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)

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
DSC-1 (Theory)	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
DSC-1 (Lab)	BC – 1502 Basic Biochemistry Lab	Practical based as per Theory syllabus.	8 hrs	4
Minor-1 (Theory + Lab) *Offered to students of other Major Discipline (Chemistry)*	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
Minor-1 (Theory + Lab) *Offered to students with Voc Biotech*	BT – 1101 Theory: Plant Tissue and Cell 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
SEC	BC – 1650 Biophysical Techniques - I	U-1: Microscopy U-2: Centrifugation	2 hrs	2
MDC *Offered to students of other Major Discipline*	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
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 - I

Minor Course – 1: Plant Tissue and Cell Culture

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 1101: Plant Tissue and Cell Culture	2 (30 hr)	0	2 (60 hrs)	10 + 2 from a recognized board in any stream	Nil

I. Course Learning Objectives

The knowledge from this course can help in the following:

a) The students could pursue a career in Agriculture sector, Environment Sector and Biotech industries related with plant products.
b) The students can carry out basic research that can be translated to the field or industry, thereby going for higher studies in this field.
c) Due to knowledge of techniques, they can proceed to study further and be part of teams that are involved in policy making related to the field.
d) Plant Proteomics is an area that can be explored as a career option.
e) Comprehend beginning entrepreneurship ventures in plant based products

II. Course Learning Outcomes

The main outcome of the course will be to build the basic foundation for micropropagation and plant biotechnology.

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

CO 1: Relate the basic concepts and techniques in plant biotechnology, especially the standard operating procedures for successful culture establishment and appraise how industry has been able to scale up the production of commercially important plant based products.

CO 2: Weigh the pros and cons of the various techniques in Agriculture, Environment and Industry/ Commercial set up.

CO 3: Analyze how crops have been improved and evolved due to specialized techniques like hybridization, mutagenesis and transgenics

CO 4: Evaluate the ethical concerns related to genetic modifications in plants

CO 5: Design and carry out basic plant tissue culture experiments

III. Course Content

Part A: Theory

Unit-1: Basic concepts in Plant Tissue Culture

Basics terms and definitions in plant tissue culture; Introduction to in vitro cultures; Laboratory set up; Sterilization techniques; Media: Various kinds of media, Composition and significance of media components; Plant growth regulators; Micropropagation: Axillary bud, Shoot tip, Meristem culture, Introduction to organogenesis, Production of haploid plants and their applications ; Ovary and ovule culture, In vitro pollination and fertilization, Pollen culture, Anther culture, Embryo culture: History and methodology, Embryo rescue after wide hybridization, Applications, Somatic embryogenesis. Endosperm culture and production of triploids.

Unit-2 Applications of Plant Tissue Culture

Single cell suspension cultures, Mutant Selection, Scale up of cell cultures and bioreactors, Protoplast isolation and culture, DNA transformation methods in plants, Somaclonal variation and applications, Somatic Hybridization and its applications, Virus free plants, Germplasm conservation, Synthetic seeds, Applications of plant DNA transformation. Hairy root culture, Secondary metabolite production, Transgenics in crop improvement and ethics, Plant Proteomics.

Part B: Lab sessions

1. Study of laboratory equipment and set up
2. Stocks and Media preparation
3. Sterilization techniques in plant tissue culture
4. Explant selection, treatment and inoculation
5. Subculture of initiated cultures
6. Acclimatization of cultures
7. Extraction of proteins from plants and its estimation
8. Extraction of DNA/RNA from plants and its estimation
9. Estimation of peroxidase activity in plants
10. Study of β – amylase enzyme from germinated pulses
11. Establishing cell suspensions

IV. Recommended Learning Resources

1. Plant Tissue Culture, Theory and Practice, Rev Ed.,S. S. Bhojwani, M.K. Razdan
2. Biotechnology, B.D. Singh
3. Introduction to Plant Biotechnology, 3rd Ed., H. S. Chawla
4. Plant Tissue Culture, development and Biotechnology, Edited by Robert N. Trigiano and Dennis J Gray.

5. Plant Propagation: Principles and Practices – Hartmann, H.T and Kester D. E. 6. Introduction to Practical Biochemistry. T. Plummer
6. Lab Manual prepared by the Department of Biochemistry – Biotechnology for the laboratory sessions

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 assignment comprises preparing posters on Industries of the plant biotechnology sector, their products and market/economic contributions.*

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.*