

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce, and Science College, Ahmednagar
(Autonomous)
(Affiliated to Savitribai Phule Pune University, Pune)**



**National Education Policy (NEP)
Choice Based Credit System (CBCS)**

**Programme Skeleton and Syllabus of
Biotechnology (Minor)**

**Implemented from
Academic Year 2023-24**

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)

Board of Studies in BTology

Sr. No.	Name	Designation
1.	Dr. Shubhangi S. Moharekar	Chairman
2.	Dr. Sanjay T. Moharekar	Member
3.	Dr. Sarika R. Deshmukh	Member
4.	Mr. Ashish S. Wani	Member
5.	Dr. Bimalendu B. Nath	Vice-Chancellor Nominee
6.	Prof. Dr. Nitin S. Desai	Academic Council Nominee
7.	Dr. Jyoti P. Jadhav	Academic Council Nominee
8.	Mr. Nitin Shirole	Industry Expert
9.	Mr. Sachin R. Adsare	Alumni
10.	Dr. Aparnna A. Kulkarni	Member (co-opt)
11.	Mr. Girish P. Kukreja	Member (co-opt)

1. Prologue/ Introduction of the programme:

Biotechnology has expanded and established as an advanced interdisciplinary applied science. The study of Life itself is at the core of it and the interdisciplinary networking potential of biotechnology has given it a separate status in fundamental research as well as in modern industrial enterprise. Global and local focus has slowly shifted to not only current "Century of Knowledge" but also on to technology development and application in life sciences. In the milieu of research and industrialization for economic development and social change, biotechnology is an ideal platform to work. The interdisciplinary nature of biotechnology integrates living systems including animal, plant and microbes and their studies from molecular biology to cell biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology to biodiversity, from microbiology to bioprocess engineering, from

bioremediation to material transformation and so on. The use and application of these studies on living organisms and their bioprocesses is extensively covered in this field with the help of technology. Green revolution and white revolution was possible in India thanks to the deeper and intrinsic understanding of biotechnology.

The restructured syllabus is a choice based credit system with semester pattern. Biotechnology has grown extensively in last couple of decades. The syllabi till today had been sufficient to cater to the needs of students for building up their careers in industry and research. However, with the changing scenario at local and global level, we feel that the syllabus orientation should be altered to keep pace with developments in the education and industrial sector. The need of the hour is to design appropriate syllabi that emphasize on teaching of technological as well as the economical aspects of modern biology. The proposed credit based curriculum ensures the requirement of academia and industry. Theory supplemented with extensive practical skill sets will help a graduate student to avail the opportunities in the applied fields (research, industry or institutions) without any additional training. Thus, the university/college itself will be developing the trained and skilled manpower. Biotechnology being an interdisciplinary subject, this restructured syllabus will combine the principles of physical, chemical and biological sciences along with developing advanced technology.

Biotechnology curricula are operated at two levels viz. undergraduate and postgraduate. The undergraduate curricula are prepared to impart primarily basic knowledge of the respective subject from all possible angles while postgraduate syllabus emphasizes on more applied courses. In addition, students are to be trained to apply this knowledge particularly in day-to-day applications of biotechnology and to get a glimpse of research.

The basic aim of the revised course curriculum is to integrate various disciplines of life sciences which will cater the needs of human resources in academia and industry. The Overall objective of the Program is to promote education and research in biotechnology and provide academic and professional excellence for immediate productivity in academics, government organization, biomedical sectors, health and nutrition settings for ultimate benefit of society and sustainable development.

2. Programme Outcomes (POs)

Students enrolled in the program complete a curriculum that exposes and trains students in a full range of essential skills and abilities. They will have the opportunity to master the following objectives.

The objectives of the course curriculum are:

- To introduce the concepts in various allied subjects
- To enrich students' knowledge in basic and applied aspects of life sciences.
- To help the students to build interdisciplinary approach in teaching/ learning and in research.
- To inculcate the sense of scientific responsibilities and social awareness
- To help students build-up a progressive and successful career in academia and industry.

The present course curriculum will generate skilled human resource required in academia and Industry. In general, as a result of this program, the student will be able to achieve basic and advance knowledge based proficiency in applied subjects of life sciences, create and develop students with interdisciplinary mind set for learning science, improve problem solving aptitude using scientific methods in biotechnology and allied subjects, will adopt scientific approach for implications of biotechnology in society, environment and education, will demonstrate knowledge and learn various biological processes at cellular and molecular level and get expertise in the different techniques used in the fields of Biotechnology.

Credit Distribution: B.Sc. BTology including Minor and OE and other courses.

	Type of Courses	III Yr	IV Yrs (Honours)	IV Yrs Research
Major Marathi	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
	Indian Knowledge System	02	02	02
	Total (I, II and III Year)	80	124	124
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

Programme Framework (Courses and Credits): B.Sc. Biotechnology (Minor)

Sr. No.	Year	Sem	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	MNR-1	BS-BT101	Biotechnology for human welfare	03
2.	I	II	4.5	MNR-2	BS-BT201	Biophysical and biochemical techniques	03
3.	II	III	5.0	MNR-3	BS-BT301	Computational biology	03
4.	II	IV	5.0	MNR-4	BS-BT401	Tissue culture techniques	03
5.	III	V	5.5	MNR-5	BS-BT501	Cell and Molecular Biology	04
6.	III	VI	5.5	MNR-6	BS-BT601	Genetic engineering	04
							20

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(Autonomous)
Syllabus
B.Sc. Biotechnology (Minor)

Title of the Course: Biotechnology for Human Welfare								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-1	BS-BT201 T/P	02	01	03	30+30	30	70	100

Learning Objectives:

1. Understand biotechnology's applications in human welfare.
2. Explore key concepts and principles in biotechnology.
3. Recognize the significance of genetic engineering and its role in medicine, agriculture, and environmental conservation.

Course Outcomes (Cos)

1. Gain knowledge of biotechnology's impact on human welfare.
2. Evaluate the historical milestones in biotechnology.
3. Apply biotechnological principles to address challenges in medicine, agriculture, and environmental conservation.

Detailed Syllabus:

Unit I: Introduction to Biotechnology for Human Welfare (02)

- Overview of Biotechnology and its Applications in Human Welfare
- Historical Developments and Milestones in Biotechnology
- Key Concepts and Principles in Biotechnology

Unit II: Medical Biotechnology (10)

- Biotechnology in Medicine: Introduction and Scope

- Genetic Engineering and Recombinant DNA Technology in Medicine
- Biotechnology in Diagnostics and Disease Detection
- Biotechnology in Therapeutics and Drug Development
- Biotechnology in Gene Therapy

Unit III : Agricultural Biotechnology (10)

- Biotechnology in Agriculture: Introduction and Scope
- Genetic Engineering and Genetically Modified Organisms (GMOs) in Agriculture
- Biotechnology in Crop Improvement and Yield Enhancement
- Biotechnology in Pest and Disease Management

Unit IV: Environmental Biotechnology (04)

- Biotechnology in Environmental Conservation: Introduction and Scope
- Bioremediation: Application of Biotechnology in Environmental Cleanup

Unit V. Industrial Biotechnology (04)

- Biotechnology in Industrial Processes: Introduction and Scope
- Biotechnology in Enzyme Production and Applications
- Biotechnology in Biopolymers and Biofuels

Practicals –

1. Microbial Culturing Techniques: Aseptic Handling, Streaking, and Inoculation (01)
2. DNA Extraction from Plant Material (01)
3. Agarose Gel Electrophoresis of DNA Fragments (01)
4. Enzyme Activity Assay using Colorimetric/Spectrophotometric Methods (01)
5. Antibiotic Sensitivity Testing on Bacterial Cultures (01)
6. Enzyme Linked Immunosorbent Assay (ELISA) (01)

Suggested Readings/Material:

1. William J. Thieman, Michael A. Palladino. "Introduction to Biotechnology." Pearson; 4th edition (January 3, 2012).
2. Sandy B. Primrose, Richard M. Twyman. "Principles of Gene Manipulation and Genomics." Wiley-Blackwell; 8th edition (December 4, 2012).
3. Norio Murase. "Medical Biotechnology: Achievements, Prospects, and Perceptions." Springer; 1st edition (October 14, 2016).

4. A.J. Nair. "Introduction to Biotechnology and Genetic Engineering." CRC Press; 1st edition (September 27, 2017).
5. David P. Clark, Nanette J. Pazdernik. "Biotechnology: Applying the Genetic Revolution." Academic Press; 3rd edition (October 18, 2018).
6. P.C. Misra (Editor). "Biotechnology in Agriculture and Forestry." Springer; 1st edition (December 5, 2003).
7. Arie Altman, Paul Michael Hasegawa (Editors). "Plant Biotechnology and Agriculture: Prospects for the 21st Century." Academic Press; 1st edition (June 26, 2011).
8. Gareth M. Evans. "Environmental Biotechnology: Theory and Application." Wiley; 1st edition (December 21, 2010).
9. Christoph Wittmann, James C. Liao (Editors). "Industrial Biotechnology: Sustainable Growth and Economic Success." Wiley-VCH; 1st edition (March 22, 2017).
10. Reinhard Renneberg, Viola Berkling. "Biotechnology for Beginners." Academic Press; 1st edition (August 16, 2017).

Title of the Course: Biophysical and Biochemical Techniques								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-2	BS-BT201 T & P	02	01	03	30+30	30	70	100

Learning Objectives:

Learn Absorption spectrum of protein, absorption spectra isoelectric point of amino acids.

Study electronic components of Bright field, compound microscope

To learn electronic balance for micro measurements

Course Outcomes (Cos)

1. Students will able to understand the pH meter
2. To study techniques like paper and thin layer chromatography
3. Students will able to learn the principles and applications of different analytical techniques such as chromatography, centrifugation, Spectroscopic techniques, atomic absorption spectroscopy, etc.
4. To learn the basic concept of Electrophoresis.
5. Learn about the types and importance of Microscopes
6. Study electronic components of Bright field, compound microscope.

Detailed Syllabus:

Unit I: Introduction (10)

Lab safety, Scientific notation & Units, errors & accuracy in experimentation, understanding of concentration of solutions, Strong acids and bases, weak acids and bases, polyprotic acids, buffers, biological buffers, pH metry

Unit II: Microscopy and Spectrophotometry: (08)

Introduction to different types of microscopy, con focal microscopy, phase contrast, inverted microscopy, preparation of specimens for different types of microscopy

Electromagmantic radiations, properties of Electromagnetic radiation, Beer-Lambert's Law, UV-visible spectroscopy , instrumentation(spectrophotometer and colorimeter

Unit III: Centrifugation

(03)

Introduction, basic principle of sedimentation, angular velocity & centrifugal field, preparative & analytical centrifugation, ultracentrifuge, types of rotors

Unit IV: Chromatography and Electrophoresis

(09)

Chromatography : Introduction, principles, R_F value, Types of chromatography

a) Thin layer b) Paper chromatography c) Column chromatography – gel filtration, ion-exchange electrophoresis: Introduction, principle, supporting matrices, capillary electrophoresis. Electrophoresis of proteins- SDS and Native PAGE, Electrophoresis of nucleic acid - Agarose.

Practicals:

1. Scientific notation & units, errors & accuracy in experimentation, Calibration of pipettes, pH meter & balance **(01)**
2. The separation of amino acids/pigments by paper chromatography **(01)**
3. The separation of amino acid/sugar by thin layer chromatography **(01)**
4. To obtain pH titration curve for amino acid and to determine its pK_a value. **(01)**
5. Spectrophotometry – Absorption spectra of Protein, nucleic acid. **(02)**

Suggested Readings/Material:

1. Biophysics, an introduction. 1st edition. (2002) Cotteril R. John Wiley and Sons Ltd., USA
2. Biophysics. 1st edition (2002), Pattabhi V and Gautham N. Kluwer Academic Publisher, USA.
3. Textbook of optics and atomic physics – P.P. Khandelwal (Himalaya Publishing House.)
4. Instrumentation measurements and analysis – 2nd edition (2003). Nakra and Choudhari, Tata Mc Graw Hill, India.
5. Nuclear Physics: An Introduction. 2nd edition (2011). S. B. Patel. Anshan Publication, India
6. Jayaram T. 1981. Laboratory manual in Biochemistry, Wiley Eastern Ltd. New Delhi.
7. Plummer D. 1988. An Introduction to Practical Biochemistry. 3rd ed. Tata McGraw Hill, New Delhi.

8. Nath RL. 1990. Practical Biochemistry in Clinical Medicine. Academic Pub.
9. Sadasivam S and Manickam A. 1996. Biochemical Methods. 2nd ed. New Age International (P) Ltd. Publisher, New Delhi.