St. Xavier's College (Autonomous), Ahmedabad
Syllabus of Semester – II of the following departments under Faculty of Science based on Under Graduate Curriculum Framework – 2023 (NEP) to be implemented from the Academic Year 2023-24.

FACULTY OF SCIENCE

DEPARTMENT OF BIOCHEMISTRY

Course	Title	Content	Hours/ Week	Credit
Minor-I (Theory+ Lab)	BT – 2101 Theory: Environmental Biotechnology	U-1: Renewable energy and Biofuels U-2: Bioremediation and Biofertilizers	2 hrs	**2**
	Lab: Basic Techniques in Environmental Biotechnology	Labs based on plant tissue culture and its analysis	4 hrs	**2**

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

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.