

SAURASHTRA UNIVERSITY



COURSE STRUCTURE

&

SYLLABUS

FOR

UNDERGRADUATE PROGRAMME

IN

BIOCHEMISTRY 3rd and 4th Semester

CORE COURSES

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f June, 2020.

COURSE STRUCTURE FOR UG PROGRAMME
BIOCHEMISTRY- 301
SEMESTER 3

Semester	Course	Title	Hours/week	Credit	Exam hours	Internal marks	External Marks	Total Marks
3rd	301	Biomolecules	6	4	3	30	70	100
3rd	301	Practicals	6	3		15	35	50

Saurashtra University
Semester 3rd Syllabus of Biochemistry (CBCS)
Biochemistry – 301
BIOMOLECULES

Credit : 4

Theory : 6 lectures/week

Total Lectures: 60

Unit 1: Carbohydrates and glycobiology

[12 hours]

- 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 2: Lipids

[12 hours]

- 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 3: Amino acids and Proteins

[12 hours]

- Structure and classification of amino acids.
- Physical, chemical and optical properties of amino acids
- Biologically important amino acids (standard and non standard)
- **Peptides:** Structure of peptide bond. Determination of the amino acid sequence of polypeptide chain.

- **Protein structure:** Primary, secondary, tertiary and quaternary structure of proteins. Denaturation and renaturation of proteins. Behavior of proteins in solutions, salting in and salting out of proteins.
- Introduction, classification based on solubility, shape, composition and functions.
- Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (hemoglobin, myoglobin), lipoproteins, metalloproteins, glycoproteins and nucleoproteins.

Unit 4: Nucleic acids

[12 hours]

- Experimental evidences of Genetic Material
- Building Blocks of Nucleic Acids
- Nucleic acid structure – Watson-Crick model of DNA, Different forms of DNA
- Structure of major species of RNA - mRNA, tRNA and rRNA.
- Nucleic acid chemistry- UV absorption, effect of acid and alkali on DNA.

UNIT 5: Porphyrins and Vitamins:

[12 hours]

- Porphyrins: Porphyrin nucleus and classification of porphyrins. Important metalloporphyrins occurring in nature. Detection of porphyrins spectrophotometrically and by fluorescence.
- Bile pigments- chemical nature and their physiological significance.
- Vitamins: Introduction, classification, biological significance
- Deficiency and or toxicity symptoms of different vitamins.

Text Books:

1. Satyanarayan, U., & Chakrapani, U. (2013). Textbook of Biochemistry .4 edition
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.

Biochemistry Practicals:301

Credit: 3

6 Hours / Week (2 Days)

- 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.

COURSE STRUCTURE FOR UG PROGRAMME
BIOCHEMISTRY- 401
SEMESTER 4

Semester	Course	Title	Hours/week	Credit	Exam hours	Internal marks	External Marks	Total Marks
4th	401	Biophysical And Biochemical Techniques	6	4	3	30	70	100
4th	401	Practicals	6	3		15	35	50

Saurashtra University
Semester 4th Syllabus of Biochemistry (CBCS)

PAPER NO 401
BIOCHEMISTRY – CBCS
BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

Credit: 4

Theory: 6 lectures/ week

Total Lectures: 60

Objectives:

To enable the students to

1. Understand the principles of various biophysical techniques and their working.
2. Apply this knowledge for characterization, separation, identification and purification of different biomolecules.

Unit 1: Spectroscopic techniques

[12 Hrs]

- Electromagnetic radiation and spectra. Quantitative aspects of light absorption; Beer-Lamberts laws of light absorption with their limitations. Extinction coefficients.
- Instrumentation, principles, components and working of single and double beam colorimeter and spectrophotometer.
- Advantages of double beam instruments. Applications of UV-Visible spectroscopy.

Unit 2: Hydrodynamic techniques

[12 Hrs]

- Sedimentation- the concepts of Centrifugal force (F) and Relative centrifugal force (RCF).
- Different types of rotors and centrifuges.
- Preparative and analytical centrifugation- instrumentation, techniques, and their applications.

- Differential centrifugation and its applications in isolation of cell organelles. Principle of density gradient centrifugation, materials used to prepare density gradient and applications of density gradient centrifugation.

Unit 3: Radio isotopic techniques **[12 Hrs]**

- Radioactive decay by emission of alpha, beta and gamma radiations with suitable examples. Half life of radio isotopes. Types of radioisotopes commonly used in biochemistry, units of radioactivity.
- Techniques for measurement of radioactivity (gas ionization and liquid scintillation counting). Overview of GM counter, Liquid Scintillation counter and gamma counters.
- Biological applications of radioisotopes. Biological hazards of radiation and safety measures in handling radioisotopes.

Unit 4: Chromatography **[12 Hrs]**

General principles, materials, methods and applications of the following techniques:

- Paper and thin-layer chromatography techniques.
- Ion exchange chromatography.
- Molecular sieve chromatography.
- Affinity chromatography
- Gas-Liquid chromatography (GLC)
- High performance liquid chromatography (HPLC)

Unit 5: Electrophoresis **[12 Hrs]**

- Basic principles of electrophoresis and factors affecting electrophoretic mobility.
- Principle, materials, apparatus used and applications of Agarose and Polyacrylamide gel electrophoresis (PAGE).
- Principle and applications of SDS PAGE, Native v/s SDS PAGE, Isoelectric focusing and 2D Gel electrophoresis

Text Books

1. Upadhyay, A., Upadhyay, K., & Nath, N. (2009). Biophysical chemistry (principles and techniques). Mumbai: Himalaya Pub. House.
2. Wilson K. and Walker J. (2010) Principles and Techniques of Biochemistry and Molecular Biology 7th Edition, Cambridge: Cambridge University Press.

Reference Books

1. Conn Erice, E. and Stumpf Paul, K. (2007). Outlines of Biochemistry, [5th Edition]. John Wiley & Sons, New Delhi.
2. Freifelder, D. (1986). Physical biochemistry: Applications to biochemistry and molecular biology. San Francisco: W.H. Freeman.
3. Van Holde, K. E., Johnson, W. C., & Ho, P. S. (2006). Principles of physical biochemistry. Prentice-Hall.

Practicals 401:

- 1) Introduction to principle and working of Colorimeter and spectrophotometer.
- 2) Determination of absorption spectrum and absorption maxima of given compound.
- 3) Verification of Beer's Law of light absorption using colored solutions.

- 4) Introduction to principle and working of centrifuge.
- 5) Separation of amino acids using paper chromatography. Determination of Rf values and identification of amino acids from mixtures.
- 6) Separation of lipids by thin layer chromatography.
- 7) Separation of compounds using column chromatography.
- 8) Agarose Gel electrophoresis of DNA.