

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



**DEPARTMENT OF BIOCHEMISTRY – BIOTECHNOLOGY**

**SEMESTER – II SYLLABUS**

**OF**

**BSc BIOCHEMISTRY (HONOURS)**

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

**(Effective from Academic Year 2023)**

---

## **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 – II BSc (Hon.) Biochemistry and BSc Biochemistry with Vocational Biotechnology

Course	Title	Content	Hours/ week	Credit
<b>DSC-1 (Theory)</b>	BC – 2501 Concepts in Cell Biology	Unit 1: Membrane Structure and Cytoskeleton Unit 2: Cell organelles Unit 3: Cell – cell Interaction and Communication Unit 4: Cell cycle and Cell Death	4 hrs	4
<b>DSC-1 (Lab)</b>	BC – 2502 Basic Techniques in Cell Biology	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 – 2101 Theory: (Ultrastructure of Cell	Unit 1: Membrane Structure and Cytoskeleton Unit 2: Cell Organelles	2 hrs	2
	Lab: Basic Cell Biology Lab	Practical based as per Theory syllabus.	4 hrs	2
<b>Minor-1 (Theory + Lab)</b> <i>Offered to students with Voc Biotech</i>	BT – 2101 Theory: Environmental Biotechnology	Unit 1: Renewable energy and Biofuels Unit 2: Bioremediation and Biofertilizers	2 hrs	2
	Lab: Basic Techniques in Environmental Biotechnology	Labs based on environmental biotechnology	4 hrs	2
<b>SEC</b>	BC – 2650 Biophysical Techniques - II	U-1: Spectroscopy U-2: Chromatography	2 hrs	2
<b>MDC</b> <i>Offered to students of other Major Discipline</i>	MDC – 201_1C (Sem 3) Nutrition and Health	U-1: Food groups and diet U-2: Nutrients in food U-3: Food adulteration and Food safety standards U-4: Activity Modules	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 - II

#### Minor Course – 1: Ultrastructure of the Cell

*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 – 2101 Ultrastructure of Cell	2 (30 hr)	0	2 (60 hrs)	10 + 2 from a recognized board in any stream	Nil

#### I. Course Learning Objectives

The course will give a detailed description of

- The detailed study of membrane biochemistry, transport across membranes and within cells by cytoskeleton
- Studying the organization of the cell and the structure and functions of various organelles.

Thus, the knowledge from this course can help in the following:

- Research in elucidation of molecular mechanisms within a cell
- Research in cancer biology, tissue engineering, stem cells etc.
- Drug discovery targeting various anomalies due to malfunction of organelles

#### II. Course Learning Outcomes

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

- CO 1: Correlate the importance of semi permeable nature of plasma membrane in maintaining the integrity of a cell.
- CO 2: Evaluate how proper conformations of lipids and proteins in a membrane are needed for optimum functioning
- CO 3: Evaluate how important cytoskeleton and each organelle is to make cell the basic unit of life – the entire organization within a cell is a perfect example of division of labour with proper coordination and networking.

### III. Course Content

#### Part A: Theory

##### **Unit 1: Membrane Structure and Cytoskeleton (1 credit)**

Membrane structure: Singer – Nicholson's Fluid Mosaic Model, Structure and functions of membrane lipids and glycolipids – membrane fluidity and movement, lipid rafts.

Membrane proteins: structure and types; principles of membrane transport, Carrier proteins and active membrane transport, Ion channels

Membrane carbohydrates: Glycocalyx

Cytoskeleton: Nature of cytoskeleton, Intermediate filaments, Microtubules, Cilia and flagella, Actin filaments; Molecular motors associated with cytoskeleton

##### **Unit 2: Cell Organelles (1 credit)**

Detailed structure and functions of: Mitochondria and Chloroplast (Energy Conversions) and the Endosymbiont Theory, Endoplasmic reticulum: Rough and Smooth, Golgi apparatus, Ribosomes, Lysosomes, Peroxisomes, Nucleus; Endomembrane network system and its importance.

#### Part B: Lab sessions

1. Basic working of a Colorimeter
2. Staining and observation of yeast cells using Microscope
3. Growth curve of yeast cells by turbidometry
4. Cell count and Checking cell viability using Trypan blue
5. Staining and observation of buccal cells
6. Lipid extraction from yeast cells
7. Estimation of total lipids colorimetrically using phosphovanillic method
8. Protein estimation by Biuret method
9. Sugar estimation by DNSA
10. Extraction of soluble sugar from plant tissue and its quantification

### IV. Recommended Learning Resources

1. Molecular Cell Biology, 7<sup>th</sup> Edition. Lodish, et. al.
2. Biochemistry, 4<sup>th</sup> edition. Donald Voet and Voet Judith
3. Lehninger's Principles of Biochemistry, 5<sup>th</sup> Edition. Nelson DL and Cox MM
4. Biochemistry, 5<sup>th</sup> Edition. Garrett and Grisham
5. Molecular Biology of Cell – Bruce Alberts
6. Gerald Karp's Cell and Molecular Biology
7. Origin of life on the earth and in the cosmos (2<sup>nd</sup>ed), Geoffrey Zubay:Academic Press
8. Molecular Biology of the Cell, 5<sup>th</sup> Edition, Bruce Alberts et. al.

9. Organelle structure and function, David E Sadava, Jones Bartlett publishers.
10. Cytology, P.S. Verma, V.K. Agarval, S. Chand Publications.
11. Cell and Molecular Biology, 8<sup>th</sup> Edition. De Robertis.
12. Cell and Molecular Biology, Sheeler and Bianchi
13. The Cell: A Molecular Approach, 6<sup>th</sup> Edition, G.M. Cooper
14. Introduction to Practical Biochemistry. T. Plummer.
15. Practical Biochemistry - Satyanarayan

## V. Pedagogy

### A. For Theory

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

### B. For Lab Sessions

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.

## VI. Evaluation

**The theory part of 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
<b>Continuous Internal Assessment (CIA) I and II</b>	<b>15</b>	-
<b>Assignment</b>	<b>05</b>	-
<b>Attendance</b>	<b>05</b>	-
<b>End Semester Exam</b>	-	<b>25</b>
<b>Total</b>	<b>25</b>	<b>25</b>

*\*The assignment comprises activities designed by the faculty members concerned. The activities are to be carried out as a group and presented as a team*

**The laboratory part of 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, and to perform one experiment. The journal duly completed and signed will also carry weightage in the end semester evaluation.*