

**Shree Manibhai Virani and Smt.Navalben Virani Science College,Rajkot
(Autonomous)
Affiliated to Saurashtra University, Rajkot
Department of Biochemistry**

SEMESTER -III

17UAMDA10	DSE allied-6: Biochemistry- III (Biomolecules)	4 Hrs/wk	4 Credits
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Objectives:

To enable the students to

1. Learn the basic structures, functions and biological importance of water.
2. Understand structure, properties and functions of different biomolecules -carbohydrates, lipids, amino acids, vitamins and nucleic acids.

Unit 1: The foundations of biochemistry and Water

(9 Hrs)

- Cellular and chemical foundations of life
- Unique properties of water
- Weak interactions in aqueous systems
- Ionization of water and buffers

Unit 2: Carbohydrates and glycobiology

(10 Hrs)

- Monosaccharides - structure , function and properties ,
- Formation of disaccharides, reducing and nonreducing disaccharides.
- Polysaccharides –types, structure and function
- Proteoglycans, glycoproteins and glycolipids--types, structure and function

Unit 3: Lipids

(10 Hrs)

- Building blocks of lipids - fatty acids, glycerol, ceramide.
- Classification of lipids
- Storage lipids - triacylglycerol and waxes.
- Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids

- Sterols, structure, distribution and role of membrane lipids.

Unit 4: Amino acids and Vitamins

(10 Hrs)

Structure and classification

- Physical, chemical and optical properties of amino acids
- Structure and active forms of water soluble and fat soluble vitamins
- Deficiency diseases and symptoms, hypervitaminosis

Unit 5: Nucleic acids

(09 Hrs)

Nucleotides – structure, properties and functions.

- Nucleic acid structure – Watson-Crick model of DNA.
- Structure of major species of RNA - mRNA, tRNA and rRNA.
- Nucleic acid chemistry- UV absorption, effect of acid and alkali on DNA.

Text Books:

1. Conn Erice, E. and Stumpf Paul, K. (2007). Outlines of Biochemistry, [5th Edition]. John Wiley & Sons, New Delhi.
2. Jain, J. L. Sunjay Jain and Nitin Jain (2004). Fundamentals of biochemistry. S. Chand Publishing, New Delhi.

Reference Books:

1. Nelson, D. L., & Cox, M. M. (2013). Lehninger Principles of Biochemistry. [6th edition] Freeman and Company, New York.
2. Berg, J. M., Tymoczko, J. L., Gatto G.J. & Stryer, L., (2015) Biochemistry, [8th Revised edition] W H Freeman, New York.
3. Devlin, T. M. (Ed.). (2010). Textbook of Biochemistry: with Clinical Correlations. 7th Edition, John Wiley & Sons, New York.

17UAMDA12	DSE allied-6: Biochemistry- III Practicals (Biomolecules)	5 Hrs/wk	3 Credits
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Objectives:

To enable students to

- The ability to apply lecture concepts in a laboratory setting.
- To obtain basic laboratory skills such as microscopy, spectrophotometry, measuring, etc. and understand the principles and concepts behind basic techniques used by biochemist.

- Perform chemical tests to determine the presence/absence of carbohydrates, proteins, and lipids

List of Practicals:

- 1) Qualitative analysis of carbohydrates.
- 2) Qualitative analysis of amino acids and proteins.
- 3) Qualitative analysis of different classes of lipids.
- 4) Introduction to colorimeter and spectrophotometer and their use in quantitative analysis.
- 5) Estimation of reducing sugars by DNSA method.
- 6) Quantitative estimation of amino acids by Ninhydrin method.
- 7) Estimation of proteins by Biuret method.
- 8) Estimation of RNA by orcinol method.

Reference Books:

1. Wilson, K., & Walker, J. M. (2000) Principles and techniques of practical biochemistry. Cambridge: Cambridge University Press.
2. J. Jayaraman (2011) Laboratory Manual in *Biochemistry New Age International Publishers, New Delhi*.
3. Thimmaiah S.R. (2004) *Standard Methods of Biochemical Analysis*. Kalyani Publishers, New Delhi

SEMESTER -IV

17UAMDA14	DSE allied-8: Biochemistry- IV (Basic Metabolism)	4 Hrs/wk	4 Credits
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Objectives:

To enable the students to

1. Elucidate various metabolic pathways and their significance
2. Integrate different metabolic pathways and understand the cause of various metabolic diseases.

Unit 1: Basic design and metabolism of carbohydrate

[10 Hrs]

- Autotrophs, heterotrophs
- Metabolic pathways, catabolism, anabolism
- ATP as energy currency,
- Glycolysis - reactions of glycolysis and control of glycolysis,
- Synthesis of glucose from various non-carbohydrate sources,(Gluconeogenesis)
- Pentose phosphate pathway and its importance.

Unit 2: Citric acid cycle

[09 Hrs]

- Fates of pyruvate
- TCA (citric acid cycle) as a central metabolic pathway and its importance.
- Subcellular localization of TCA cycle and Reactions of citric acid cycle,
- anaplerotic reactions and amphibolic role of TCA cycle,
- Regulation of citric acid cycle.

Unit 3: Metabolism of lipids

[10 Hrs]

- Synthesis and breakdown of triglycerides, Significance of fats (TAG) as major energy storage form of fuel in human body.
- Fatty acid transport to mitochondria, Activation and β oxidation of fatty acids, brief overview of oxidation of unsaturated and odd numbered fatty acids
- Fatty acid synthase complex as a multienzyme complex and synthesis of fatty acids. Comparison of fatty acid synthesis and fatty acid oxidation
- Important steps in synthesis of cholesterol and its regulation.
- Different types of lipoproteins and their role in transport of lipids.

Unit 4: Overview of amino acid metabolism

[10 Hrs]

- Importance and biological functions of different amino acids, peptides and proteins. Why proteins are not preferred as an energy source in human body? Glucogenic and ketogenic amino acids. Entry points of different amino acids in TCA cycle.
- Oxidative deamination and transamination reactions in amino acid catabolism. Amino acid decarboxylation reaction and synthesis of different biologically important amines.
- Ammonotelic, Uricotelic and ureotelic organisms .Reactions of Urea cycle. Link between urea cycle and TCA cycle.

- Essential v/s non essential amino acids. Overview of biosynthesis of non-essential amino acids.

Unit 5: Metabolism of nucleic acids

[9 Hrs]

- Chemical Structures of purine and pyrimidine bases nucleoside ,nucleotides,
- Salvage and denovo synthesis of Purine and pyrimidine nucleotides
- Conversion of ribonucleotides to deoxyribonucleotides and to triphosphates,
- Degradation of nucleic acids, purine and pyrimidine nucleotides.
- Inhibitors of nucleotide metabolism.
- Disorders of purine and pyrimidine metabolism – Lesch-Nyhan syndrome, Gout, SCID, adenosine deaminase deficiency.

Text Books

1. Campbell, N. A., & Reece, J. B. (2016). Campbell biology: Concepts & connections. Boston: Pearson
2. Deb, A. C. (2006). Fundamentals of Biochemistry. Calcutta, India: New Central Book Agency.

Reference books

1. Nelson, D. L., Cox, M. M., & Lehninger, A. L. (2013) 6th ed., Lehninger principles of biochemistry Freeman and Company (New York),
2. Devlin, T. M. (2011) Textbook of Biochemistry with Clinical Correlations. 7th ed., John Wiley & Sons, Inc. (New Jersey).
3. Berg, J. M., Tymoczko, J. L., & Stryer, L (2012), Biochemistry , 7th ed., W.H. Freeman and Company (New York).
4. Garrett, R. H., & Grisham, C. M. (2013). Biochemistry Belmont, CA: Brooks/Cole, Cengage Learning.

17UAMDA16	DSE allied--8: Biochemistry- IV Practicals (Basic Metabolism)	5 Hrs/wk	3 Credits
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Objectives:

To enable the students to

1. Comprehend the role of various metabolites in the human body & their clinical significance.
2. Perform chemical tests to determine the presence/absence of carbohydrates, proteins, and lipids present in body fluids.

List of Practicals:

1. Introduction to clinical biochemistry practicals and significance of estimation of different biochemical compounds in blood /plasma.
2. Estimation of blood glucose by GOD/POD method.
3. Estimation of plasma urea by urease method.
4. Estimation of serum uric acid by uricase method.
5. Estimation of Total proteins from plasma by biuret method and albumin by BCG method.

6. Calculation of globulin content and A/G ratio.
7. Determination of total cholesterol from plasma sample by enzymatic method.
8. Estimation of triglycerides from plasma samples by enzymatic method.
9. Determination of HDL cholesterol from plasma sample by PTA and enzymatic method.
10. Different tests of lipid profile, their normal values and clinical significance: Triglycerides, VLDL, total cholesterol, LDL cholesterol and HDL cholesterol.

Reference Books:

1. Wilson, K., & Walker, J. M. (2000) Principles and techniques of practical biochemistry. Cambridge: Cambridge University Press.
2. J. Jayaraman (2011) Laboratory Manual in *Biochemistry New Age International Publishers, New Delhi*.
3. Thimmaiah S.R. (2004) *Standard Methods of Biochemical Analysis*. Kalyani Publishers, New Delhi