

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: V

**BIOCHEMISTRY PAPER V
METABOLISM 1**

Course Code: 18VBC5

No. of Hours: 45

COURSE OBJECTIVES:

Through this course, the student is imparted knowledge of:

- The concept of metabolism and energy flow in biological systems
- The metabolism of different biomolecules with an emphasis on carbohydrates and lipids
- The energy coupling in biochemical reactions
- The disorders associated with lack of metabolism of a particular species or its incomplete metabolism.

LEARNING OUTCOMES:

By the end of the course students should be able to:

- Describe anabolic and catabolic pathways in cellular metabolism.
- Understand the carbohydrate metabolic pathways: glycolysis, gluconeogenesis, glycogenesis TCA cycle, HMP shunt pathway and lipid metabolic pathways : beta oxidation of fatty acids, fatty acid biosynthesis , ketogenesis, cholesterol biosynthesis, triacylglycerol biosynthesis.
- Discuss carbohydrate and lipid metabolic disorders.
- Understand the bioenergetics and its importance in the living system.
- Comprehend the process of oxidation through which biomolecules supply energy for biological existence.

UNIT I

Chapter 1.1 INTRODUCTION TO METABOLISM

02 HRS

Anabolism, catabolism, and amphibolic pathways, compartmentalization of metabolic pathways in cells. Major metabolic features of the principal organs – liver, muscle and adipose tissue.

Chapter 1.2 BIOENERGETICS AND BIOLOGICAL OXIDATION

10 HRS

Thermodynamic treatment of biological reactions.

Bioenergetics: Introduction, metabolic energy capture, energy transformations in living systems, free energy concept, exergonic and endergonic reactions. ATP and other high energy compounds, phosphagens as energy reservoirs, energy coupling. Biological oxidation: Stepwise process, calculation of energy yields from biological oxidation reduction reactions, mitochondrial electron transport chain – components, schematic representation indicating sites of energy conservation, Inhibitors of respiratory chain, ATP synthesis: ATP Synthase $-F_0F_1$, proton motive force , oxidative phosphorylation – chemiosmotic theory. Uncouplers and Ionophores

UNIT II

Chapter 2.1 CARBOHYDRATE METABOLISM

13 HRS

Overview of carbohydrate metabolism, cellular ingestion of glucose. Glycolysis: preparatory and pay-off phase. Reactions of glycolysis, importance of phosphorylated

intermediates. Entry of galactose, lactose, fructose into glycolysis, aerobic and anaerobic fate of pyruvate. Rappaport Leubering cycle and its significance. The citric acid cycle – pyruvate dehydrogenase complex, reactions and regulation of the citric acid cycle, importance of succinylCoA (active succinate), anaplerotic reactions, the amphipathic and integrating role of citric acid cycle. The energetics of glucose metabolism, regulation of glycolysis and TCA cycle. The Cori cycle, Substrate level phosphorylation. Futile cycle and its significance. Glycogen metabolism: glycogenesis and glycogenolysis (Outline). Outline of gluconeogenesis with reciprocal regulation. Pentose phosphate pathway: Oxidative and non-oxidative phase, significance of pentose phosphate pathway.

Chapter 2.2 CARBOHYDRATE METABOLIC DISORDERS **06 HRS**

Hyperglycemia and Hypoglycemia; Diabetes mellitus and its types (IDDM & NIDDM), complications and symptoms. Glycosuria and its types. Ketonuria. Diagnosis and treatment of diabetes mellitus and glucose tolerance test (GTT). Regulation of Blood Glucose (Homeostasis): Random, fasting and post-prandial blood glucose level and its significance. Role of hormones (insulin, glucagon, adrenocortical hormones, catecholamines and thyroid hormones) in carbohydrate metabolism. Effect of Diabetes mellitus on gluconeogenesis and glycogenolysis. Glycogen Storage disorder and its types.

UNIT III

Chapter 3.1 LIPID METABOLISM **11 HRS**

Structure and functions of fatty acyl synthase (FAS). Scheme of biosynthesis of fatty acids - chain elongation and desaturation. Regulation of fatty acid biosynthesis. Cholesterol biosynthesis: stages of cholesterol biosynthesis - acetyl CoA to isopentenyl pyrophosphate, isopentenyl pyrophosphate to squalene, lanosterol to cholesterol (summary and structure of cholesterol), regulation of cholesterol. Biosynthesis of the triacylglycerol cycle and its regulation.

The beta-oxidation pathways for the metabolism of even (Palmitic, stearic acid), odd numbered saturated and unsaturated fatty acids. Energetics of beta-oxidation of saturated fatty acids. Alpha and Omega oxidation, Ketone bodies- structure, ketogenesis and utilization, overproduction of ketone bodies and regulation of ketogenesis.

Chapter 3.2 LIPID METABOLIC DISORDERS **03 HRS**

Hyperlipidemia and its types, Atherosclerosis, Ischemic Heart Disease (IHD), Refsum's disease. Diagnosis and therapeutic drugs for the above diseases.

REFERENCES:

1. Biochemistry by Debajyoti Das 13th edition 2008, Academic publishers
2. Fundamentals of Biochemistry by J.L Jain, Sunjayjain, Nitin Jain Sixth edition S. Chand company.
3. U.Satyanarayana-Text book of Biochemistry, 2nd edition-Books and Allied private Limited.
4. Lehninger, David Nelson and M. Chael. M Cox-Principles of Biochemistry, 4th edition W.H. Freeman and company Ltd.
5. Lubert Stryer-Biochemistry, 4th edition-W.H. Freeman and Co. New York.
6. Devlin, Text Book of Biochemistry with clinical correlations, 4th edition.
7. Phillip D Maine-Clinical chemistry in Diagnosis and Treatment, 6th edition.

BIOCHEMISTRY
V SEMESTER PRACTICAL PAPER V

DURATION: 3 HRS/ WEEK

NO. OF UNITS:15

1. a. Preparation of serum for biochemical analysis.
b. Preparation of protein free extract.
 2. Estimation of pyruvate by dinitrophenylhydrazine(DNPH) method.
 3. Estimation of lactate by p-hydroxy diphenyl method.
 4. Assay of alkaline phosphatase from serum.
 5. Estimation of blood sugar by orthotoluidine method.
 6. Estimation of cholesterol by Zak's method.
 7. Estimation of phospholipid (inorganic phosphate) in urine by Fiske-Subbarow method
 8. Qualitative analysis of urine (normal constituents).
 9. Qualitative analysis of urine(abnormal constituents).
- Repetition and Tests.

REFERENCES:

1. Varley,Alan,H, Gowenlock - Practical Biochemistry,6th edition, 2002, CBS Publishers.
2. J.Jayaraman– Manual in Biochemistry, 2001, New Age International Publishers.
3. David Plummer- Practical Biochemistry, 3rd edition, 2017, McGraw Hill Publishers.
4. S.K.Sawhney, Randhir Singh – Introductory Practical Biochemistry, 2nd Edition, 2005, Narosa Publishing house