



**Dr. D. Y. Patil Medical College, Hospital & Research Centre,
Pimpri, Pune - 18.
Department of Biochemistry**

PG SYLLABUS (2014)

M.D. (Biochemistry)

1. GOAL

The broad goal of the teaching biochemistry to post graduate students is to achieve complete understanding of the scientific basis of the life processes at the molecular level and to orient them towards the application of the knowledge acquired in solving clinical problems.

2. OBJECTIVES

The major objective of biochemistry is the complete understanding, at the molecular level, of all of the chemical process associated with living cells. To achieve this objective, biochemists have sought to isolate the numerous molecules found in cell, determine their structures, and analyze how they function.

2.1 Knowledge:

At the end of the course, the student shall be able to:

- 2.1.1 Describe the molecular and functional organization of a cell and its subcellular components in detail.
- 2.1.2 Delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal.
- 2.1.3 Elaborate the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered
- 2.1.4 Describe digestion and assimilation of nutrients and consequences of malnutrition
- 2.1.5 Integrate the various aspects of metabolism and their regulatory pathways
- 2.1.6 Explain the biochemical basis of inherited disorders with their associated sequelae;
- 2.1.7 Describe mechanisms involved in maintenance of body fluid and pH homeostasis and interpretation and diagnosis of acid base disorders.

- 2.1.8 Outline the molecular mechanisms of gene expression and regulation, the principles of genetic engineering and their application in medicine with recent advances in Recombinant DNA Technology.
- 2.1.9 Describe the molecular concept of body defences and their application in medicine
- 2.1.10 Describe the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis;
- 2.1.11 Describe with the principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of given data;
- 2.1.12 Suggest experiments to support theoretical concepts and clinical diagnosis

2.2 Skills:

At the end of the course, the student shall be able to:

- 2.2.1 Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;
- 2.2.2. Analyze and interpret investigative data;
- 2.2.3 Demonstrate the skills of solving scientific and clinical problems and decision-making.

3 INTEGRATION OF TEACHING:

The knowledge acquired in biochemistry shall help the students to integrate molecular events with structure and function of the human body in health and disease.

4 TRAINING SCHEDULE

- 4.1 Training will be imparted to the student termwise in form of didactic lectures, seminars, group discussion, microteaching, Journal club and presentation of special topic.
- 4.2 Hands on experience shall be in form of the various practicals in Appendix I and case studies.

5 DETAILS OF THE SYLLABUS

- 5.1 Biochemistry and Medicine- History of Biochemistry, relationship of Biochemistry to all life sciences, inter relationship of Biochemistry and Medicine i.e. study of disease process at molecular level, diagnosis and designing appropriate therapies.
- 5.2 Cell structure and functions- Structure function relationship in respect to the cellular and sub cellular components with methods of their separation and analysis.

- 5.3 Chemistry of proteins, amino acids and their biological importance, which includes classification and properties. Structural organization of proteins with special reference to the application. Biologically important peptides. Plasma proteins – Detailed study of the various plasma proteins including immunoglobulins with reference to the clinical importance of each.. Methods of separation with merits and demerits.
- 5.4 Chemistry of carbohydrates-Classification and biological importance, chemistry and functions of monosaccharides, disaccharides and polysaccharides including Glycosaminoglycans, Glycoproteins.
- 5.5 Chemistry of lipids- classification and biological importance, chemistry and functions of triacylglycerol, phospholipids, Glycolipids, fatty acid (PUFA), cholesterol, lipoproteins, prostaglandins.
- 5.6 Enzymes- Apo & coenzymes, classification, chemistry, specificity, mechanism of action, factors affecting enzyme action, Kinetics, Enzyme inhibition. Clinical enzymology- Isoenzymes, Diagnostic, prognostic, therapeutic and analytical applications.
- 5.7 Biological oxidation: General concepts of oxidation and reduction. Redox potential and its importance. Enzymes and coenzymes in biological oxidation. Electron transport chain. Substrate and oxidative phosphorylation including theories. Inhibition of oxidative phosphorylation. Bioenergetics, high energy compounds.
- 5.8 Vitamins – general nature, classification, source, active forms and metabolic role, deficiency manifestations, RDA and hypervitaminosis.
- 5.9 Mineral metabolism –Macro and micronutrients, calcium and phosphorus with special reference to bone mineralisation, magnesium, sodium and potassium, sulphur, chlorine. Biological importance of trace elements.
- 5.10 Nutrition- Principles of nutrition, Balanced diet and its planning, nutritive importance of various food stuffs, Malnutrition- Kwashiorkor, Marasmus, Obesity.
- 5.11 Digestion and absorption of carbohydrates, lipids, proteins, nucleoproteins. Bile-chemistry and functions including bile salts, bile pigments and related disorders
- 5.12 Carbohydrate metabolism- Fate of glucose, glycolysis, Citric acid cycle, Glycogen metabolism, HMP shunt, Uronic acid pathway, Gluconeogenesis, Regulation of blood sugar, Diabetes mellitus, GTT, Glycosuria, metabolism of glucose in erythrocytes, metabolism of physiologically important hexoses and related disorders.
- 5.13 Lipid metabolism- Fate of absorbed lipids, metabolism of lipoproteins, catabolism of free fatty acids, denovo biosynthesis of fatty acids, metabolism of triacylglycerol, phospholipids, Glycolipids and cholesterol, ketone bodies metabolism, adipose tissue metabolism with special reference to brown adipose tissue, disorders of lipid metabolism- hereditary and acquired –Dysbetalipoproteinemia, lipid storage disorders, atherosclerosis, fatty liver.
- 5.14 Protein metabolism- Nitrogen balance, amino acid pool. Fate of amino acids, general catabolic reaction, metabolism of individual amino acids and their disorders- Inborn (hereditary) errors and acquired defects.

- 5.15 Chemistry and metabolism of purines and pyrimidines. Biosynthesis of purine salvage and catabolism of purines and pyrimidines. Hereditary and acquired defects of the same.
- 5.16 Chemistry and metabolism of porphyrins with special reference to Haemoglobin, Porphyrins, jaundice and importance of haemoglobin derivatives, HbA1C, Methods of separation.
- 5.17 Integration of metabolism, interorgan interlinking of metabolic reactions, with special reference to diabetes mellitus and starvation.
- 5.18 Hormones-Classification, mechanism of action, metabolic roles of hormones of thyroid, pancreas, adrenals, pituitary, testis and ovaries and their disorders.
- 5.19 Chemistry, composition and functions of body fluids: blood, urine, CSF, Ascitic fluid.
- 5.20 Chemistry, composition and functions of specialised tissues like nucleus, nerve, bone, adipose tissue, brain etc.
- 5.21 Organ function tests; liver, Kidney, pancreas, adrenal gland, thyroid, fetoplacental
- 5.22 Biochemistry of pregnancy
- 5.23 Xenobiotics, biotransformation.
- 5.24 Water and electrolyte balance and imbalance including the laboratory investigation, Acid base balance and imbalance.
- 5.25 Radioisotopes in medicine.
- 5.26 Biochemistry of AIDS, cancer (Carcinogens, oncogenes, tumour markers).
- 5.27 Free radicals and antioxidants.
- 5.28 Inborn errors of metabolism-Molecular disease.
- 5.29 Protein biosynthesis its regulation, Molecular genetics and regulation of gene expression. Recent advances like recombinant DNA technology, PCR, Blotting techniques, Gene therapy.
- 5.30 Principles and application of techniques such as Chromatography, Electrophoresis, Ultra centrifugation, colorimetry, spectrophotometry, Fluorometry, Flame photometry, ISE etc, Immunochemistry.
- 5.31 Automation in Clinical Biochemistry.
- 5.32 Quality assurance in Clinical Chemistry.
- 5.33 Environmental Biochemistry.

6 TITLE OF THE THEORY PAPERS WITH CONTENTS

6.1 Paper-I: General Biochemistry and Instrumentation

100 Marks

- 6.1.1 History and scope of Biochemistry.
- 6.1.2 Cell structure and Functions.
- 6.1.3 Chemistry and Biological significance of proteins, Lipids, Carbohydrates, Nucleic acids, Porphyrins etc.

- 6.1.4 Enzymes (Including coenzymes) chemistry, specificity, mechanism of action, Kinetics, factors affecting enzyme action, Enzyme inhibition.
- 6.1.5 Bioenergetics and Biological oxidation, high and low energy phosphate compounds, Oxidative phosphorylation, theories of Biological oxidation, inhibitors.
- 6.1.6 Principles and application of techniques such as chromatography, Electrophoresis, Ultracentrifugations, Colorimetry, spectrophotometry, Fluorometry, Flame photometry etc.
- 6.1.7 Automation in Clinical Biochemistry.
- 6.1.8 Immunochemistry.
- 6.1.9 Quality Control in Clinical Chemistry.
- 6.1.10 Free radicals and antioxidants.

6.2 Paper-II: Metabolism and Nutrition

100Marks

- 6.2.1 Energy metabolism: R.Q. Colorimetry, B.M.R. its determination and factors affecting it. S.D.A etc.
- 6.2.2 Intermediary metabolism of Carbohydrates, Proteins, Lipids, Nucleic acids, Porphyrins etc. Metabolic inter-relationship and the regulatory mechanism and metabolic control.
- 6.2.3 Chemistry and Biological importance of Vitamins.
- 6.2.4 Chemistry and Biological importance of minerals and trace elements.
- 6.2.5 Principles of nutrition, balanced Diets and its planning, nutritive importance of various food sources etc.

6.3 Paper-III: Clinical Biochemistry

100 Marks

- 6.3.1 Chemistry, composition and functions of blood and urine, C.S.F. Ascitic fluid
- 6.3.2 Composition, chemistry, and functions of specialised tissues like nucleus, nerve, bone, adipose tissue, brain etc.
- 6.3.3 Hormones- General mechanism of action of hormones, Metabolic role of hormones of Thyroid, pancreas, adrenals, pituitary, testis and ovaries.
- 6.3.4 Disorders of Metabolism:
 1. Diabetes Mellitus
 2. Atherosclerosis
 3. Protein calorie malnutrition
 4. Fatty Liver
 5. Biological changes in pregnancy and obesity.
- 6.3.5 Liver function tests, Kidney function tests, pancreatic function tests, adrenocortical tests, thyroid function tests, fetoplacental function tests.
- 6.3.6 Water and electrolyte balance and disorders. Acid base balance and disorders.
- 6.3.7 Biotransformation of Xenobiotics
- 6.3.8 Applications of Radioisotopes in Medicine.

- 6.3.9 Inborn errors of metabolism.
- 6.3.10 Biochemistry of AIDS
- 6.3.11 Biochemistry of cancer, tumour markers and Growth factors

6.4 Paper-IV: Molecular diagnostics and recent advances. 100 Marks

- 6.4.1 Nucleic acid isolation, techniques and diagnostic applications.
- 6.4.2 Recent advances in metabolism, nutrition, enzymology and Clinical Biochemistry.
- 6.4.3 Recombinant DNA technology and Gene therapy.
- 6.4.4 Polymerase chain Reaction and its applications.
- 6.4.5 Blotting techniques.
- 6.4.6 Antimetabolites.
- 6.4.7 Protein biosynthesis its genetic regulation.
- 6.4.8 Molecular genetics and Control of gene expression.
- 6.4.9 Biosynthesis of Nucleic acids.
- 6.4.10 Mutations

(7) PRACTICALS

Details of practical / clinicals the student has to perform:-

Appendix – I

List of Practicals

Sr. No.	Name of the Practical
1.	Standardization & estimation of analytes in blood eg. Urea, Glucose, Bilirubin, Uric acid, ALT, AST, LDH etc.
2.	Kinetics of enzyme activity.
3.	Lipid Profiles – Total cholesterol, Triglycerides, HDH, LDL, and its importance.
4.	Diabetic profile- BSL (F,PP,R) GTT,GHb
5.	Clearance tests for renal function.
6.	Xylose excretion test.
7.	Gastric function test.
8.	Liver function test.

9.	Two dimensional paper chromatography for amino acid separation.
10.	TLC for phospholipids separation.
11.	Cellulose acetate paper electrophoresis for separation of serum proteins.
12.	PAGE for separation of LDH and ALP isoenzymes.
13.	Use of flame photometry and ISE for estimation of serum electrolytes including serum lithium.
14.	Blood gas analysis and its application.
15.	Urinary (24hr, excretion) calcium, Phosphorus, Uric acid, Creatinine.
16.	Biochemistry of CSF – Proteins, Glucose & Chloride.
17.	Biochemistry Ascitic fluid, Synovial fluid, Pleural fluid, Amniotic fluid etc.
18.	Analysis of urinary calculi.
19.	Automation, its importance and Quality control.

6 DISSERTATION:

Every candidate shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis.

Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the candidate to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. Thesis shall be submitted at least six months before the theoretical and clinical / practical examination.

The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical; and on the acceptance of the thesis by two examiners, the candidate shall appear for the final examination.

7 METHOD OF EVALUATION OF STUDENTS:

8.1 Theory

It will consist of

8.1.1 Four theory papers of 400 marks (100 marks each)

Paper I, II, III & IV will have following pattern

Each paper will have two sections each:

Section A : will have two LAQs of 25 marks each. (50 marks)

Section B : will have five SAQs of 10 marks each (50 marks)

8.2 Practical

(A) **100 marks** consisting of:

- | | |
|---|---------|
| 1. Case discussion | 25 |
| 2. Two biochemical investigations by kit method | 2X25=50 |
| 3. Interpretation of QC chart | 25 |

(B) **100 marks** consisting of:

- | | |
|--|----|
| 1. Enzyme kinetics/Blood Gas Analysis/Urine analysis/Hormone assay | 50 |
| 2. Chromatography/Electrophoresis | 50 |

(C) Standardization

50

(D) Microteaching

50

(E) Grand Viva

100

Total

400