

1.1 DETAILS OF SYLLABUS FOR HUMAN BIOCHEMISTRY.

1.1.1 Theory (Structural formulae are not obligatory)

- Introduction of Biochemistry as a basic science for the study of medicine, it's importance in clinical practice.
- Molecular and functional organization of a cell and its subcellular components, sub cellular fractionation by preparative ultra- centrifugation and importance of analysis.
- **Chemistry of carbohydrates:** Classification and biochemical importance, chemistry and functions of monosaccharides (excluding isomerism), disaccharides and polysaccharides including Glycosaminoglycans (mucopolysaccharides).
- **Chemistry of Lipids:** classification of lipids and biological importance of triacyl glycerol, phospholipids, glycolipids, fatty acids (PUFA), cholesterol, prostaglandin, steroids and lipoproteins.
- **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.
- **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 & as a Laboratory reagent) of enzymes & isoenzymes.
- **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.
- **Hemoglobin:** Chemistry and functions of hemoglobin. Types of normal and abnormal hemoglobins (HbS, M, Thalassemia). Hemoglobin derivatives.
- **Hemoglobin Metabolism:** Synthesis and break down of hemoglobin, porphyrias (in brief), Fate of bilirubin, different types of Jaundice.

- **Vitamins:** General nature, classification, sources, active forms and metabolic role, deficiency manifestations, daily requirement and hypervitaminosis.
- **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.
- **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.
- **Protein Metabolism:** Bio-chemical 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.
- **Lipid Metabolism:** Bio-chemical 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.
- **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,
- Metabolic interrelationship of carbohydrates, lipids and proteins metabolism and metabolic changes during starvation.
- **Hormones:** General characteristics, classification & Mechanism of hormone action. cAMP the second messengers, phospho-tidyl inositol / calcium/ calmodulin system as second messengers.
- **Chemistry of nucleic acids:** Structure and function of DNA

and RNA.

- **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.
- **Mineral Metabolism:** Study of (i) Calcium and phosphorous (ii) magnesium (iii) copper, iodine, iron, manganese, selenium, zinc and fluoride. Their importance in body in brief.
- Water and electrolyte (sodium, potassium and chloride) balance and imbalance including laboratory investigations.
- Acid base balance and imbalance, anion gap, laboratory investigations.
- **Function tests:**
 - (i) Liver function tests,
 - (ii) Kidney function tests and
 - (iii) Thyroid function tests.
- **Detoxification mechanisms :** Bio-transformation phase-I hydrolysis, oxidation, reduction, phase-II conjugation.
- **Molecular concept of body defense and their application:**
 - Immunoglobulin- structure and functions.
 - Free radicals, enzymatic and nonenzymatic antioxidants.
- **Radioisotopes:** Uses of radioisotopes (therapeutic, diagnostic) and radiation hazards.
- **Environmental Biochemistry:** Definition, chemical stress, air and water-pollution, effects of temperature.
- **Biochemistry of cancer:** carcinogens, and outline mechanism of carcinogenesis, tumour markers, metastasis.
- **Tissue proteins in health and disease:** Collagen, muscle proteins, elastin, fibronectin, laminin, keratin, lens proteins, prion proteins.
- **Lectures : Curriculum of Bioethics (2 topics in 6 Hours)**
 - i. What is ethics, medical ethics and bioethics
 - ii. Historical perspectives of medical ethics

- **Language and Skills**

1.1.2 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. ELISA
6. Automation in clinical biochemistry

7. Laboratory investigations for Jaundice and Diabetes Mellitus
8. Laboratory investigations of Acute Myocardial Infarction
9. **Electrolyte analysis by Ion selective electrode (ISE) technique** The journal should be scrutinized by the teacher concerned and presented during university examination.

1.2 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 |
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| 13 | Mechanism of hormones action | 2 |
| . | | |
| 14 | Vitamins (Fat & Water soluble) | 6 |
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| 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 |
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| 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 |

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| 24. | Water and Electrolyte Balance | 2 |
| 25. | Acid base balance | 3 |
| 26. | Environmental Biochemistry | 1 |
| 27. | Molecular concepts of body defence. | 1 |

**MAPPING OF PROGRAMME OUTCOMES [POs] AND
COURSE OUTCOMES [COs] OF MBBS PROGRAMMES**

| Programme Outcomes | |
|-----------------------------------|--|
| Programme Name: MBBS | |
| Subject Code: 01010103 | |
| Sr.No. | By the end of the programme, the MBBS Graduate will have /be: |
| PO 1 | Knowledge and Skills |
| PO 2 | Planning and Problem-solving abilities |
| PO 3 | Communication |
| PO 4 | Research Aptitude |
| PO 5 | Professionalism and Ethics |
| PO 6 | Leadership |
| PO 7 | Societal Responsibilities |
| PO 8 | Environment and Sustainability |
| PO 9 | Lifelong Learner |

| Course Outcomes and Mapping with Programme Outcomes | |
|--|---------------------|
| Year I | |
| Course Code | Course Title |
| 01010101 | Human Anatomy |
| 01010102 | Human Physiology |
| 01010103 | Human Biochemistry |

| Human Biochemistry (01010103) | | |
|--------------------------------------|--|-----------------------------------|
| CO No. | At the end of the course, the learners should be able to: | Mapped Programme Outcomes |
| CO 1 | Describe the molecular and functional organization of a cell and list its subcellular components. | PO1, PO3, PO4, PO5, PO6, PO7, PO9 |
| CO 2 | Delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal. | PO1, PO5, PO7, PO9 |
| CO 3 | Summarize the fundamental aspects of enzymology and its clinical application. Describe enzyme inhibitors as poisons and drugs and as therapeutic enzyme. | PO1, PO2, PO4, PO5, PO7, PO9 |
| CO 4 | Describe digestion and assimilation of nutrients and consequences of malnutrition. | PO1, PO3, PO5, PO7 |
| CO 5 | Integrate the various aspects of metabolism and their regulatory pathway with structure and function of human body in health & disease. | PO1, PO5, PO7, PO9 |
| CO 6 | Explain the biochemical basis of inherited disorders with their associated sequelae. | PO1, PO3, PO4, PO5, PO7, PO9 |
| CO 7 | Describe mechanisms involved in maintenance of body fluid and pH | PO1, PO2, PO5, PO7, PO9 |

| | | |
|-------|---|--------------------------------|
| | homeostasis. | |
| CO 8 | Outline the molecular mechanisms of gene expression and regulation; the principles of genetic engineering and their application in medicine | PO1,PO2,PO4, PO5,PO7,PO9 |
| 103.9 | Summarize the molecular concept of body defences and their application in medicine. | PO1,PO4, PO5, PO7,PO8, PO9 |
| CO 10 | Make use of conventional techniques /instruments to perform MB103 chemical analysis relevant to clinical screening and diagnosis. | PO1,PO 2, PO4,PO 5, PO7,PO 9 |
| CO 11 | Analyze and interpret investigative data | PO1, PO2 PO3,PO 5, PO6,PO7,PO9 |

| Human Biochemistry (01010103) | | |
|--------------------------------------|--|---|
| CO No. | At the end of the course, the learners should be able to: | Mapped Programme Outcomes |
| CO 12 | Demonstrate the skills of solving scientific and clinical problems and decision making | PO1, PO2 PO3,PO4,PO5, PO6,PO7,PO9 |