermodynamics and Donnan membrane equilibrium.
3. Cell and subcellular structures (6 hrs)

   Structure and functions of - Mitochondria, Endoplasmic Reticulum, Golgi complex, Peroxisomes, Lysosome, Ribosome, Nucleolus, Centrosome, chromosomes, Nucleosomes, Histones.
4. Biological membranes (6 hrs)

   Membranes Structure and function; composition of Cell Membrane-Fluid Mosaic Model, specialized membrane structures- liposomes, etc. Transport across biological membranes: Passive diffusion, Facilitated diffusion, I on channels, Ligand-gated channels, Voltage-gated channels, Ionophores, Active transport, Uniport, Symport, Antiport, Exocytosis, Endocytosis, Pinocytosis, Phagocytosis.
5. pH and buffers (4 hrs)

   Definition of Acids, Bases, Buffers, pH, pH of biological fluids, Henderson-Hassel Balch equation: Derivation and Applications.
6. Chemistry of Carbohydrates (10 hrs)

   Definition, functions, and classification of Carbohydrates.

   Monosaccharides: Glucose, Fructose, Mannose, Galactose, Physical Properties & Chemical reactions of Monosaccharides.

   Disaccharides: Sucrose, Lactose, Maltose. Physical Properties & Chemical reactions of Disaccharides.

   Polysaccharides: Structure, Chemistry and Functions of Homopolysaccharides and Heteropolysaccharides/Mucopolysaccharides.
7. Chemistry of Amino Acids, Peptides, and Proteins (8 hrs)

   Definition and Classification of amino acids, properties of amino acids. Peptide bond- Properties and formation Color reactions of amino acids. Proteins. - Definition, Classification, and properties. Structural organization of proteins and their determination. Insulin - Primary structure and Structure-function relationship. Biologically important peptides.
8. Chemistry of Lipids. (8 hrs)

   Lipids. -Definition, classification, and function.

   Classification of fatty acids, properties of fatty acids, essential fatty acids. Triglycerides: properties and their reactions.

   Phospholipids, Glycolipids, and Lipoproteins: Sub-Classification and its functions. Derived Lipids: Steroids and cholesterol.

9. Chemistry of Nucleic Acids. (10 hrs)

   Definition of nucleosides, nucleotides, and nucleic acids. Nucleotides: Structure, nomenclature, and functions of nucleic acids.

   DNA: Structure of DNA (Watson and Crick Model), Chargaff's rule, Organization of DNA, Genes, and chromosomes.

   RNA: Types and functions of RNA

SDL: (5x3 hrs = 15 hrs)

1. Mucopolysaccharides
2. Structural Organization of Proteins
3. Biological Important Peptides.
4. Lipoproteins
5. Structure and functions of Nucleic Acids.

Semester I

M.Sc Medical Biochemistry

Practical: BCHM 1.3 P (60 hrs)

Practicals:

1. Reactions of Monosaccharides: Glucose and fructose (8 hrs)
2. Reactions of Disaccharides: Lactose, maltose and sucrose (12 hrs)
3. Reactions of Polysaccharides: Starch (4 hrs)
4. Identification of unknown carbohydrate (8 hrs)
5. Precipitation and coagulation reactions of proteins (8 hrs)
6. Colour reactions of proteins (4 hrs)
7. Reactions of Albumin (4 hrs)
8. Reactions of Casein (4 hrs)
9. Identification of unknown solution. (8 hrs)

Electives for I SEMESTER

Electives 1

GE Human rights

Learning objectives:

- To understand the relevance and importance of human rights
- To understand the relevance and importance of value education
- To understand the regulations and help-groups that support human rights and value Education

Course Contents:

I. Basic concepts:

Rights, duties - Nature of rights: absolute/reasonable; universal/ relativistic; discriminatory/ justifiably differential; Linkage with core concepts of liberty, equality, fraternity and justice.

II. Classification of rights and duties –

Rights – moral, social, cultural, economic, civil and political; Duties – towards self, family, community, society, nation/state, humankind and mother earth.

III. United nation and human rights –

Universal Declaration of human rights 1948, UN Declaration and Duties and Responsibilities of Individuals 1997.

IV. General Problems Relating to Human Rights:

Poverty and illiteracy; Discrimination – Caste, Class and Gender.

V. Institutions for implementation of human rights –

Human rights and duties in India, National human rights commission, Protection and enforcement of human rights and duties.

Learning outcome:

1. To understand the human rights and value education from the national and global Perspectives
2. To obtain insights for the integration of such values in real-life situations

Reference Text Books

1. T.S.N. Sastry, Introduction to human rights and duties, University of Pune, (2011).
2. Baxi, Upendra (2002) The Future of Human Rights. New Delhi: Oxford University Press.

Reference Books

1. Dube, M. P. and Neeta Bora, (ed.) (2000) Perspectives on Human Rights New Delhi: Anamika Publishers.
2. Sanajaoba, N. (2000) Human Rights in the New Millennium. New Delhi: Manas Publications.
3. Vadkar, Praveen, (2000) Concepts, Theories and Practice of Human Rights. New Delhi: Rajat publications

Web Links

www.ohchr.org/EN/Issues/Pages/WhatareHumanRights.aspx

GE – BIOINFORMATICS

Learning Objectives

1) To know the importance of computers in biology
2) To understand software tools for biological sequence analysis
3) To learn the concepts associated to Genomics and apply the same in various fields

UNIT I

Computer Fundamentals (6hr)

Characteristics of computer, history, generations, types, classification – Hardware, Software; Operating System - Linux, Windows. Internet and search engines, Office Packages - MS Word, MS Excel, MS Power Point, internet.

UNIT II

Biological Databases (10 hrs)

Bioinformatics and its relation with molecular biology, Molecular Resources, Primary & Secondary data bases, public databases - NCBI, EBI, DDBJ, PDB, KEEG Database File formats, Submission & retrieval tools

UNIT III (10 hrs)

Sequence Alignment

Introduction, Sequence similarity, identity and homology, Dot matrix analysis, Local and global alignments, Sequence based searches; BLAST– Introduction, Definition, Types, Scoring matrices

UNIT IV (6 hrs)

Multiple Sequence Alignment & Phylogeny

Introduction, Progressive alignment method - ClustalW, Phylogenetic trees - types & topology, Methods - Maximum Parsimony, Distance methods, Maximum Likelihood approach

UNIT V (5 hrs)

Genomics

Introduction – Evolution – Genome Organisation of Prokaryotes, Eukaryotes & Organelles - Human

Genome Project − Genome Annotation – SNPs & Mutation – Gene & Genome Duplication – Gene Loss

UNIT VI (7 hrs)

Proteomics Components

Protein Structure Prediction – Mass Spectrophotometer - Analysis in Proteomics – Disease link

UNIT VII (6 hrs)

Computer Aided Drug Design

Principles - Molecular Modelling – docking – QSAR – Applications

Learning Outcomes

1) Get to know effective use of Office package
2) Understand the biological sequence analysis
3) The student will be able to understand the concepts associated to Genomics and apply the same in various fields

References

1. Introduction to computers & amp; Data processing – Shelly, Gray. B2. Mastering Microsoft office 2007 – Alison Balter's
2. Bioinformatics sequence and Genome analysis – David W. Mount, 2004, 2ed
3. BLAST. The Definitive Guide. Basic Local Alignment Search Tool – Korf, Yandell, Bedell
4. Introduction to Bioinformatics - Attwood, Smith, Parry-Smith
5. Introduction to Genomics, Arthur M. Lesk, 2007, Oxford University Press.
6. Handbook of Comparative Genomics – Principles & Methodology 2003 Saccone & G. Pesole (Publication) Wiley-Liss
7. Microbial Functional Genomics – 2004 Jizhong Zhou, Dorothea K. Thompson, Ying Xu & James. M. Tiedje (Publication) Wiley-Liss

SEMESTER II								
Course Code	**Course Name**	**Credits**	**Teaching Hours Per week**		**Marks**			
			L	**SDL**	**P**	**Internal Assessment**	**Semester Exam**	**Total**
Theory								
MANA 2.1	Medical Anatomy	4	4	1		20	80	100
MPHY 2.2	Medical Physiology	4	4	1		20	80	100
MBCHM 2.3	Medical Biochemistry	4	4	1		20	80	100
MCOM 2.4	Research Methodology & Biostatistics	3	3			20	80	100
Practical								
MANA 2.1P	Medical Anatomy	3			6	20	80	100
MPHY 2.2 P	Medical Physiology	3			6	20	80	100
MBCHM 2.3 P	Medical Biochemistry	3			6	20	80	100
Total		**24**	**36**			**140**	**560**	**700**

Semester II

M.Sc Medical Biochemistry

Theory: BCHM 2.3 T Enzymology, hormones, and Nutrition (60 hrs)

1. **Enzymes (15hrs)**
    - **Enzymology:** Definition and IUBMB Classification of enzymes. Holoenzyme, Apoenzyme, coenzymes. General Concepts and Enzyme Kinetics-Classification, Enzyme structure, Co-enzymes, Active center
    - **Mechanism of action of enzymes:**

      Lock and key model, induced fit theory, substrate strain theory, covalent catalysis, acid-base catalysis, and entropy effect.
    - **Enzyme Kinetics:**

      Factors affecting enzyme activity: concentration of enzyme, substrate, product, the effect of temperature, and pH. Michaelis constant, double reciprocal plot.
    - **Enzyme regulation:**

      Competitive inhibition, Noncompetitive inhibition, and uncompetitive inhibition.

      Allosteric inhibition, Key enzymes, Feedback inhibition, Covalent modification, Repression, Induction, zymogen activation, Specificity of enzymes, Iso-enzymes.
    - **Clinical Enzymology and Biomarkers**

      Enzyme units, Plasma specific and non-specific enzymes, enzymes of clinical significance, enzymes as therapeutic agents, enzymes as laboratory reagents, non-protein enzymes, immobilized enzymes.

2. **Mechanisms of Action of Hormones (5 hrs)**

   G proteins, Cyclic AMP, Protein kinases, Phosphatidylinositol biphosphate, Inositol triphosphate, Diacylglycerol, Cyclic GMP, Steroid receptors

   Hypothalamic and Pituitary Hormones: Anti-diuretic hormone, Oxytocin, Hypothalamic releasing factors, Growth hormone, Adrenocorticotropic hormone, Endorphins, Glycoprotein hormones, Thyroid-stimulating hormone, Gonadotropins.

   Steroid Hormones: Adrenal cortical hormones: Synthesis of steroid hormones, 17-ketosteroids, Ovarian hormones, Testicular hormones.

   Thyroid Hormones: Synthesis, Secretion, Mechanism of action, Metabolic effects

   Signal Molecules and Growth Factors: Adiponectin, Cadherins C-Jun, EGFR, Erythropoietin, ERK, Gastrin etc.

3. **Vitamins: (15 hrs)**

   Fat-Soluble Vitamins (A, D, E, K)

   Chemistry, sources, RDA, biochemical functions and deficiency manifestations, and metabolism of fat-soluble vitamins. Hyper vita minosis

   Vitamin A: Role in vision, Vitamin D, Vitamin E, vitamin K.

Water-Soluble Vitamins

Thiamine (B1), Beriberi, Riboflavin(B2), Niacin, Pyridoxine(B6), Pantothenic acid, Acetyl CoA, Succinyl CoA, Biotin, Folic acid, Folate antagonists, Folate trap, Vitamin B12, Choline, Inositol, Ascorbic acid (Vitamin C), Scurvy.

4. **Minerals (15 hrs)**

   Sources, RDA, Functions and deficiency manifestations of Calcium, Phosphorus, Iron, Zinc, Copper, Iodine, Selenium and Fluoride. Calcium-Homeostasis, Parathyroid hormone, Calcitonin, Hypercalcemia, Hypocalcemia, Bone metabolism; Markers of bone metabolism; Phosphorus, Magnesium, Sulphur, Iron, Absorption, Iron deficiency, Hemochromatosis, Copper, Ceruloplasmin, Iodine, Zinc, Fluoride, Selenium, Manganese, Molybdenum, Cobalt, Nickel, Chromium, Lithium.

5. **Nutrition and energy metabolism (10 hrs)**

   The calorific value of food - Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins, and Dietary fibers. Respiratory quotient. Principles of Nutrition: BMR (Basal Metabolic Rate)- Definition, Normal values, and Factors affecting BMR and measurement of BMR. Specific dynamic action, nutritional importance of carbohydrates, dietary fiber, lipids and proteins, Nitrogen balance, the biological value of proteins, net protein utilization, mixed diet, Balanced Diet. Principles of Diet prescription for healthy individuals. Special diets: Mediterranean diet, Diabetic diet, Diet for renal disease, Diet for liver disease. Diet for hypertension. Diet prescription for obesity and under nutrition. Total parenteral nutrition. Nutrition in health and diseases Protein-energy malnutrition (PEM), Marasmus, Kwashiorkor, Obesity. Food exchange system, Glycemic index, and Total parenteral nutrition.

SDL (5 x 3 hrs = 15 hrs)

1. Inhibition of Enzyme Activity
2. Vitamin like substances
3. Markers of Bone Metabolism
4. Nutritional importance of carbohydrate, Lipids, Proteins & dietary Fibres.
5. Glycemic Index & total parenteral Nutrition.

Semester II BCHM 2.3 P

Biochemistry Practical's: BMCH 2.3 P (60 hrs)

1. **Basics calculations: (6 hrs)**
   Calculation of Normality, Molarity, and preparation of Normal and Molar solutions, Preparation of Buffers, Factors affecting enzyme activity (temperature and pH)

2. Commonly used Equipment and Instrumentation in biochemistry laboratory **(6 hrs)**

3. **Equipment's and Instruments (18 hrs)**
   Principles, Types, and Application of
   a) Weighing Balances,
   b) Centrifuges and ultracentrifuges
   c) Hot air Ovens.
   d) Water Baths,
   e) Distillation plants,
   f) Automatic dispensers, and Diluters.

4. **Principles, Types, and Application, and Standard operating procedure (30 hrs)**
   a) pH meter- Demo, Performance, Application and Interpretation
   b) Flame photometry - Demo, Performance, Application and Interpretation
   c) Colorimeter - Demo, beer-lambert law, working with, Application and Interpretation
   d) Spectrophotometer. (Measurement of the region of maximal absorption of a colored solution)
   e) Electrophoresis- Demo, Performance, Application and Interpretation and
   f) Chromatography - Demo, Performance, Application and Interpretation

SEMESTER- III						
Course code	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
BCHM 3.1 T	Basic Metabolism and homeostasis	4	4	20	80	100
BCHM 3.2 T	Physiological Biochemistry	4	4	20	80	100
Practical						
BCHM 3.3 P	Biochemistry Practical	4	8	20	80	100
Core Elective course						
DSEBCHME 1	Good lab practice	3	3	10	--	100
DSEBCHME 2	Ethics Review of Health Research	3	3	10	--	100
POSTINGS						
BCHM 3.5	Basic research lab postings	4	12	100	--	100
BCHM 3.6	Central hospital Lab Posting (basic biochemistry)	4	12	100	--	100
BCHM 3.7	Central Research Lab Posting	4	12	100	--	100
Total		**27**	**55**	**460**	**240**	**700**

Semester III
M.Sc. Medical Biochemistry Theory

BCHM 3.1 T Basic Metabolism and homeostasis (PAPER 1)

BCHM 3.2 T Physiological Biochemistry (PAPER 2)

BCHM 3.3 P Biochemistry Practical

PAPER I

BCHM 3.1 T Basic Metabolism and homeostasis (60 hrs)

1. **Digestion, absorption & related disorders of Carbohydrates, Lipids, Proteins (4 hrs)**

2. **Carbohydrate metabolism (15 hrs)**
   Glycolysis, Gluconeogenesis, Citric acid cycle: Definition, location, reactions with enzymes, energetics and regulation. Glycolysis and BPG Shunt, Gluconeogenesis: Cori's Cycle and Glucose alanine cycle. Citric acid cycle: amphibolic nature of the cycle, anaplerotic reactions.
   Blood Glucose Homeostasis: Regulation, normal levels of Fasting, random and postprandial blood sugar. Diabetes Mellitus- Definition, Classification, Biochemical Derangements, Glucose tolerance test.

3. **Lipid Metabolism (15 hrs)**
   Beta Oxidation of fatty acids and Ketone body metabolism: Definition, location, reactions with enzymes, energetics, and regulation. Ketone Bodies:
   Normal serum levels, ketonemia, ketonuria, and ketosis

4. **Protein and Aminoacid metabolism (15 hrs)**
   General reactions of amino acids: Transamination, Nonoxidative and Oxidative deamination Formation and transport of ammonia, Disposal of ammonia (Ureacycle) Hyperammonemias.

5. **Integration of Metabolism (5 hrs)**
   Metabolism during starvation and in well-fed state.

6. **Cardiovascular Diseases and Hyperlipidemias (6 hrs)**
   Lipid profile, Hyperlipidemias, Atherosclerosis, and CAD: Risk factors and prevention of atherosclerosis, Hypolipoproteinemias, Hyperlipoproteinemias (Frederickson' classification).

Paper II

BCHM 3.2 T Physiological Biochemistry (60 hrs)

1. **Hemoglobin chemistry and metabolism** **(20 hrs)**
   Structure of hemoglobin, Transport of gases, Oxygen dissociation curve, Hemoglobin interaction, Effect of 2,3-BPG, Isohydric transport of carbon dioxide, Chloride shift,Fetal hemoglobin (HbF) , Hemoglobin derivatives, Carboxyhemoglobin, Methemoglobin, Hemoglobin variants, Sickle cell hemoglobin (HbS), Thalassemias, Myoglobin, Anemias. Heme Synthesis and Breakdown: Structure of heme, Biosynthesis of heme, Porphyrias. Catabolism of heme, Plasma bilirubin, Hyperbilirubinemias, Congenital hyperbilirubinemia. Jaundice: Hemolytic jaundice, Hepatocellular jaundice, Obstructive jaundice, Differential diagnosis of jaundice.

2. **Biological Oxidation and Electron Transport Chain** **(12 hrs)**
   Primary, secondary and tertiary metabolism, Redox potential, Biological oxidation, Oxidases, Cytochrome oxidase, Dehydrogenases, NAD+, FAD, Cytochromes, Oxygenases, High energy compounds, Organization of electron transport chain, NADH shuttle, Malate aspartate shuttle, Flow of electrons, Oxidative phosphorylation, Chemi-osmotic theory, ATP synthase, Inhibitors of ATP synthesis, Uncouplers of oxidative phosphorylation, ionophores.

3. **Detoxification and Biotransformation of Xenobiotics** **(10 hrs)**
   Phase one reactions, Oxidative reactions, Reductive reactions, Hydrolysis, Phase two reactions, Conjugation, Phase three reactions.

4. **Plasma proteins:** **(10 hrs)**
   Serum electrophoretic pattern in normal and abnormal states, Albumin, Transport proteins. Acute-phase proteins and Negative acute-phase protein.

5. **Biochemistry of AIDS and HIV** **(8 hrs)**
   Transmission, Natural course of the disease, Laboratory analysis, Virus, Replication, HIV genes and gene products, Immunology of AIDS, Anti-HIV drugs, Protection.

BCHM 3.3 P Biochemistry Practical **(60 hrs)**

1. Analysis of Urine-Normal and abnormal constituents. (10 hrs)
2. Standardization and Estimation of AST (10 hrs)
3. Standardization and Estimation of ALT (10 hrs)
4. Standardization and Estimation of ALP (10 hrs)
5. Standardization and Estimation of ACP (10 hrs)
6. Standardization and Estimation of Amylase (10 hrs)

Semester III

CORE ELECTIVES:

DSEMBHE 01 GOOD LABORATORY PRACTICES:

Learning Objectives:

1. To provide a broad-based understanding of the concept and principles of Biochemistry.
2. To identify the issues that need the intervention and to develop intelligent strategies and biochemical approaches to problem solving.
3. To provide opportunities to get hands on experience in research-oriented education in Biochemistry.

Course Content: 45 hrs-3 credits

1. Phlebotomy and laboratory workflow (4 hrs)
2. An insight into pre analytical variables: (6 hrs)
   a) Transportation and storage.
   b) Preparation of samples for analysis.
   c) Endogenous and Exogenous interferences.
3. Instrumentation, use calibration, maintenance and Standard operating procedures (10 hrs)
   - Centrifuge and ultracentrifuge Semiauto analyser, Vitros F1 S, Electrocheiluminiscence - Hormone analyser, ABG and others.
4. Method of valuation and statistical evaluation of laboratory data (6 hrs)
5. Laboratory biosafety (4 hrs).
6. Reporting of results – use of lab information system (2 hrs).
7. Quality control and quality assurance systems (4 hrs).
8. Diagnostic enzymology –reference range of markers and pitfalls (2 hrs).
9. Laboratory – Biomedical waste management (2 hrs).
10. Point of care testing (2hrs).
11. Quality management system (3 hrs).

Recommended Courses of NPTEL for DSEBCHME 2 Ethics Review of Health Research

SEMESTER - IV						
Course code	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
BCHM 4.1 T	Molecular Biology and Genetics	4	4	20	80	100
BCHMT 4.2 T	Clinical biochemistry and biochemical techniques	4	4	20	80	100
Practical						
BCHM 4.3 P	Biochemistry Practical	4	8	20	80	100
Core Elective course						
DSEBCHME 3	Nanobiotechnology	3	3	10	--	100
DSEBCHME 4	(NIE-ICMR e-Certificate course: NIeCer 102)	3	3	10	--	100
POSTINGS						
BCHM 4.5	Basic research lab postings	4	12	100	--	100
BCHM 4.6	Central hospital Lab Posting (basic biochemistry)	4	12	100	--	100
BCHM 4.7	Central Research Lab Posting	4	12	100	--	100
Total		**27**	**55**	**460**	**240**	**700**

Semester IV

BCHM 4.1 T Paper I - Molecular Biology and Genetics (60 hrs)
BCHMT 4.2 T Paper II- Biochemical techniques
BCHM 4.3 P Biochemistry Practical

BCHM 4.1 T Paper I - Molecular Biology and Genetics (60 hrs)

1. **Nucleotides; Chemistry and Metabolism (5 hrs)**

   Purine bases, Pyrimidine bases, Nucleosides, Nucleotides. Biosynthesis of purine nucleotides, Salvage pathway, Regulation of synthesis, Degradation of purines, Uric acid, Gout, Secondary hyperuricemia, Lesch-Nyhan syndrome. Synthesis of pyrimidine nucleotide, Regulation, Oroticaciduria, Degradation of pyrimidine.

2. **Deoxyribose Nucleic Acid (DNA)and RNA and Genetic code (5 hrs)**

   Structure of DNA, Watson - Crick Model, Supercoiling of DNA, Nucleoproteins, Chromosomes. Replication of DNA, Meselson-Stahl experiment, DNA polymerases, Replisome, Primosome, Okazaki fragments. Repair mechanisms, Diseases associated with repair mechanisms, Xerodermapigmentosum, Telomeres, Telomerase, Inhibitors of DNA replication. Differences between DNA and RNA, types of RNA, Genetic code: Features of Genetic Code and Wobble hypothesis.

3. **Transcription (5 hrs)**

   Transcription signals, Initiation of transcription, Elongation of transcription, Termination of transcription, Post-transcriptional processing. Spliceosomes, Ribozymes, Introns and exons, Reverse transcriptase.

4. **Translation and inheritance (15 hrs)**

   Post-translational processing, Protein folding, Chaperones, Heat shock proteins, Inhibitors of protein synthesis, Antibiotics, Micro RNA, interfering RNA, RNA silencing; Antisense therapy Mitochondrial DNA and RNA, Genomics and proteomics, and Inheritance -Principles of heredity, Dominant inheritance, Recessive inheritance, X-linked inheritance, Population genetics

5. **Mutations, and Regulation of Gene Expression (15 hrs)**

   Mutations:

   Point mutation, Termination codon mutation, Frame shift mutation, Conditional mutation, Ame's test, Mutagens, Site-directed mutagenesis. Cell cycle, Checkpoints, Oncosuppressor proteins, Rb protein, p53, Apoptosis, Caspase activation cascade.

Regulation of gene expression

Operon concept, Repression, DE repression, Lac operon, Gene rearrangement, Hormone response elements; Gene amplification, Viruses, Antiviral agents: Lysogeny, Transduction, Epigenetic modifications. Chromosomal recombination, Genetic loci on chromosome

6. Recombinant DNA Technology and Gene Therapy (15 hrs)

Application of recombinant DNA technology, Restriction endonucleases, Restriction map, cDNA, Vectors, Plasmids, Cosmids, Homopolymer tailing, Chimeric molecules, Cloning, Transfection, Selection, Expression vectors, Gene therapy. Vectors for gene therapy, Retroviruses, Adenoviruses.

BCHMT4.2 T Paper II- Biochemical techniques (60 hrs)

1. **Blotting Techniques** **(5 hrs)**

   Types and In-situ hybridization. Animal cloning, Molecular cloning in clinical diagnosis and management. DNA fingerprinting, Restriction fragment length polymorphism (RFLP)

   Polymerase chain reaction (PCR): Types and Applications

2. **General Techniques for Separation, Purification, and Quantitation** **(20 hrs)**

   Electrophoresis, PAGE, Immuno-electrophoresis, High voltage electrophoresis, Capillary electrophoresis, Chromatography (adsorption, partition, ion exchange, gel filtration, affinity), HPLC, Ultracentrifugation, Determination of molecular weight of proteins, Radioimmunoassay, ELISA test, pH meter, Colorimeter, Spectrophotometer, Flame photometer, Auto analyzers, Dry chemistry systems, Ion-selective electrodes, Tandem mass spectroscopy, Fluorescent activated cell sorter.

3. **Mutation detection Techniques** **(20 hrs)**

   Single-Strand Conformation Polymorphism (SSCP), Heteroduplex Analysis, Conformation Sensitive Gel Electrophoresis (CSGE), Protein Truncation Test (PTT), Denaturing High-Performance Liquid Chromatography (DHPLC)

   Transgenesis: Transgenic animals and their protein products

   DNA sequencing: Maxam Gilbert Technique, Dideoxynucleotide Method, Automated DNA sequencing and Microarray

4. **Immunological Techniques** **(15 hrs)**

   RIA, ELISA, Hybridoma technology, and Monoclonal antibodies

BCHM 4.3 P Biochemistry Practical (60 hrs)

Standardization and Estimation of following substances in serum /urine and clinical interpretation **(6 hrs each)**

a) Glucose
b) Urea
c) Uric acid
d) Creatinine
e) Cholesterol
f) Total Protein
g) Albumin
h) Bilirubin
i) Calcium
j) Phosphorus.

Semester IV
CORE ELECTIVES:

DSE BCHME 02: Nanobiotechnology

UNIT I: Introduction, History & Applications

Various definitions and Concept of Nano-biotechnology & Historical background. Fundamental sciences and broad areas of Nanobiotechnology. Various applications of Nano-biotechnology. Cell – Nanostructure interactions

Unit II: Protein-based Nanostructures, Nanobio- machines & Signalling

Overview, chemistry and structure, Genetics & Secondary cell-wall polymers, Self-assembly in suspension, Re-crystallization at solid supports, Formation of regularly arranged Nano-particles, Cell as Nanobio-machine, link between the signaling pathways & molecular movements as well as neuron function, Concepts in nanobio-machines for information processing and communications

UNIT III: Microbial Nanoparticle Production

Overview and concept of microbial nano-particle production, Methods of microbial nano-particle production, Applications of microbial nano-particles, Bacteriorhodopsin and its potential in technical applications – overview, structure, photoelectric applications, photochromic applications and applications in energy conversion

Unit IV: DNA-Protein Nanostructures

Overview and introduction, Oligonucleotide-Enzyme conjugates, DNA conjugates of binding proteins, Non-covalent DNA-Streptavidin conjugates, DNA - Protein conjugates in microarray technology.

Unit V: Biomaterials & Bio-electronic

Biomaterials- types, properties and applications, Biomaterial nano-particle systems for bio-electronic & biosensing applications, Biomaterial-based Nano-circuitry, Protein-based Nano-circuitry, DNA as functional template for Nano-circuitry

Recommended Online Course

DSEBCHME 4	**(NIE-ICMR e-Certificate course: NIeCer 102)**

Tutorials – 60 (4 hours /week)

Hospital posting - 90 (6 hours /week)

Dissertation work - 90 (6 hours /week)

Seminar / Journal club - 60 (4 hours /week)

SEMESTER - V						
Course code	**Course Name**	**Credits**	**Teaching Hours/Week**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
BCHM 5.1 T	Automation in clinical lab and quality Control	4	4	20	80	100
BCHMT 5.2 T	Oncogenesis and immunity	4	4	20	80	100
Practical						
BCHM 5.3 P	Biochemistry Practical	4	8	20	80	100
Core Elective course						
DSEBCHME 5	IPR	3	3	10	--	100
DSEBCHME 6	Health Informatics	3	3	10	--	100
POSTINGS						
BCHM 5.5	Basic research lab postings	4	12	100	--	100
BCHM 5.6	Central hospital Lab Posting (basic biochemistry)	4	12	100	--	100
BCHM 5.7	Central Research Lab Posting	4	12	100	--	100
Total		**27**	**55**	**460**	**240**	**700**

SEMESTER V

BCHM 5.1 T PAPER I Clinical Chemistry and Quality Control
BCHM 5.2 T PAPER-II Oncogenesis and immunity

BCHM 5.5 P Biochemistry Practicals

BCHM 5.1 T PAPER I - Clinical Chemistry and Quality Control (60 hrs)

1. **Clinical chemistry- Fundamentals (20 hrs)**

   Accuracy, Precision, Sensitivity, Specificity, and Predictive Values -Negative and Positive Predictive Value, Reference Intervals and their use in interpreting laboratory values. Test Variability-Variability and Coefficient of Variation Limits of errors allowable in the laboratory, Percentage error.

2. **Automation in Clinical Laboratory -Kit Validation (10 hrs)**
3. **Quality Control in clinical lab (20 hrs)**

   Preanalytical, Analytical, and Post analytical Variables Affecting Error: Variability with Phlebotomy; and Patient Identification.

   Critical Values; Turnaround time; and Stat vs. Routine Test Priorities.

   Potential Sources for Test Interference

   Point of care testing and errors associated with POCT

   Test Panels

   Commonly Ordered Test Panels: Basic metabolic panel, Comprehensive metabolic panel, Electrolyte panel, Hepatic function panel

4. **Prenatal diagnosis: AFP, hCG, uE3, DIA, PAPP-A; Newborn screening (10 hrs)**

THEORY PAPER II

BCHM 5.1 T PAPER II Oncogenesis and Immunity (60 hrs)

1. **Biochemistry of Cancer (30 hrs)**

   Etiology, Chemical carcinogens, Antimutagens, Oncogenic Viruses, Oncogenes, Proto-oncogene, Antioncogenes, Oncosuppressorgenes, Growthfactors, Tumourkinetics, doubling time, Contact inhibition, Anchorage dependence, Apoptosis, Oncofetal antigens, Tumor markers, Alpha-fetoprotein, Carcinoembryonic antigen, Tissue polypeptide antigen, Prostate-specific antigen, other tumor markers, Anticancer drugs, Drug resistance.

2. **Immunochemistry (30 hrs)**

   Immune response, Effector mechanisms, Cell-mediated immunity, Humoral immunity. Immunoglobulins-Structure, Variability, and Classes of immunoglobulins, Isotypes, allotypes, idiotypes, Complement system, Multiple myeloma, Plasmacytoma, Bence-Jones Proteinuria, Macroglobulinemia, Hypergamma-globulinemia, Hereditary angioneurotic edema. Immunodeficiency states, Molecular mechanisms of antibody production, Transposition of genes, Somatic recombination, Molecular structure of antigens, HLA antigens, Cytokines, Lymphokines.

Semester V

BCHM 5.3 P Biochemistry Practicals (60 hrs)

Biochemistry Practical

1. Isolation of DNA (10 hrs)
2. Electrophoretic separation of Plasma proteins (20 hrs)
3. Tests for Inborn Errors of Metabolism (30 hrs)

   Qualitative: DNPH, Benedict's test, Ferric chloride test, Methylmalonic acid test, Nitrosonapthol test, spot test, and CPC test for mucopolysaccharidoses,

   Test for sulfhydryl compounds, Paper, and Thin Layer Chromatography.

Dissertation submission will be at the end of Vth Semester (six months before VIth semester End Exam)

CORE ELECTIVES

DSE BCHME 5

INTELLECTUAL PROPERTY RIGHTS (Theory)

Learning Objectives:

This subject seeks to equip students with a broad understanding of the international intellectual property rights system, the main forms of intellectual property rights and the relevant international institutional framework. Its specificity is to provide students with a broad understanding of intellectual property in the context of sustainable development. Overall, it seeks to equip students with the necessary analytical tools to understand intellectual property in its broader environment, with particular emphasis on the situation of developing countries.

The objectives of this subject are to:

1. Acquaint the learners with the basic concepts of Intellectual Property Rights
2. Develop expertise in the learners in IPR related issues
3. Sensitize the learners with the emerging issues in IPR and the rationale for the protection of IPR.

Learning outcomes:

At the end of the course, students would be able to

1. Understand the implications of Patents, Copyrights and Designs, Trademarks and Geographical Indications.
2. Understand the relevance and impact of IP Law on academic/scientific works/studies.
3. Recognize the intellectual property likely to be produced in the academic and professional environment.
4. Understand the different forms of infringement of intellectual property rights.
5. Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
6. Demonstrate and develop basic skills of legal reasoning, individual critical thinking and group interaction, as well as interpretative, analytical and argumentative skills in oral and written forms of communication.

COURSE CONTENT Theory (45 Hours) Credit-3

Unit 1: Concepts of Intellectual Property (10Hours)

Concept, Theories, Types of Intellectual Property Rights- An Overview,

Role of International Institutions: World Intellectual Property Organisation (WIPO), WTO.

Unit 2: Patent Law and Act (10 Hours)

Introduction to Patent Law, Paris Convention, Patent Cooperation Treaty, WTO- TRIPS, The Patents Act, 1970, Amendments to the Patents Act

Unit 3: Patentability Criteria 15 Hours)

Patentable Subject Matter, Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Access and Benefit Sharing Issues

Unit 4: Types of IPR (10 Hours)

DSE BCHME 6

Health Informatics Theory (45 Hours) Credit-3

Health Informatics integrates information science, computer science, and healthcare to manage and analyze health data. Which form the backbone to bridge the gap between technology, clinical practice, and policy to transform healthcare delivery.

1. **Healthcare Information Technology management-** Healthcare Information Technology Computer Applications and Technologies in Healthcare Office Applications - Word processor, electronic spreadsheet, database management, and presentation software programs. Database – Definition, terms, common function, Basic data processing, Database and spreadsheet operations (**6 Hrs)**

2. **Database Management System** – Introduction to database management system, design, development, deployment, and evaluation of database systems, data integrity, relational normalization theory, security, privacy, and concurrence control. **(6 Hrs)**

3. **Basic ICD-10 Coding -** medical nomenclature and classification systems, ICD-10 structure, conventions, and guidelines for coding in hospitals and physicians offices. **(6 Hrs)**

4. **Hospital Information System (HIS) -**Electronic Medical Records, Personal Health Records, Telemedicine. Organizational Development and Planning in Health Information Management: Leadership, management, organizational structures theory, accreditation requirements, licensing regulations, and certification requirements relevant to department/organization, financial management and budgeting. **(6 Hrs)**

5. **Health Information Management & Nomenclature:** Informatics and Health Information Management - Introduction, Health care delivery systems, Informatics in Health Care, Health Information Management profession, Data and formation management, Information systems Development Aggregate Health care data - Secondary records and Health care database, Clinical classification and Terminologies, Reimbursement methodologies Nomenclature: Introduction, Statistical classification, choosing a classification system, other classification, Encoding system. **(6 Hrs)**

6. **Electronic Health Records EHR –** definitions, components, merits & demerits, Preliminary steps in implementation of EHR , Issues and challenges in implementation of HER, Planning for the introduction of EHR , Factors to be considered when developing EHR & implementation plan , Implementation plan, Laboratory Information system, Pharmacy Information system, Picture archiving and communication system, order sets, provider order, point of care charts, clinical decision support system **(6 Hrs)**

7. **Fundamental of Health Informatics, Clinical coding and Terminology -** Fundamentals of Health Informatics & Data Security Introduction to health informatics: Definition, Domain, Sub-domain, Tools, Focus, Application, subject area, Aspects, & Functions Major theories such as System Theory, Information Theory, Learning Theory and Change Theory Health Informatics Literacy: Information, computer and professional literacy. **(6 Hrs)**

8. **Health Information System:** Definition, Purposes, Structure (operation, telecommunication, system development / project management, application support, support, network, system administration), Roles and responsibilities (CIO, Director, Manager, Supervisor, Operator, Telecommunication technician, Telecommunication Operator, System Analyst, Programmer, Consultant), Technology infrastructure (Computers, Networks, Peripherals) **(3Hrs)**

Tutorials - 60 (4 Hours /Week)
Dissertation work – 60 (4Hours/Week)
Seminar/Journal Club presentations 30 (2 Hours/Week) Hospital Lab Postings-90 (6Hours/Week)

SEMESTER - VI						
Course Code	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
BCHME 6.1 T	Clinical and Diagnostic Biochemistry	4	4	20	80	100
BCHME 6.2 T	Contemporary topics in Biochemistry	4	4	20	80	100
Practical						
BCHME 6.1 P	Biochemistry Practical	4	8	20	80	100
BCHME 6.3	Central research lab postings	4	12	100	--	100
BCHME 6.4	Central hospital Lab Posting (Hormone Analysis)	4	12	100	--	100
BCHME 6.5	Basic Research Lab Posting	4	12	100	--	100
Total		**24**	**52**	**360**	**240**	**600**

Semester VI

M.Sc Medical Biochemistry Theory

BCHM 6.1 T - Paper I Clinical and Diagnostic Biochemistry
BCHM 6.2 T - Paper II Contemporary topics in Biochemistry
BCHMP 6.3 P - Biochemistry Practical

Paper I

BCHMT6.1 T: Clinical and Diagnostic Biochemistry - 60 Hrs

1. **Acid-Base Balance and pH** **(5 Hrs)**
   Acids and bases, Henderson-Hasselbalch equation, Buffers, Buffering capacity, Buffers of body fluids, Respiratory regulation of pH, Renal regulation of pH, Titratable acid, Cellular buffers, Disturbances in acid-base balance, Anion gap, Metabolic acidosis, Metabolic alkalosis, Respiratory acidosis, Respiratory alkalosis.

2. **Electrolyte and Water Balance** **(5 Hrs)**
   Body water compartments, Donnan membrane equilibrium, Osmolality, Electrolyte concentration of body fluid compartments, Regulation of sodium and water balance, Renin-angiotensin system, Assessment, Disturbances, Isotonic contraction, Hypotonic contraction, Hypertonic contraction, Isotonic expansion,
   Hypotonic expansion, Hypertonic expansion; Clinical applications of Sodium, Potassium, Chloride, Hypernatremia, Hyponatremia, Hypokalemia, Hyperkalemia, Hyperchloremia, Hypochloremia.

3. **Body Fluids (Milk, CSF, Amniotic Fluid)** **(5 Hrs)**
   Milk, Colostrum, Aqueous Humour, Cerebrospinal fluid , Amniotic Fluid, Assessment of Fetal Maturity.

4. **Tissue Proteins in Health and Disease** **(10 Hrs)**
   Collagen, Elastin, Keratins, Contractile proteins, Actin, Myosin, Troponin, Muscle contraction, Calmodulin, Microfilaments, Microtubules, Lens proteins; Prions, Human prion diseases, Biochemistry of aging, Alzheimer's disease.

5. **Organ function tests** **(10 Hrs)**

   Liver Function Tests **(10 Hrs)**
   Tests for liver function, Serum bilirubin, Classification of jaundice, Bile acids and bile salts, Tests based on the metabolic capacity of the liver, Tests based on synthetic function, Serum enzymes as markers of hepatobiliary diseases,

Kidney Function Tests **(10 Hrs)**

Formation of urine, Functions of the tubules, Renal threshold, Tubular maximum, Abnormal constituents of urine, Proteinuria, Reducing sugars, Clearance tests, Inulin clearance, Creatinine clearance test, Cystatin C, Urea clearance test, Tests for tubular function, Osmolality, Acidification test

Pancreatic Function Tests and Thyroid Function Tests. **(5 Hrs)**

Pancreatic enzymes, secretin–cholecystokinin, Thyroid function tests: T3, T4, TSH, TBG,

BCHM 6.2 T Paper-II-Contemporary topics in Biochemistry (60 Hrs)

1. **Neurobiology:** **(10 Hrs)**

   Neuron, Neurotransmitters, Neurodegenerative disorders: Parkinson's disease, Alzheimer's disease.

2. **Applications of Isotopes in Medicine** **(5 Hrs)**

   Subatomic particles, Valency, Isotopes, Radioactive decay, Alpha, Beta, Gamma radiations, Half-life, Units of radioactivity, Research applications, Diagnostic applications, Teletherapy, Radio sensitivity, Fractionation of doses, Biological effects of radiation, Radiation protection.

3. **Biology of Free Radicals and Antioxidants** **(15 Hrs)**

   Free radicals, Reactive oxygen species, Generation, Damage, Free radical scavenger systems, Inflammation, the role of free radicals in respiratory diseases, Retrolental fibroplasia, Reperfusion injury, Atherosclerosis, Skin diseases, Age-related diseases. .Lipid peroxidation, Initiation, propagation and termination phases, Preventive anti-oxidants, Chain breaking anti-oxidants, Total Antioxidant capacity

4. **Environmental Pollution and Heavy Metal Poisons** **(15 Hrs)**

   Corrosives and irritants, Organic irritant poisons, Neurotoxins, Heavy metal poisons, Lead, Mercury, Aluminium, Arsenic, Pesticides and insecticides, Organophosphorus compounds, Industrial hazards, Air pollutants, Sulphur dioxide, Toxic substances in food stuff, Lathyrism.

5. **Human Genome Project and Bioinformatics** **(15 Hrs)**

   Gene library, Linkage analysis, Micro satellite markers, Human Genome Project, Bioinformatics

Semester VI

Biochemistry Practicals

BCHM 6.3 P Biochemistry Practicals-60 Hrs

Advanced Techniques in Biochemistry:

a) Demonstration of PCR, HPLC **(5 Hrs)**
b) Automation. **(5 Hrs)**
c) Liver panel. **(10 Hrs)**
d) Renal panel. **(10 Hrs)**
e) Diabetic panel **(10 Hrs)**
f) Analysis of urine: Normal and Abnormal constituents **(5 Hrs)**
g) Kit Validation **(6 Hrs)**
h) CSF Analysis **(4 Hrs)**
i) Estimation of Malondialdehyde, SOD, Glutathione peroxidase, Vit C, Total Antioxidant Capacity **(5 Hrs)**

Tutorials- 60 hours (4Hours/Week)
Seminar/Journal Club/Pedagogy - 60 (4Hours/Week LabPosting-60hours (4Hours/Week)

1st Semester & 2nd Semester

Scheme of Examination:

Sl. No	Theory	Subjects	Theory Max. + IA + Viva Voce	Max. Marks Theory (Total)	Max. Marks Practical	Grand Total
1	Paper 1	Anatomy	80+20	100	80+20	200
2	Paper 2	Physiology	80+20	100	80+20	200
3	Paper 3	Biochemistry	80+20	100	80+20	200

Type of question and distribution of Marks for Theory Examination – Anatomy, Physiology and Biochemistry

Type of questions	Number of questions	Marks for each question	Total
Long Essay	03	10	30
Short Essay	10	05	50
		Total	**80**
Internal Assessment Marks			**20 Marks**
		Grand Total	**100 Marks**

Type of Questions	Practical Marks
Major Experiments	50 Marks
Minor Experiments	30 Marks
Total	**80 Marks**
Internal Assessment Marks (15+5 Marks Records)	**20 Marks**
Grand Total	**100 Marks**

Scheme of Examination for 3rd, 4th, 5th, & 6th Semester
(Theory 02 Papers Each of 100 Marks)

Theory	Pattern	Marks
Paper I		
Long Essay Questions	10 x 3	30 Marks
Short Essay Questions	10 x 5	50 Marks
	Total	**80 Marks**
Paper II		
Long Essay Questions	10 x 3	30 Marks
Short Essay Questions	10 x 5	50 Marks
	Total	**80 Marks**
	Grand Total(Total Theory+ IA)	**200**

Practical – 100 Marks

Type of Questions	Practical Marks
Major	50 Marks
Minor	30 Marks
Total	80 Marks
Internal Assessment Marks**(15 + 5 Marks Record)**	20 Marks
Grand Total	**100 Marks**

PG BIOCHEMISTRY REFERENCE TEXT BOOKS

Latest editions of following Reference Books

Sl. No	Author	Title	Publisher
1	Murray	Harper's Illustrated Biochemistry	Jaypee
2	Michael Bishop	Clinical Chemistry	Wolters Kluwer/Lippincott Williams & Wilkins
3	Denise R Ferrier	Lippincott's Illustrated Reviews: Biochemistry	Wolters Kluwer/Lippincott Williams & Wilkins
4	Voet	Principles of Biochemistry	John Wiley & Sons
5	Carl Burtis Adwal. Ashweed David Bruns	Teitz Text Book of Clinical Chemistry and Molecular Diagnostics	Elsevier
6	Devlin	Text Book of Biochemistry – Clinical Corelation	John Wiley & Sons
7	Panini	Medical Biochemistry – An Illustrated Review	Thieme
8	Ranjana Chawla	Practical Clinical Biochemistry	Jaypee
9	Sankar Kumar Ghosh Senthil Kumar P Nagarajan	Principles and Methods of Molecular Biology – A Practical Approach	Panima Publishing Corporation
10	Vasudevan	Text Book of Biochemistry for Medical Students	Jaypee
11	Dinesh Puri	Text Book of Biochemistry	Elsevier
12	Satyanarayana	Biochemistry	Elsevier
13	Bhagvan	Essentials of Medical Biochemistry	Vikas Medical Book House