## IV - SEMESTER BIOENERGETICS AND METABOLISM OF CARBOHYDRATES AND LIPIDS-(Course No-3)

#### Credits -3

#### **COURSE OBJECTIVES**

- 1. To acquire knowledge related to the intermediary metabolism and the role of TCA cycle in central carbon metabolism.
- 2. To learn basic concepts of Bioenergetics, the importance of high energy compounds, electron transport chain, synthesis of ATP, mechanisms of oxidative phosphorylation and photophosphorylation.
- 3. To understand the fundamentals of cellular metabolism of carbohydrates their association with various metabolic diseases.
- 4. To learn biosynthesis and degradation of Lipids, fatty acids and cholesterol, Metabolism of lipoproteins and Ketone bodies.

## UNIT-I

Principles of thermodynamics, free energy, enthalpy and entropy, Free energy changes in biological transformations in living systems. Redox potential, phosphate group transfer potential and ATP, High-energy compounds, oxidation and reduction reactions.

## UNIT-II

Oxidative phosphorylation, Mitochondria ultrastructure, Energy harnessing cascade from nutrients, Reducing equivalents, Electron transport and its carriers-Complex I, II, III, IV; Mitchell's Hypothesis—experimental verification, Determination of P:O ratio, ATP synthesis by F1-FO ATP synthase, E. Racker's experiment. Relation of proton movement and ATP synthesis. Experimental demonstration of the movement of ATP synthase.

Oxidation and reduction enzymes, utilization of oxygen aby oxygenase's, superoxide dismutase and catalase. respiratory control, Mechanism, and theories of oxidative phosphorylation. Respiratory chain inhibitors and unvouplers of oxidative phosphorylation. Microsomal electron transport system. Bioluminescence.

## UNIT-III

Approaches for studying intermediary metabolism. Glucose as fuel, glucose transporters, Glycolysis, and its regulation. Substrate cycling, TCA cycle – function and regulation, Glyoxylate cycle, Gluconeogenesis, and its regulation, HMP shunt and its significance, Uronic acid pathway, Glycogen metabolism and its regulation with special reference to phosphorylase and glycogen synthase, Metabolism of fructose, galactose and lactose, Biogenesis of amino sugars, peptidoglycans, glycosyl aminoglycans and glycoproteins. In born errors of carbohydrate metabolism.

## UNIT-IV

Lipid metabolism – Oxidation of fatty acids, Biosynthesis of fatty acids and regulation; Metabolism of arachidonic acid; formation of prostaglandins, thromboxanes, leukotrienes, Biosynthesis of triglycerides.

## UNIT-V

Metabolism of phospholipids, sphingolipids. Biosynthesis of cholesterol and its regulation, Formation of bile acids. Role of liver and adipose tissue in lipid metabolism. In born errors of lipid metabolism

#### IV - SEMESTER BIOENERGETICS AND METABOLISM OF CARBOHYDRATES AND LIPIDS-(Course No-3) Credits -1

#### PRACTICAL SYLLABUS

- 1. Isolation of casein from milk
- 2. Preparation of lactalbumin from milk
- 3. Estimation of reducing sugar by DNSA (dinitrosalicylic acid) method
- 4. Titration of glucose by Benedict's method
- 5. Estimation of urea by Diacetylmonoxime method
- 6. Estimation of creatinine in serum
- 7. Estimation of cholesterol by ZAK's method

#### **COURSE OUTCOMES**

After the completion of this course, the student will be able to

- 1. Explain the broad outlines of intermediary metabolism and importance of carbohydrate metabolism in life.
- 2. Describe the importance of Electron transport and ATP production mechanism.
- 3. Gain in knowledge in Carbohydrate metabolism and their associated with disorders.
- 4. Describe the details of lipid metabolism.

#### **RECOMMENDED BOOKS**

- 1. Principles of Biochemistry, White. A, Handler, P and Smith.
- 2. Biochemistry, Lehninger A.L.
- 3. Biochemistry, David E. Metzler.
- 4. Biochemistry, LubertStryer.
- 5. Text of Biochemistry, West and Todd.

## IV - SEMESTER Clinical Biochemistry-(Course No-4)

## Credits -3

#### **COURSE OBJECTIVES**

- 1. To understand the basic concepts of laboratory techniques.
- 2. To understand the basic concepts of organ functions.
- 3. To gain knowledge about various investigations and their interpretations.

## UNIT-I

Clinical Biochemistry Laboratory and Investigation of Homeostasis. The use of biochemical tests- Specimen collection and types, Automation and Computerization Water and electrolyte homeostasis - renin angiotensin – aldosterone system Pathological variations of water and electrolytes- diagnosis and Interpretations Self Study: Acid base balance and imbalance - Mechanism of regulations, Anion gap, Acidosis and Alkalosis.

## UNIT-II

Abnormal Hemoglobin and Inherited Disorders 9hrs Inborn errors of Metabolism: Patterns of inheritance - alkaptonuria, phenyl ketonuria, albinism, glycogen storage diseases and inherited disorders associated with urea cycle. Abnormal hemoglobin and' hemoglobinopathies- Sickle cell anemia and thalassemias, porphyrias and porphyrinurias. Self-study: Plasma proteins in health and diseases

## UNIT-III

Investigation of Renal and Gastric Functions. Renal functions tests: Preliminary investigations, tests based on GFR, RPF and tubular function. Diseases related to kidney - nephritis, nephrosis, uremia, renal failure, renal calculi, renal hypertension, renal tubular acidosis, diabetes insipidus.. Dialysis - hemodialyis and peritoneal dialysis. Gastric function tests: Examination of resting content, Fractional gastric analysis, stimulation tests, Tubeless gastric analysis. Malabsorption syndrome, acidity, ulcers - gastric, duodenal and peptic, colon cancer, pancreatitis, gastric and pancreatic 'function tests. Self study: Gout, Leschnyhan syndrome and oroticaciduria.

## UNIT-IV

Liver Function Tests and Lipid Disorder Liver function tests: Tests based on abnormalities of bile pigment metabolism, detoxification and excretory functions. Diagnosis of different types of jaundice. Pancreatic function tests. Diseases relating to liver - jaundice, cirrhosis, hepatitis, cholestasis, cholelithiasis, hepatic coma, hepatic carcinoma, inherited diseases of bilirubin metabolism Lipid: Lipoprotinemias and atherosclerosis coronary heart diseases and hypertension. Self study: Biochemical changes in cancer - detection of tumor markers

#### UNIT- V

Blood Glucose Regulation and Enzymes of Diagnostic Importance 9 hrs Carbohydrates: Blood glucose level - regulation and its clinical significance, Diabetes mellitus, Glycosuria and GTT. Enzymes and Isoenzymes of clinical importance - general principles of assay -Clinical significance of enzymes and isoenzymes (LDH, CK, phosphatase, 5' nucleosidase, amylase, lipase, acetyl cholinesterase, transaminase and gamma glutamyl transferase) Self study: meningitis, encephalities, epilepsy, Parkinson's, Alzheimer's, cerebral palsy.

# IV - SEMESTER Clinical Biochemistry-(Course No-4)

Credits -1

#### PRACTICAL SYLLABUS

- 1. Blood analysis: Iron and Hemoglobin, Glucose, GTT. 10hrs
- 2. Serum and Urine analysis: Creatine, chloride, phosphorus, calcium. 10 hrs
- Lipid profiles (Serum) Total cholesterol, triglycerides, HDL, LDL 5 hrs
- Liver function tests Total Bilirubin, total protein, albumin, globulin, albumin/globulin ratio, AST, ALT, ALP 10 hrs
- 5. Kidney function tests Urea, creatinine, uric acid.

## **COURSE OUTCOMES**

- 1. After completing this course, the student will:
- 2. Obtain basic knowledge about specimen collections, pathological variations of water, electrolytes
- 3. Interpret the results to diagnose the abnormal functions of organs.
- 4. Understand the antinutrient factors and its implication on other nutrients in food.Understand the, patterns of inherited disorders and disorders of hemoglobin metabolism
- 5. Correlate the tests used for renal and gastric functions and their interpretations
- 6. Impart the diagnostic tests for liver function and lipoprotein metabolic disorders
- 7. Evaluate the alterations in blood glucose regulation and enzymes of clinical importance

## **REFERENCE BOOKS**

- 1. Gowenlock, A.H. and Donald, J(2002). Varley's practical clinical Biochemistry, sixth edition, CBS publications and Distributors, New Delhi.
- 2. Sembulingam, K and Sembulingam, P(2010). Essentials of Medical Physiology, fifth edition. Jaypae Brothers (p) ltd, New Delhi.
- 3. Burtis and Ashwood (2007) Tietz Fundamentals of Clinical chemistry, 6th edition, WB Saunders Company, Oxford Science Publications USA.
- 4. Chatterjee and Shindae(2012). Text book of medical biochemistry, 8th edition.

- 5. Devlin, T.M(2010). Text Book of Biochemistry with clinical correlations, 7th edition. NewYork.
- 6. Gans, G and Murphy, J.M. (2008). Clinical Biochemistry, fourth edition, Churchill Livingstone, Elsevier