



Hindi Vidya Prachar Samiti's
Ramniranjan Jhunjhunwala College of Arts, Science & Commerce
(Empowered Autonomous College)

Affiliated to
UNIVERSITY OF MUMBAI
Syllabus for the T.Y.B.Sc. (under NEP 2020)

Program: B.Sc.
BIOTECHNOLOGY
Program Code: RJSUBT
Course code: RJFPBT351
Field Project
Semester V

(Revised syllabus in alignment with the NEP 2020 facilitating the inter and multidisciplinary learning and multiple entry and exit of the students)

Level 5.5

(CBCS)

Revised and to be implemented from 2025-2026

THE PREAMBLE

Biotechnology is a fast growing field of science where biological systems are used in diverse applications in the areas of fermentation, environment, diagnosis, treatment, agriculture, food industry etc. It is the most recent offshoot of biological sciences thriving on the latest technological advancements in engineering technology, recombinant DNA technology, computer sciences and many more. Biotechnology is an interdisciplinary field that brings together knowledge from diverse fields such as physics, statistics, mathematics, chemistry, microbiology, biological sciences, information technology, as well the most current technological advancements such as Artificial Intelligence and Machine Learning.

Biotechnology encompasses the study of all living beings including bacteria, archaebacteria, fungi, algae, protozoa, helminths, plants, animals and viruses. It includes the basic understanding of each type of cell - prokaryotic, eukaryotic, viral particles along with their intracellular architecture, their anatomical features, their physiological and biochemical process and their molecular mechanisms of inheritance right from chromosomes, genes to the nucleic acids. Biotechnology as a field of science is the most application oriented field where the knowledge gained in this course has direct and immediate application in the real world, be it pharmaceutical industry, food industry, diagnostics, personalized medicine, genetically modified crops and animals, bioprinting of organs, bioinformatics or clinical research.

Why Biotechnology in R J College?

The Department of Biotechnology was established in 2002. In 2005 MSc (By Papers & Research) and PhD Biotechnology approval from University of Mumbai was received. The department hosts 3 state of the art laboratories equipped with all the required instruments and facilities for carrying out practical sessions of UG and PG courses as well as research projects. We have experienced and well qualified teaching and supporting staff. Individualized and personal training is given to every student for various microbiology, molecular biology, biochemistry and medical diagnostics techniques that are a part of our extensive and inclusive UG and PG curriculum. Under autonomy, the department has made curriculum more robust by incorporating skill-based learning and Value Added Courses (VACs) such as Fermented Foods and Beverages, Clinical Research etc, that impart practical knowledge of the subject to the students. These value added courses are offered to students without any additional charge, from other subjects as well likewise Biotech students can complete VACs offered by other departments. These VACs, mini projects, internships and other co- curricular courses completed by the students help them to earn extra credits every year along with the credits earned by successfully completing the prescribed course work. The department organizes talks titled 'Gyan-Vigyan' by eminent personalities from industry, research organizations and academia on a regular basis to acquaint the students with the current research and industrial developments.

The Department also offers PG Diploma courses such as Clinical Studies, Data Management & Medical Writing, Post Graduate Diploma in Industrial Hygiene and Safety and Post Graduate Diploma in Medical Laboratory Techniques. In 2019 the department has earned DBT Star college grant which is being used to procure more equipment and instruments so that each student can carry out the molecular biology and other such advanced experiments on an individual basis.

The Department also has its Departmental Library and reading area which the students use after their daily schedule. The library holds more than 1000 subject reference books and journals, and many e-books. Along with these there are books for preparing for Entrance Exams such as JAM, GATE, CSIR-NET, SET, PET which the students can borrow and make the most of the resources and time available.

The department hosts its own [Webpage](#), RJBT, showcasing various departmental activities such as competitions, field trips, festivals, popular lecture series by eminent personalities, workshops and research projects. The department has its presence on various social media platforms such as **Facebook** and **Instagram**, this helps in interaction between our current students and alumni. We also have our official **YouTube** channel showcasing various practical techniques, students' videos and eminent talks. We are proud to share that many of our alumni are very well placed in national and international institutes such as Yale university, Max Plank, Pasteur Institute, CCMB, IIT, IISC, BHU and companies such as Biocon Ltd, Reliance Life Sciences to name a few.

PROGRAM OUTCOMES FOR UNDERGRADUATE DEGREE PROGRAMS IN BIOTECHNOLOGY

The undergraduate program in Biotechnology has been designed to empower students to obtain domain knowledge, analyze, apply and innovate. The courses have been designed to hone the analytical skills of students so as to solve real life situations. Modern tools have been introduced for studying biotechnology without compromising on the basic concepts. All the courses in the program are carefully designed to equip students for teaching the subject as well as qualify competitive examinations like GAT B, IIT JAM, JNU EE, CUET PG, etc.

Some basic attributes which a student would acquire after completion of undergraduate program are listed below.

Application of Knowledge

Maintain a high level of scientific excellence in research with specific emphasis on the technological advances in molecular biology techniques and bioinformatics. Create, select and apply appropriate techniques and modern technology in a multidisciplinary way. Apply the subject knowledge to design experiments, analyze and interpret data to reach an effective conclusion.

Ability to convey the concept clearly

They would identify, formulate, and analyze the complex problems and reach a conclusion. Logical thinking with application of biological, physical, and chemical sciences. Learning that develops analytical skills and integrative problem-solving approaches.

Teamwork

Students would perform functions by way of organizing academic events, projects and going on field trips which will build team spirit. Thus the course will help learners to develop qualities of empathy and sympathy for fellow beings.

Honesty and Integrity and Ethics

Students will be aware of ethical issues and regulatory considerations while addressing social and societal needs for growth with honesty.

Environment and Sustainability

The problem-solving skills in students would encourage them to carry out innovative research projects to identify and solve environmental issues. All actions are towards achieving United Nations Sustainable Development Goals.

Lifelong learning and motivating others to learn

Students would lend support to one another for self and institutional growth, contribute to national development and provide equal opportunity.

Global thinking

Students would be equipped with life and technical skills and would be empowered with domain knowledge in thrust areas; these attributes will make them globally competitive.

Programme Specific Outcomes

Sr. No.	A student completing B.Sc. Biotechnology will be able to:
PSO1	Understand concepts in Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology and molecular biology.
PSO2	Demonstrate the laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects.
PSO3	Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.
PSO4	Critically analyze the environmental issues and apply the knowledge gained in biotechnology for conserving the environment and resolving the problems.
PSO5	Demonstrate comprehensive innovations and skills in the field of biomolecules, cell biology, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.
PSO6	Critically analyze, interpret data, and apply tools of bioinformatics in various sectors of biotechnology including health and food.
PSO7	Learn and practice professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA technology, genetic engineering, animal handling, intellectual property rights, biosafety, and biohazards.
PSO8	Explore the biotechnological practices and demonstrate innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.
PSO9	Gain thorough knowledge and apply good laboratory and good manufacturing practices in biotech industries.
PSO10	Understand and apply molecular biology techniques and principles in forensic and clinical biotechnology.
PSO11	Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up of small-scale enterprises.
PSO12	Understand concepts, importance of Biostatistics and to comprehend the principles behind various statistical analytical methods and their uses in biotechnology for data analysis.
PSO13	To develop a deep understanding of the immune system's functions and mechanisms.
PSO14	Gain proficiency in applying immunological techniques for research, diagnostics, and therapeutic innovations.
PSO15	Will be able to apply their knowledge to address emerging infectious diseases and contribute to global immunization strategies.
PSO16	Design, optimize, and scale microbial processes for the efficient production of bio-based products in industrial settings
PSO17	Apply cell biology concepts to analyze cellular structures, functions, and processes, and understand their roles in health, disease, and biotechnology.
PSO18	Apply principles of developmental biology to analyze the genetic, molecular, and

Sr. No.	A student completing B.Sc. Biotechnology will be able to:
	environmental factors that drive organismal development and contribute to understanding developmental disorders.
PSO19	Gain proficiency in ability to accurately identify microorganisms using various laboratory techniques, interpret diagnostic results for infection control, and apply principles of microbiology to clinical practice to support patient care and treatment.
PSO20	Gain knowledge of blood collection, blood cell analysis, and blood disorders like anemia. Learn about blood group systems and the process of blood transfusion
PSO21	Understand the importance of organ function tests in assessing the health of vital organs, as well as their role in the detection, diagnosis, and monitoring of diseases.
PSO22	Understand the clinical significance of using urine, stool, semen, and CSF samples, along with cancer markers, in the detection and diagnosis of diseases.

Progressive Certificate, Diploma, Bachelor's Degree or Bachelor's Degree with Honors provided at the end of each year of exit of the four-years Undergraduate Programme.

	Exit options	Credit Required
1.	Certificate upon the successful completion of the First Year (Two Semesters) of the multidisciplinary Four-years Undergraduate Programme/ Five- years Integrated Master's Degree Programme.	44
2.	Diploma upon the successful completion of the Second Year (Four Semesters) of the multidisciplinary Four-years Undergraduate Programme/ Five- years Integrated Master's Degree Programme.	88
3.	Basic Bachelor's Degree upon the successful completion of the Third Year (Six Semesters) of the multidisciplinary Four-years Undergraduate Programme/ Five- years Integrated Master's Degree Programme.	132
4.	Bachelor's Degree with Honors in a Discipline at the successful completion of the Fourth Year (Eight Semesters) of the multidisciplinary Four-years Undergraduate Programme/ Five- years Integrated Master's Degree Programme.	176

UGC GRID UNDER NEP 2020

YEAR & LEVEL	SEMESTER	MAJOR		MINOR	VSEC		OE	IKS/AEC/VEC			OJT/FP/CEP/CC/RP				TOTAL
		DSC	DSE		VSC	SEC		IKS	AEC	VEC	CC	CEP	FP	OJT	
FY 4.5	I	6	-	6	2	-	2	2	-	2	2	-	-	-	22
	II	6	-	6		2	2	-	2	2	2	-	-	-	22
TOTAL	FY	12	0	12	2	2	4	2	2	4	4	0	0	0	44
SY 5.0	III	6	-	3	-	2	3	-	4	-	2	-	2	-	22
	IV	6	-	3	2	2	3	-	2	-	2	2	-	-	22
TOTAL	SY	12	0	6	2	4	6	0	6	0	4	2	2	0	44
TY 5.5	V	12	4	-	4	-	-	-	-	-	-	-	2	-	22
	VI	12	4	-	2	-	-	-	-	-	-	-	-	4	22
TOTAL	TY	24	8	0	6	0	0	0	0	0	0	0	2	4	44
GRAND TOTAL		48	8	18	10	6	10	2	8	4	8	2	4	4	
		56		18	16		10	14			18				132

IMPLEMENTED FROM ACADEMIC YEAR 2023-24

Key:

FY = First Year BSc

SY = Second Year BSc

TY = Third Year BSc

DSC= Discipline Specific Course

DSE= Discipline Specific Elective

VSEC = Vocational Skill Enhancement Course

VSC= Vocational Skill Course

SEC = Skill enhancement course

OE = Open Elective

IKS - Indian Knowledge System

AEC = Ability enhancement Course

VEC = Value education Course

CC = Co-Curricular

CEP = Community Engagement Program

FP = Field Project

OJT = On Job Training

**Credit Structure for B. Sc. Semester V Major Subject: BIOTECHNOLOGY as per NEP
2020 Implemented from the academic year 2025-2026 Level 5.5**

THIRD YEAR BACHELOR OF SCIENCE IN BIOTECHNOLOGY

SEMESTER V			
Courses	Credits	Course Titles	Course code
Discipline Specific Course I	4	Immunology and developmental biology	RJDSCBT351
Discipline Specific Course II	4	Microbial Production Technology	RJDSCBT352
Discipline Specific Course Practical	4	Product purification, assays and analysis - Practicals	RJDSCBTP351
Discipline Specific Elective	3	Diagnostic Microbiology	RJDSEBT351
Discipline Specific Elective Practical	1	Diagnostic Microbiology - Practicals	RJDSEBTP351
Vocational Skill Course	4	Industrial Processes	RJVSCBT351
Field Project/ Community Engagement Program	2	Field Project / Community Engagement Program	RJFPBT351/ RJCEPBT351
Total Credits	22		

***As per University Grid**

SEMESTER	:	V
TITLE OF THE SUBJECT/COURSE	:	FIELD PROJECT
COURSE CODE	:	RJFPBT351
CREDITS	:	02
DURATION	:	60 HOURS

LEARNING OBJECTIVES
1. To develop research and analytical skills
2. To bridge theory with real-world applications
3. To build communication and critical thinking abilities

COURSE OUTCOME NUMBER	On completing the course, the student will be able to:	PSO Addressed	BLOOMS LEVEL
CO1	Apply survey-based research methodology	PSO 1,3,4	Bloom's Level: 3
CO2	Analyze and interpret data scientifically	PSO 1,3,4	Bloom's Level: 4
CO3	Relate biotechnology concepts to real-world issues	PSO 1,3,4	Bloom's Level: 5

Course Content: 2

Credits Duration: 60 hrs

The field project is to be conducted as part of a field study to understand and analyze the opinions, preferences, and perceptions of a selected group of respondents on a chosen topic. A **survey method** shall be adopted because it is one of the most effective ways to collect primary data directly from individuals. A structured **questionnaire** will be prepared and distributed among the target sample to collect relevant information. Data collected shall be interpreted and inferences would be drawn based on the data analysis.

The main objectives of the survey:

1. To identify key trends and opinions related to the chosen topics of biotechnology
2. To analyze the collected data systematically and interpret the findings.
3. To provide suggestions or recommendations based on the analysis.
4. To propose solution to the respondents for the problem studied

Assessment Grid

30M Project Report + 20M presentation

Project Report

Interest Shown	Participation	Understanding	Data Analysis	Over all Appearance	Total
6M	6M	6M	6M	6M	30M

Presentation

Slide Design	Understanding	Data Analysis	Q&A	Total
5M	5M	5M	5M	20M

Mapping of the course to Local/ Regional/National/International relevance

Class	Course Name	Course Code	Local relevance	Regional relevance	National relevance	International relevance
TYBT	Field Project	RJFPBT351	Data collection from local societies	Data can be extrapolated to regional level	✓	✓

Mapping of the course to Employability/ Entrepreneurship/Skill development

Class	Course Name	Course Code	Topic focussing on Employability/ Entrepreneurship /skill development	Employability/Entrepreneurship/Skill development	Specific activity
TYBT	Field Project	RJFPBT351	Domain Knowledge, Data collection, research	Statistical analysis	Using online tools for Data collection and analysis

Integration of Cross cutting Issues

Class	Course Code	Cross Cutting Issues
BIOTECHNOLOGY CEP	RJCEPBT351	Ethics, UNSDG 3, 4, 5, 6, 7, 11, 12, 13, 14, 15 NEP 2020 Interdisciplinary/Multidisciplinary/ Transdisciplinary

SEMESTER	:	V
TITLE OF THE SUBJECT/COURSE	:	Community Engagement Program
COURSE CODE	:	RJCEPBT351
CREDITS	:	02
DURATION	:	60 HOURS

LEARNING OBJECTIVES
1. Understand the concept of community engagement and its importance in social development.
2. Learn about ethical practices and responsibilities in working with diverse communities.
3. Gain awareness of local community issues, needs, and resources.
4. Develop knowledge of social, cultural, economic, and environmental contexts affecting the community.

COURSE OUTCOME NUMBER	On completing the course, the student will be able to:	PSO Addressed	BLOOMS LEVEL
CO1	Contribute positively to community welfare and development projects.	PSO 1,3,4	Bloom's Level: 6
CO2	Build long-term partnerships between the institution/organization and the community.	PSO 1,3,4	Bloom's Level: 4
CO3	Inspire continued involvement in social service, volunteering, or civic activities beyond the program.	PSO 1,3,4	Bloom's Level: 5

Course Content: 2**Credits Duration: 60 hrs**

Community engagement programs will create awareness in the community about scientific concepts, technological advancements, and their role in daily life. It will help students' to connect classroom learning with real-life community needs, allowing them to apply knowledge for the benefit of society. It will provide opportunities for students to learn from local knowledge, practices, and challenges while contributing scientific insights.

The main objectives of CEP:

1. CEP will enhance students' skills in communication, teamwork, problem-solving, and social responsibility.
2. It will foster empathy, ethical values, and civic responsibility by engaging in meaningful interactions that address community concerns
3. CEP will encourage community participation in adopting biotechnological or scientific solutions that promote health, environmental care, and sustainable practices.

Assessment Grid:

Place one tick in each appropriate row. Overall marks should reflect the positions of ticks in the individual rows. In boxes that have more than one set of marks, cancel out the marks that are not applicable and circle the correct marks.

Project work and report should include the following Parameters	Marks	80 – 100% Excellent	60 -80% Good	40 – 60% Satisfactory	20 – 40% Average
Work Done at NGOs, societies and community centers, includes attendance	20	20 / 19	18 / 17	16 / 15	14 /13
Report writing	20	20 / 19	18 / 17	16 / 15	14 /13
Presentation and sharing of experiences	10	10 / 9	8 / 7	6 / 5	4 /3

Mapping of the course to Local/ Regional/National/International relevance

Class	Course Name	Course Code	Local relevance	Regional relevance	National relevance	International relevance
T.Y.B.Sc. BIOTECHNOLOGY Major	Community engagement program	RJCEPBT351	✓	✓	✓	✓

Mapping of the course to Employability/ Entrepreneurship/Skill development

Class	Course Name	Course Code	Topic focusing on Employability/ Entrepreneurship skill development	Employability/ Entrepreneurship/ Skill development	Specific activity
T.Y.B.Sc. BIOTECHNOLOGY Major	Community engagement program	RJCEPBT351	Domain Knowledge, teaching, research	Organizational skills, teamwork, event management	Field trips

Integration of Cross cutting Issues

Class	Course Code	Cross Cutting Issues
BIOTECHNOLOGY CEP	RJCEPBT351	Ethics, UNSDG 2, 4, 11, 12,15, 16, 17 NEP 2020 Interdisciplinary/Multidisciplinary/ Transdisciplinary