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
DSC-1 (Theory)	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
DSC-1 (Lab)	BC – 2502 Basic Techniques in Cell Biology	Practical based as per Theory syllabus.	8 hrs	4
Minor-1 (Theory + Lab) *Offered to students of other Major Discipline (Chemistry)*	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
Minor-1 (Theory + Lab) *Offered to students with Voc Biotech*	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
SEC	BC – 2650 Biophysical Techniques - II	U-1: Spectroscopy U-2: Chromatography	2 hrs	2
MDC *Offered to students of other Major Discipline*	BC 2201 Public Health	U-1: Prevalent Diseases U-2: Methodology to study Public Health U-3: Public Health Organisations U-4: Challenges and Prospects	4 hrs	4
AEC	English	(To be offered by the concerned subject Department)		2
VAC	Value Added Courses	(To be offered by the concerned subject Department)		2
Total Credits				22

BSC. (HONS.) BIOCHEMISTRY with

VOCATIONAL BIOTECHNOLOGY SYLLABUS

SEMESTER - II

Minor Course – 1: Environmental Biotechnology

For Vocational Biotechnology Students

Course Title & Code	**Credit Distribution of The Course**			**Eligibility Criteria**	**Prequisite(s) of the Course (if any)**
	Lecture	**Tutorial**	**Practical / Practice**		
BT – 2101 Environmental Biotechnology	2 (30 hr)	0	2 (60 hrs)	10 + 2 from a recognized board in any stream	Nil

I. Course Learning Objectives

The main objective of the course will be to comprehend the concepts of Environmental Biotechnology and its important applications. Thus, the knowledge from this course can help in the following:

a) The students could pursue a career in industries of the Environment Sector
b) Avail jobs in Production, Quality Control and Rand D divisions of Biotech and Chemical companies.
c) The students can begin their own start up catering to agriculture and environment
d) Students may go on to higher studies such as management or policy designing and contribute towards environment and energy management

II. Course Learning Outcomes

By the end of the paper, a student should be able to:

CO 1: Evaluate the importance of requirement of alternate fuels and its production
CO 2: Apply bioremediation methods for reclamation of contaminated water and soil
CO 3: Compare and contrast how some microbes are able to degrade xenobiotics and how some microbes enable assimilability of nutrients
CO 4: Use biological systems to recover trace elements, to control growth of weeds, pests etc., Clean the environment by waste water and solid waste management.
CO 5: Design products benefitting agriculture and environment

III. Course content

Part A: Theory

Unit-1: Renewable Energy Sources and Alternative fuels (Credit 1)

Introduction to Environmental Biotechnology; Renewable sources and its classification; Biofuels – definition, benefits and prospects; Biogas production using methanogenic bacteria; Microbial hydrogen gas production; Ethanol production and its use as fuel, eg. Gasohol; Cellulose degradation for combustible fuel; Photosynthetic pigments as solar energy convertors; Plant based petroleum industry.

Unit-2 Biofertilizers and Bioremediation (Credit 2)

Biofertilizers: Nitrogen fixing microorganisms enriching the soil with assimilable nitrogen; Phosphate solubilizers; Vermicompost; Plant growth promoting rhizobacteria

Bioremediation and phytoremediation; Bioleaching: Enrichment of ores by microorganisms; Wasteland reclamation

Xenobiotic degradation – pesticide degradation, herbicide degradation etc. by microbes; Biopesticides, thuringiensis toxin as a natural pesticide, Bt plants etc

Part B: Lab Sessions

1. Estimation of total hardness of water samples
2. Determination of pH, carbonates and nitrates in soil
3. Estimation of Dissolved oxygen and Biological oxygen demand
4. Estimation of chemical oxygen demand
5. Alcoholic fermentation, purification and estimation
6. Bioremediation (Suggestion: Degradation of methyl red by *P.aeruginosa*)
7. Strain development
8. Preparation of compost from vegetable/leaf /fruit wastes – Checking NPK!
9. Preparation of liquid bioformulation for biofertilizer and assessing its shelf life

IV. References

1. Principles and Techniques of Biochemistry and Molecular Biology, Wilson and Walker, 7th Edition, 2010, Cambridge University Press
2. Microbial Biotechnology, Glazer et al, 2nd edition, 2007, Cambridge University Press
3. Principles of Fermentation, Whitaker et al, 2nd Edition, 1999, Butterworth – Heinemann publishers
4. Biotechnology – B.D. Singh, 2010, Kalyani Publishers

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
Continuous Internal Assassment (CIA) I and II	**15**	**-**
Assignment	**05**	**-**
Attendance	**05**	**-**
End Semester Exam	**-**	**25**
Total	**25**	**25**

**The assignment comprises activities designed by the faculty members concerned*

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)

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

***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.*