



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)

Program: B.Sc.

BIOTECHNOLOGY

Program Code: RJSUBT

ON JOB TRAINING

Course Code: RJOJTBT361

Semester VI

(Revised in alignment with the NEP2020 facilitating the inter-and multidisciplinary learning and multiple entry and exit of the students)

Level 5.5

(CBCS)

Revised 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, archaeobacteria, 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, 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 IMPLEMENTED FROM ACADEMIC YEAR 2023-24

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

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 VI as per NEP 2020 Implemented from the
academic year 2025-2026
Major Subject: BIOTECHNOLOGY**

**Semester VI
Level 5.5 Major BIOTECHNOLOGY**

SEMESTER VI			
Courses	Credits	Course Titles	Course code
Discipline Specific Course I	4	Cancer biology, Immunotechnology and Pharmacology	RJDSCBT361
Discipline Specific Course II	4	Genetic engineering & Ethics	RJDSCBT362
Discipline Specific Course Practical	4	Immunological and pharmacological techniques - - Practicals	RJDSCBTP361
Discipline Specific Elective	3	Clinical pathology	RJDSEBT361
Discipline Specific Elective Practical	1	Clinical pathology - Practicals	RJDSEBTP361
Vocational Skill Course	2	Tissue Culture	RJVSCBT361
OJT	4	On-Job Training/ On -Field Training	RJOJTB361
Total Credits	22		

***As per University Grid**

Course code	Topic Headings	Credits	Hour
RJ OJTBT 361	On Job Training (OJT)	4	120 hour

OJT will be done in research institutions/ research centers/ NGO involved in environment related activities / Industry - R&D, QA-QC /Pathological Labs/ IVF centers / Instrumentation Facilities/ Clinical Research/ Computation Biology Lab.

Minimum duration - 120 hours

Total marks for OJT- 100 mks

OJT and Report writing

Dept. of_____Course Code_____Date

UID No_____Roll No_____Marks /100

Name of student: _____

Title of Assignment:

Assessment Grid: Place one tick in each appropriate row. The overall mark 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.

OJT (Parameters)	Marks	80 – 100% Excellent	60 -80% Good	40 – 60% Satisfactory	20 – 40% Average
Work Done at OJT and attributes as per guidelines includes attendance	50	40-50 / 50	30-40/ 50	20-30 / 50	10-20/50
Report writing and conclusions	20	16-20 / 20	12-16 /20	08-12 / 20	04-08/20
Presentation Communication	30	24-30/30	18-24/30	12-18/30	06-12/30

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	OJT	RJOJTBOT361	✓	✓	✓	✓

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
TYBSc BIOTECHNOLOGY Major	OJT	RJOJTBOT361	Campus to corporate training, soft skills, teamwork	Organizational skills, teamwork, event management	On Job training in various sectors

Integration of Cross cutting Issues

Class	Course Code	Cross Cutting Issues
T Y BSc BIOTECHNOLOGY	RJOJTBOT361	Ethics, UNSDG 4, 8 NEP2020 Interdisciplinary/Multidisciplinary