

DPU

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(DEEMED UNIVERSITY)

SYLLABUS
for
I - MBBS
(Pre - Clinical Subjects)

2014-15

A decorative border consisting of two parallel lines forming a rectangular frame. Each corner is embellished with a diamond-shaped motif where the lines intersect.

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**HUMAN
BIOCHEMISTRY
SYLLABUS**

Total no. of teaching hours allotted to Human Biochemistry – 240 hrs.

1.1 GOAL:-

The broad goal of the teaching of undergraduate students in biochemistry is to make them understand 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.

1.2 OBJECTIVES:-

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

- i. describe the molecular and functional organization of a cell and list its subcellular components ;
- ii. delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal;
- iii. summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered;
- iv. describe digestion and assimilation of nutrients and consequences of malnutrition;
- v. integrate the various aspects of metabolism and their regulatory pathways;
- vi. explain the biochemical basis of inherited disorders with their associated sequelae;
- vii. describe mechanisms involved in maintenance of body fluid and pH homeostasis;
- viii. outline the molecular mechanisms of gene expression and regulation; the principles of genetic engineering and their application in medicine;

- ix. Summarize the molecular concept of body defences and their application in medicine;
- x. Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis;
- xi. familiarize with the principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of given data;
- xii. suggest experiments to support theoretical concepts and clinical diagnosis.

1.2.1 SKILLS

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

- i. make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;
- ii. analyze and interpret investigative data;
- iii. demonstrate the skills of solving scientific and clinical problems and decision making.

1.2.2 INTEGRATION

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.

1.3 DETAILS OF SYLLABUS FOR HUMAN BIOCHEMISTRY.

1.3.1 THEORY (Structural formulae are not obligatory)

1. Introduction of Biochemistry as a basic science for the study of medicine, it's importance in clinical practice.
2. Molecular and functional organization of a cell and its subcellular components, sub cellular fractionation by preparative ultracentrifugation and importance of analysis.

3. **Chemistry of carbohydrates:** Classification and biochemical importance, chemistry and functions of monosaccharides (excluding isomerism), disaccharides and polysaccharides including Glycosaminoglycans (mucopolysaccharides).
4. **Chemistry of Lipids:** classification of lipids and biological importance of triacyl glycerol, phospholipids, glycolipids, fatty acids (PUFA), cholesterol, prostaglandin, steroids and lipoproteins.
5. **Chemistry of proteins:** general nature of amino acids, various ways of classification of amino acids, biologically important peptides, classification, properties and biological importance of proteins.. Structural organization of proteins and its importance, Plasma proteins-functions, clinical significance of various fractions, methods of separation (only principle). Acute phase reactants and their applications.
6. **Enzymes:** General nature, classification of enzymes, specificity and mode of action of enzymes, mechanism of action- different models. Factors affecting enzymes activity. Enzymes inhibitions (Kinetics not expected). Clinical importance (Diagnostic, therapeutic and as a Laboratory reagent) of enzymes and isoenzymes.
7. **Biological oxidation:** General concept of oxidation and reduction. Role of enzymes and co-enzymes. Electron transport chain. Enzyme complexes, substrate level and Oxidative phosphorylation, Role of uncouplers and inhibitors.
8. **Haemoglobin:** Chemistry and functions of haemoglobin. Types of normal and abnormal hemoglobins (HbS, M, Thalassemia). Hemoglobin derivatives.
9. **Haemoglobin Metabolism:** Synthesis and break down of haemoglobin, porphyrias (in brief), Fate of bilirubin, different types of Jaundice.
10. **Vitamins:** General nature, classification, sources, active forms and metabolic role, deficiency manifestations, daily requirement and hypervitaminosis.
11. **Nutrition:** Balanced diet for normal adult, Quality of dietary protein, Nutritional quality of proteins, chemical score and reference protein, BMR, SDA, protein energy malnutrition (Kwashiorkor and Marasmus), obesity.

12. **Carbohydrate Metabolism:** Biochemical aspects of digestion and absorption of carbohydrates. Glycolysis, Rapoport Luebering cycle, Citric acid cycle, Gluconeogenesis, HMP shunt pathway and its biological significance, Synthesis and break down of glycogen, Uronic acid pathway (significance only). Metabolism of Galactose and Galactosemia. Blood sugar level and its regulation, oral GTT and glycosuria, Biochemistry of diabetes mellitus, manifestation and complications.
13. **Protein Metabolism:** Biochemical aspects of digestion and absorption of proteins. Nitrogen balance. Fate of amino acid in the body, General catabolic reactions, Fates of ammonia (Urea cycle, glutamine formation), Metabolism of glycine, aromatic and sulphur containing amino acids and their inborn errors.
14. **Lipid Metabolism:** Biochemical aspects of digestion and absorption of Lipids. Oxidation, biosynthesis of saturated fatty acids only, cholesterol biosynthesis, transport (role of HDL * LDL), excretion. Ketogenesis, Ketolysis and Ketosis. Adipose tissue metabolism, Lipolysis and re-esterification, fatty liver, lipotropic factors and atherosclerosis.
15. **Chemistry and Metabolism of purines and pyrimidines:** nucleosides, nucleotides. Biologically important free nucleotides, Biosynthesis of purines (sources of ring and regulatory steps only, conversion of IMP to GMP and AMP) and salvage pathway, Biosynthesis of pyrimidines. Breakdown of purines and pyrimidines, regulation of purine and pyrimidine metabolism. Gout, Lesch - Nyhan Syndrome,
16. Metabolic interrelationship of carbohydrates, lipids and proteins metabolism and metabolic changes during starvation.
17. **Hormones:** General characteristics, classification and Mechanism of hormone action. cAMP the second messengers, phosphatidylinositol / calcium/ calmodulin system as second messengers.
18. **Chemistry of nucleic acids:** Structure and function of DNA and RNA.
19. **Molecular Biology:** Genetic code, DNA Replication, fidelity, conservation of genome, types of mutations. Transcription, Translation, chain initiation, chain elongation, chain termination, Inhibitors of protein biosynthesis. Molecular

Mechanism of gene expression and regulation, Lac-operon model. Recombinant DNA, Restriction endonuclease, chimeric molecule and Gene library. Applications of recombinant DNA technology in relation to medicine, PCR and its applications.

20. **Mineral Metabolism:** Study of (i) Calcium and phosphorous (ii) magnesium (iii) copper, iodine, iron, manganese, selenium, zinc & fluoride. Their importance in body in brief.
21. Water and electrolyte(sodium, potassium and chloride) balance and imbalance including laboratory investigations.
22. Acid base balance and imbalance, anion gap, laboratory investigations.
23. **Function tests:** (i) Liver function tests, (ii) Kidney function tests & (iii) Thyroid function tests.
24. **Detoxification mechanisms:** Bio-transformation phase-I hydrolysis, oxidation, reduction, phase-II conjugation.
25. **Molecular concept of body defence and their application:**
 - i. Immunoglobulin- structure and functions.
 - ii. Free radicals, enzymatic and nonenzymatic antioxidants.
26. **Radioisotopes:** Uses of radioisotopes (therapeutic, diagnostic) and radiation hazards.
27. **Environmental Biochemistry:** Definition, chemical stress, air and water pollution, effects of temperature.
28. **Biochemistry of cancer:** carcinogens, and outline mechanism of carcinogenesis, tumour markers, metastasis.
29. **Tissue proteins in health and disease:** Collagen, muscle proteins, elastin, fibronectin, laminin, keratin, lens proteins, prion proteins.

1.3.2 PRACTICAL

Experiments:

- 1) Tests for monosaccharides.
- 2) Tests for disaccharides.
- 3) Colour reactions of proteins.
- 4) Precipitation reactions of proteins.
- 5) Estimation of blood sugar.
- 6) Estimation of blood urea.
- 7) Estimation of i) Serum creatinine, ii) Creatinine in urine.

- 8) Determination of serum total protein and albumin
- 9) Estimation of total and direct serum bilirubin.
- 10) Estimation of serum cholesterol.
- 11) Estimation of serum calcium.
- 12) Estimation of serum phosphorous (Inorganic)
- 13) Estimation of S.G.P.T./ALT.
- 14) Estimation of S.G.O.T./AST.
- 15) Estimation of serum alkaline phosphatase. (ALP)
- 16) Estimation of serum acid phosphatase.
- 17) Urine report; Physical characteristics and abnormal constituents.
- 18) C.S.F.- Sugar and Protein.
- 19) Serum uric acid.

Lecture – cum – Demonstrations:

1. pH – measurement and Blood Gas Analysis
2. Colorimetry
3. Electrophoresis.
4. Chromatography.
5. Flame photometry.
6. ELISA
7. Automation in clinical biochemistry
8. Laboratory investigations for Jaundice and Diabetics Mellitus
9. Laboratory investigations of Acute Myocardial Infarction

The journal should be scrutinized by the teacher concerned and presented during university examination.

1.4 EXAMINATION:-

1.4.1 THEORY EXAMINATION:

There will be TWO papers, each of two and half hours duration. Each paper will be of 50 marks with one compulsory question on applied biochemistry.

**Paper wise distribution of theory topics:
(Structural formulae are not obligatory.)**

Paper – I (50 marks) 2 ½ hours duration.

1. Molecular and functional organisation of a cell and its sub-cellular components.
2. Chemistry and metabolism of proteins and related disorders, Tissue proteins in health and diseases
3. Chemistry and metabolism of purines and pyrimidines and related disorders.
4. Chemistry and functions of DNA and RNA, genetic code; protein biosynthesis & regulation of gene expression.
5. The principles of genetic engineering and their applications in medicine.
6. Chemistry and Metabolism of haemoglobin.
7. Molecular concept of body defence and their applications in medicine.
8. Nutrition, Vitamins and Minerals.
9. Investigation techniques: (LCD-Topics) Colorimeter, Electrophoresis, Chromatography, ELISA & Flame photometer, Automation.

Paper – II (50 marks) 2 ½ hours duration.

1. Chemistry and metabolism of carbohydrates and related disorders.
2. Chemistry and metabolism of lipids and related disorders.
3. Water and electrolyte balance & imbalance.
4. Acid base balance and imbalance.
5. Integration of various aspects of metabolism and their regulatory pathways. Starvation metabolism.
6. Mechanism of hormone action.
7. Environmental biochemistry.
8. Liver function tests, Kidney function tests, Thyroid function tests.
9. Detoxification mechanisms.
10. Biochemical basis of cancer and carcinogenesis.
11. Radioisotopes.
12. Enzymes and Biological oxidation.

1.4.2 PRACTICAL EXAMINATION

Practical examination in Biochemistry will be of TWO hours duration. 40 marks

Exercise

Q.No.1 One quantitative experiment from group A 20 marks

Q.No.2 One qualitative / quantitative experiment from 15 marks
group B

Q.No.3 Spot identification from group C. 5 marks

Group A:

Blood sugar, Blood urea; Serum total protein, Albumin, Serum ALT/SGPT, Serum AST/SGOT, Serum Alkaline phosphatase, Serum Acid phosphatase, Serum total and direct bilirubin, Serum uric acid, Serum calcium, CSF- sugar and protein.

Group B:

Creatinine in urine, Serum cholesterol, Serum phosphorus, Tests for monosaccharides, Tests for disaccharides, Colour reactions of proteins, Precipitation reactions of proteins and abnormal constituents of urine.

Group C:

Identification of slide under microscope.

Use of reagent.

Significance of test.

Use of Instrument / Appliances.

Identification of GTT, Electrophoretogram and Chromatogram.

Candidates will be allowed to use Test procedures for quantitative and qualitative exercises. There will be table viva on Q.No.1 & Q.No.2 exercise.

Pattern of question paper

There will be two papers (Paper I & paper II) of 50 marks each. The pattern of both the question papers will be the same & as follows.

Section 'A'

Q.1 – One line answer (10 out of 12) (1X 10 = 10)

Q.2 – Long question (2 out of 3) (8X2= 16)

Section 'B'

Q.3 – A) Problem based learning (compulsory) 3 marks

B) Short answer question (7 out of 9) (3X7 = 21)

1.5 MARKS DISTRIBUTION:-

Theory:

Paper I. 50 marks.

Paper II. 50 marks.

TOTAL 100 marks.

Theory viva 15 marks (Paper I & II)

Interpretation of case history & Lab. data 05 marks

Practical:

Q.1. Quantitative. 20 marks.

Q.2. Qualitative / Quantitative 15 marks.

Q.3. Spotting. 5 marks.

TOTAL 40 marks.

Internal assessment

Theory 20 marks.

Practical 20 marks.

TOTAL 40 marks.

Standard of passing: In each of the subjects a candidate must obtain 50% in aggregate with 50% in Theory + orals, 50% in Practicals.

1.6 Topics of the lectures and approximate number of lectures:

1.	Introduction to Biochemistry.	1
2.	Chemistry of Carbohydrates.	5
3.	Chemistry of Proteins	6
4.	Chemistry of Lipids	4
5.	Enzymes	6
6.	Biological oxidation	3
7.	Chemistry and functions of Haemoglobin and abnormal haemoglobins	3
8.	Haemoglobin metabolism.	2
9.	Carbohydrate metabolism	6
10.	Protein Metabolism	7
11.	Lipid Metabolism	6
12.	Integration of metabolism and metabolic changes during starvation	2
13.	Mechanism of hormones action	2
14.	Vitamins (Fat & Water soluble)	6
15.	Nutrition	2
16.	Chemistry of Purines and Pyrimidines	2
17.	Purine and Pyrimidine metabolism	3
18.	Chemistry and functions of Nucleic acids; Protein biosynthesis, Gene expression, mutations, Genetic engineering and its applications.	6
19.	Biochemistry of cancer	1

20.	Radioisotopes	1
21.	Liver function tests, Detoxification mechanisms	2
22.	Kidney function tests, thyroid function tests	2
23.	Mineral Metabolism.	6
24.	Water and Electrolyte Balance	2
25.	Acid base balance	3
26.	Environmental Biochemistry	1
27.	Molecular concepts of body defence.	1

1.7 BOOKS RECOMMENDED:-

1. Biochemistry for Medical students by D.M.Vasudevan & Shree Kumari
2. Medical Biochemistry – U.Satyanarayan
3. Biochemistry by Pankaja Naik

REFERENCE BOOKS:

1. Harper's Biochemistry.
2. Lippincott's Illustrated Reviews Biochemistry
3. Biochemistry by L. Stryer.
4. Lehninger's Principles of Biochemistry