

**ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD-9  
FACULTY OF SCIENCE**



**DEPARTMENT OF BIOCHEMISTRY – BIOTECHNOLOGY**

**SEMESTER – I SYLLABUS**

**OF**

**BSc BIOCHEMISTRY (HONOURS)**

**BASED ON UNDERGRADUATE CURRICULUM FRAMEWORK  
(NEP – 2020)**

**(Effective from Academic Year 2023)**

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## **Programme Outcomes**

- PO1. Create a strong knowledge domain/ expertise
- PO2. Develop critical thinking, Problem solving and research aptitude
- PO3. Skill development
- PO4. Encouraging social interaction, service learning and develop equity centred national development (Social Extension work)
- PO5. Self-directed and lifelong learning
- PO6. Developing employability and entrepreneurial skills
- PO7. Promoting Ecological sustainability development
- PO8. Nurturing creativity and humane values

## **Programme Specific Outcome for BSc Biochemistry**

- PSO1. Comprehensive and Procedural Knowledge: Discuss and interpret the basic concepts of all subjects under the aegis of current multidisciplinary Biochemistry to translate and apply the same for professional, entrepreneurial and societal benefits.
- PSO2. Skill development: Learn wide – ranging technical skills inclusive of digital learning skills through laboratory sessions/ research projects and develop self-directed experiential learning with an objective to associate biochemistry with improving life, industrial applications and environment.
- PSO3. Critical thinking, Creativity and Problem Solving: Develop competence to solve problems in familiar and non – familiar context especially to alleviate stress in all life forms, develop an analytical mind to use information from various sources and create plans/models to come up with innovations in the field of Biochemistry.
- PSO4. Communication and Collaboration: Ability to communicate the understanding of the learning to others confidently and precisely, interact with diverse multicultural groups working in the subject area as well as collaborate to achieve goals that have a wider outreach.
- PSO5. Leadership, Lifelong learning and ethics: Extend the applicability of Biochemistry to service learning and nation development through awareness programmes/ action - oriented projects in health, nutrition, and environment; be accountable, responsible and conscientious in leading roles both in profession and personal space.

## Curriculum Framework for Semester – I BSc (Hon.) Biochemistry and BSc Biochemistry with Vocational Biotechnology

Course	Title	Content	Hours/ week	Credit
<b>DSC-1 (Theory)</b>	BC – 1501 Fundamentals of Biomolecules	U-1: Scope of Biochemistry and Origin of Life U-2: Carbohydrates U-3: Lipids U-4: Amino acids and Proteins	4 hrs	4
<b>DSC-1 (Lab)</b>	BC – 1502 Basic Biochemistry Lab	Practical based as per Theory syllabus.	8 hrs	4
<b>Minor-1 (Theory + Lab)</b> <i>Offered to students of other Major Discipline (Chemistry)</i>	BC – 1101 Theory: Fundamentals of Biochemistry	U-1: Origin of Life, Nucleic Acids and Proteins U-2: Carbohydrates and Lipids	2 hrs	2
	Lab: Laboratory Analysis of Biomolecules	Practical based as per Theory syllabus.	4 hrs	2
<b>Minor-1 (Theory + Lab)</b> <i>Offered to students with Voc Biotech</i>	BT – 1101 Theory: Plant Cell and Tissue Culture	Unit 1: Basic concepts in Plant Tissue Culture Unit 2: Applications of Plant Tissue Culture	2 hrs	2
	Lab: Plant Tissue Culture	Labs based on plant tissue culture and its analysis	4 hrs	2
<b>SEC</b>	BC – 1650 Biophysical Techniques - I	U-1: Microscopy U-2: Centrifugation	2 hrs	2
<b>MDC</b> <i>Offered to students of other Major Discipline</i>	BC – 1201 Nutrition and Health	U-1: Food groups and diet U-2: Nutrients in food U-3: Food adulteration and Food safety standards U-4: Tutorials/Activities	4 hrs	4
<b>AEC</b>	English	(To be offered by the concerned subject Department)		2
<b>VAC</b>	Value Added Courses	(To be chosen from a basket of courses)		2
<b>Total Credits</b>				22

# BSC. (HONS.) BIOCHEMISTRY SYLLABUS

## SEMESTER - I

### Minor Course – 1: Fundamentals of Biochemistry

*For Chemistry Major Students*

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
BC – 1101: Fundamentals of Biochemistry	2 (30 hr)	0	2 (60 hrs)	10 + 2 from a recognized board in any stream	Nil

#### I. Course Learning Objectives

The course has been structured to enable students to relate biomolecules and life. The learning from this course work can help in the following:

- Relate the structure of biomolecules with its functions in the biological systems
- Comprehending their relevance as commercial products
- Relate the balance of these molecules in the body and its implications on health and day to day activities.
- Develop a skill set to identify biomolecules in given samples.

#### II. Course Learning Outcomes

The main outcome of the course will be to build the basic foundation for studying biochemistry. By the end of the paper, a student should be able to:

- CO 1: To integrate experiments and evidences to deduce origin of life
- CO 2: To establish how proper conformations are needed for optimum functioning of the molecules and thereby the entire cell
- CO 3: To analyze how biomolecules contribute to structural integrity of the cell as well as the biochemical reactions and a change in the structure of the molecules can lead to abnormalities, for eg. A mutated globin results in sickle cell anaemia
- CO 4: Applying the principles and protocols to analyze biomolecules in given samples.

### III. Course Content

#### **Part A: Theory**

#### **III A.**

##### **Unit 1: Origin of life, Nucleic Acids and Proteins (1 Credit)**

Origin of life: Living matter, early history, Chemical evolution, Origin of living systems (molecules to first cell), RNA world, development of metabolic pathways, Central dogma of life, mutation and evolution. Biological evolution: prokaryotes to eukaryotes; Differences between plant and animal cells; Types of cells.

Nucleic Acids: Basic structure and functions of nucleotides, DNA and RNA

Proteins: Introduction to Amino acids, its amphoteric nature and concept of pI; Peptides – structure, formation and characteristics of peptide bond; Structure of proteins – primary, secondary, super secondary, tertiary and quaternary structures

##### **Unit 2: Carbohydrates and Lipids (1 Credit)**

Introduction, natural occurrence and physiological importance and functions:

Carbohydrates: Simple sugars, Oligosaccharides, Amino sugars, Deoxysugars, sugar phosphates, blood group polysaccharides, cell wall polysaccharides, teichoic acid, muramic acid, sialic acid, mucopeptides, starch, cellulose, hemicellulose, dextrin, chitin, inulin, dextran, pectin, agar, alginic acid, mannans, glycoproteins, glycosaminoglycans, glycolipids, proteoglycans.

Lipids: Lipids: Introduction, classification of lipids, fatty acids. Structure, properties, functions and importance of saturated, unsaturated, hydroxyl, cyclic, branched chain fatty acids and PUFA; Complex lipids and Sterols: Glycerophospholipids – classification, properties and functions of lecithin, lysolecithin, cephalins, plasmalogens, phosphatidyl serine, phosphatidyl inositol; Sphingolipids: Classification, properties and functions of cerebrosides, gangliosides; Sulpholipids, gangliosides, proteolipids and prostaglandins; Structure and properties of sterols; Colour reactions of cholesterol.

#### **III B. Recommended Learning Resources**

1. Biochemistry, 5th Edition. Garrett and Grisham
2. Biochemistry, 3<sup>rd</sup> Edition. Matthews, van Holde, and Ahern
3. Biochemistry. 7th edition. Berg JM, Tymoczko JL, Stryer L. New York: W H Freeman;
4. Lodish et al. Molecular Cell Biology. 8<sup>th</sup> Edition. W. H. Freeman and Company.
5. Textbook of Biochemistry with Clinical Correlations, 7<sup>th</sup> Edition by T. Devlin
6. Voet, D. and Voet, J.G. (2012) : Biochemistry 4<sup>th</sup> ed., ( John Wiley & Sons Inc/, New York)
7. Harpers Review of Biochemistry, 25<sup>th</sup> Edition. Murray RK, Rodwell VW.
8. Lehninger's Principles of Biochemistry, Nelson and Cox (2012) : Principles of Biochemistry (Worth Publ. Inc. USA)
9. Biochemistry, 4<sup>th</sup> Edition. U. Satyanarayana and U. Chakrapani. Elsevier; 2013

### III C. Pedagogy

1. Classroom engagement through lectures and PowerPoints
2. Lecture videos and online resources
3. Workbooks/Group activities/Assignments/Class Tests

### III D. Evaluation

The course paper is evaluated out of 50 marks, of which 50 percent weightage is of Internal Assessment and 50 percent weightage is of the End semester examination (External)

ASSESSMENT CRITERIA	INTERNAL EVALUATION	EXTERNAL EVALUATION
Continuous Internal Assessment (CIA) I and II	15	-
Assignment	05	-
Attendance	05	-
End Semester Exam	-	25
Total	25	25

*\*The assignment comprises searching literature or experiments carried out by scientists or labs across the globe elucidating the structural and functional aspects of biomolecules, and then representing the findings as a report or article or presentation or poster.*

### Part B: Lab sessions

### III E. Laboratory Experiments

(2 Credits)

#### Qualitative Analysis

1. Qualitative tests for monosaccharides.
2. Qualitative tests for Disaccharides
3. Qualitative tests for Polysaccharides
4. Qualitative tests for mixture of sugars
5. Quantitation of sugar in samples by Cole's method
6. Qualitative analysis of lipids
7. Qualitative analysis of proteins

### III F. Recommended Learning Resources

1. Concepts in Biochemistry, 3<sup>rd</sup> Edition. Rodney Boyer

2. Introduction to Practical Biochemistry. T. Plummer.
3. Textbook of Biochemistry, 4<sup>th</sup> Ed. West and Todd.

### **III G. Pedagogy**

1. Explanation of each laboratory experiment emphasising on the use of different reagents and instruments
2. Problem solving, group activities and presentations. There are defined activities for every laboratory experiment in the journal, which encourages self-learning, peer learning, team work, developing presentation skills and reading from science articles and research papers.
3. Learning outcome based questions, which develops reading and writing skills and lab tests

### **III H. Evaluation**

**The course paper is evaluated out of 50 marks, of which 50 percent weightage is of Internal Assessment and 50 percent weightage is of the End semester examination (External)**

<b>ASSESSMENT CRITERIA</b>	<b>INTERNAL EVALUATION</b>	<b>EXTERNAL EVALUATION</b>
<b>Internal Practical Examination*</b>	<b>20</b>	<b>-</b>
<b>Attendance</b>	<b>05</b>	<b>-</b>
<b>End Semester Practical Exam</b>	<b>-</b>	<b>25</b>
<b>Total</b>	<b>25</b>	<b>25</b>

*\*The internal practical exam will entail the students to answer a question paper based on the experiments in their journal, to perform one experiment. The journal duly completed and signed will also carry weightage in the end semester evaluation.*