



ST. XAVIER'S COLLEGE – MUMBAI
(Est. 1869)
**(An Autonomous College affiliated with the University
of Mumbai)**

**Syllabus for Two-Year Postgraduate
Programme as per National Education Policy
(NEP-2020)**


Programme: MSc in Biotechnology

Academic year 2023–2024

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APPROVED SYLLABUS




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PREAMBLE

The National Education Policy 2020 (NEP 2020), as put forth by the Ministry of Human Resource Development (MHRD), is anchored in a set of fundamental principles.

These principles serve as the guiding tenets of the education system and encompass the following key elements:

NEP 2020 advocates for a student-centric approach to education, offering a broad spectrum of courses with emphasis placed on outcome-based learning, ensuring a well-rounded education.

Half of the coursework is designed for conceptual and theoretical understanding, with the other half dedicated to practical application through student engagement in activities, apprenticeships, and internships. Pedagogical methods prioritize problem-centered and project-based learning and activities.

NEP 2020 promotes the integration of technology into teaching, learning, and evaluation processes. It also highlights the need to strengthen research pedagogy within each discipline. The policy emphasizes the integration of skilling and employability initiatives into the curriculum and teaching-learning processes. This integration helps to prepare students for real-world employment opportunities.

NEP 2020 supports flexibility within academic programs, allowing students to exit after every year. Credit transfer mechanisms and the accumulation of credits in the Academic Bank of Credits (ABC) provide learners with options to tailor their educational journey according to their needs and aspirations. The overarching goal of NEP 2020 is to achieve equality in education. To do so, it recognizes equity as a process that fosters inclusivity and ensures that all students feel a sense of belonging in the educational system.

The framework of the choice-based credit system

Major Subject: It is the primary area of specialization that a student chooses to focus on during their postgraduate studies. It forms the core of their curriculum, allowing them to delve deeply into a specific field of knowledge and build expertise in that particular subject area.

Elective Course: Students can choose to study from a list of available options, often as part of their PG degree requirements. These courses provide students with the flexibility to select topics that cater to their interests, academic objectives, and career goals.

Research Methodology: In research methodology, students will explore advanced techniques and approaches for conducting rigorous academic research. This comprehensive study will equip them with the skills and knowledge needed to design, implement, and analyze research studies in their respective fields of study.

On-Job Training (OJT)/Internship/Field Project (FP)/Research Project (RP)/Dissertation: These are essential components of experiential learning in higher education. These hands-on

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experiences provide students with practical exposure, allowing them to apply theoretical knowledge in real-world contexts, thereby fostering skill development and deepening their understanding of their chosen fields.

Programme Outcomes aligned to the Vision and Mission of St. Xavier's College (Autonomous), Mumbai (Master's degree programme)

The completion of a two-year post-graduation program at St. Xavier's College equips students with a range of valuable skills and competencies.

1. Disciplinary knowledge and Core competencies/skills:
 - Gain a deep understanding of the subject-related curriculum.
 - Demonstrate advanced skills and knowledge in their academic field of study.
2. Critical and Creative thinking:
 - Reflect critically on acquired knowledge and skills within their core competencies.
 - Generate creative and resourceful ideas to explore new possibilities.
3. Problem-solving and Analytical reasoning:
 - Identify, investigate, and analyze problems effectively.
 - Collect and interpret relevant qualitative or quantitative data.
 - Formulate evidence-based solutions based on their analysis.
4. Research-related skills:
 - Apply research acumen and skills in identifying research issues.
 - Design research studies and interpret the results.
 - Communicate the findings of their studies effectively and accurately.
5. Social Application of Research and Development:
 - Utilize their core competencies and skills to improve social and environmental conditions.
6. Industry-related skills:
 - Acquire skills and techniques relevant to their chosen industry.
 - Demonstrate maturity and professional ethics in managing responsibilities.
7. Ethical and Moral Integrity:
 - Practice values such as honesty, transparency, and accountability.

- Commit to interpersonal and social ethics.
8. Collaboration, Teamwork, and Multidisciplinary competence:
- Apply their knowledge and mentoring skills in individual, team, or leadership roles.
 - Manage ventures in monodisciplinary, interdisciplinary, or multidisciplinary settings.
9. Leadership and Management:
- Demonstrate effective strategic planning skills.
 - Exhibit efficient organizational and transformational leadership abilities.
10. Social Concern:
- Show empathy and care for marginalized and disadvantaged individuals.
 - Display respect, compassion, and concern for others.
11. Social and Environmental Well-being:
- Investigate and design strategies to enhance the well-being of society and the environment.
12. Self-motivation and Lifelong learning:
- Cultivate a passion for continuous personal and professional growth.

These outcomes reflect the holistic approach taken by St. Xavier's College to develop well-rounded individuals who are equipped to contribute positively to society, exhibit strong leadership qualities, and adapt to the demands of a dynamic world.

Credit Framework

Credit Structure for 2023-24								
Level	Sem	Mandatory	Elective	RM	OJT	RP		
6 (2023-24)	I	14 (4+4+4+2)	4	4	0	0	22	PG Diploma after TY
	II	14 (4+4+4+2)	4	0	4	0	22	
	Cum Cr	28	8	4	4	0	44	
6.5 (2024-25)	III	12 (4+4+4)	4	0	0	6	22	PG Degree after TY or after FYUG
	IV	0	4	0	0	18	22	

	Cum Cr	12	8	0	0	24	44	
88 credits (2 years) after TY or 44 credits (1 year) after FYUGP								
6.5 (2027-28)	I	12 (4+4+4)	4	0	0	6	22	PG Degree MSc (only for UG Biotechnology after Four Year UG))
	II	0	4	0	0	18	22	
	Cum Cr	12	8	0	0	24	44	

Abbreviations:

- C-Core Course E-Elective Course FP- Field Project
- RM-Research Methodology, OJT- On the Job Training, Cr- Credit, RP- Research Project
- One Credit= 15 hrs Theory
- One Credit= 30 hrs. Practical

Preamble for MSc Biotechnology Programme

The Rationale:

Biotechnology is a field that implements biological processes for improvisation and innovation in healthcare, food industry, agriculture, and fuel products. It has become one of the biggest disruptors of the traditional pharmaceutical and agriculture sector. India is counted among the top 12 destinations for Biotechnology and is predicted to contribute to 19% to the global biotechnology market by 2025. To cater to the human resource needs of this ever-growing field, St. Xavier's College, Mumbai started M. Sc in Biotechnology program affiliated to the University of Mumbai from the academic year 2007-08. In June 2010, St. Xavier's College, Mumbai was granted academic autonomy, and the M. Sc Biotechnology program came under the umbrella of academic autonomy from the academic year 2012-13, with the degree being conferred by the University of Mumbai.

Highlights of the Programme:

- ✓ A 4-semester programme (with exit option) that covers the core concepts in Biochemistry, Immunology, Molecular Biology, Cell Biology, Animal and Plant Biotechnology, Bioinformatics, Bioprocess technology, Biostatistics, Drug development and Entrepreneurship.
- ✓ Curriculum that embeds critical thinking, problem solving, analytical approach and project-based learning.
- ✓ Semester 1-2 focuses on Knowledge base strengthening and Skill - development
- ✓ Semester 3-4 focuses on Application of Concepts and Analysis
- ✓ Training in Scientific Communication Skills
- ✓ Rigorous Learner centric Blended approach for providing training relevant for research and development in the field of Biotechnology.
- ✓ Innovative methods of Evaluation

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- ✓ Expert Guest Lectures, Seminars, Workshops and Discussions on Trending and relevant topics in Biotechnology
- ✓ Fully equipped Laboratory relevant for Modern Biology Techniques including Animal Cell Culture, Bioinformatics and Molecular Biology.
- ✓ Research Internship of 5-6 months at research institutes of National and International Repute.

Interdisciplinary approach in Biotechnology:

The core subject is interdisciplinary in nature with amalgamation of technology with Biology. Learners have an opportunity to gain knowledge of Statistical, Mathematical, Biophysics and Chemistry Concepts involved in various Biotechnology Processes and its application. They are also trained in the Entrepreneurial aspects of the field.

List of Courses offered from Semesters I and II in MSc- Biotechnology

Level	Semester	Core /Mandatory Course titles	Elective Course titles	RM
6 (2023-24)	Sem 1	1. Biomolecular studies 2. Fundamentals of Molecular biology 3. Essential Techniques in Biotechnology-Lab course 4. Molecular Immunology	1. Microbial and Nano Biotechnology 2. Plant biotechnology-	Introduction to Research Methods
	Sem 2	1. Bioinformatics and Computational Biology 2. Genetic Engineering and functional genomics 3. Animal Cell technology 4. Advanced Techniques in Biotechnology Lab course	1. Molecular Oncology 2. Regulations in Biotechnology and IPR	On-Job Internship

Composition of the Board of Studies in Biotechnology 2023-2024

Representation	Name	Affiliation
Chairperson: Head of the Department	Dr. Shiney Peter	PGDBT, St. Xavier's College
Department faculty members	Ms. Norine D'Souza Dr Punita Jain	PGDBT, St. Xavier's College
VC nominee	Ms. Supriya Kale Assistant Professor and Head of Department,	Dept of Biotechnology R Ruia College of Arts and Science, Matunga, Mumbai
Industry Experts	Dr Stephanie Misquitta Principal Scientist	Proteomics Department, Advanced Enzyme Technologies Ltd., Mumbai.
	Dr. Vivek Borse Senior Scientist, Assay Development	Achira Labs Pvt Ltd, Bengaluru
Subject Experts from other Universities	Dr Vivek Natarajan, Senior Principal Scientist Professor	CSIR-Institute of Genomics and Integrative Biology, Delhi
	Dr V L Sirisha, Reader,	School of Biological Sciences, UM-DAE-Center for Excellence in Basic Sciences, Mumbai
Experts from outside the college (co-opted)	Dr Deepali Karkhanis Assistant Professor, Dean of SF courses and Head, Biotechnology	Dept of Biotechnology KET's V G Vaze College, Mithaghar Road, Mulund East, Mumbai
Other members of staff of the same faculty	Dr. Varsha Mane Associate Professor and Head	UDBT, Univ. of Mumbai
Postgraduate meritorious alumnus	Dr Antara Banerjee Scientist 'B'	Cellular and Structural Biology Division, National Institute For Research in Reproductive and Child Health (Indian Council of Medical Research), Mumbai

Two-Year Postgraduate Programme in Biotechnology

Year of Implementation	Semester	Course Code	BOS Date	Academic Council Date
2023-2024	1	PSBTY6001CR1 PSBTY6002CR1 PSBTY6003CR1 PSBTY6004CR1 PSBTY6001RM1 PSBTY6001EL1 PSBTY6002EL1	24 th June 2023	6 th October 2023
2023-2024	2	PSBTY6005CR1 PSBTY6006CR1 PSBTY6007CR1 PSBTY6008CR1 PSBTY6001OJ1 PSBTY6003EL1 PSBTY6004EL1	24 th June 2023	6 th October 2023

PROGRAMME SPECIFIC OUTCOMES

PSO No.	Upon completion of the courses the student would be able to
PSO-1	Understand the fundamental concepts and applications of the core courses in Biotechnology (Biochemistry, Immunology, Cell Biology and Tissue Culture, Bioinformatics and Biostatistics, Bioprocess Technology, Environment Biotechnology, Drug Development, Molecular biology methods with an emphasis on the application of recombinant DNA technology to animals, plants and microbial organisms)
PSO-2	Demonstrate proficiency in various laboratory techniques and experimental methods in Biotechnology and computational techniques necessary for research and development
PSO-3	Design, perform, analyse and interpret scientific experiments and projects on various aspects of Biotechnology.

	Record, represent and communicate scientific data obtained through experimental procedures in an ethical manner.
PSO-4	Develop the ability to analyze complex biotechnological problems, propose hypotheses, and apply critical thinking skills to evaluate scientific literature and experimental data and discuss scientific literature with researchers and laypersons
PSO-5	Recognize and address ethical issues and social implications related to biotechnological advancements. Apply biotechnological knowledge and skills to devise creative solutions for real-world problems, fostering innovation and entrepreneurship in the field.
PSO-6	Effectively communicate scientific ideas and research findings through oral presentations, written reports, and scientific publications. Work collaboratively in multidisciplinary teams, demonstrating effective communication, leadership, and interpersonal skills while addressing biotechnological challenges.
PSO-7	Well-Equipped for competitive exams in the field . Acquire research and development positions in the various fields of Biotechnology and competent employment positions in allied fields .
PSO-8	Develop a commitment to continuous learning, keeping up-to-date with the latest developments in biotechnology, and contributing to the advancement of the discipline.