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 2024-25

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of Studies in Biotechnology

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 ce 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 restructures 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 man-power. 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	Industrial biotechnology	03
4.	II	IV	5.0	MNR-4	BS-BT401	Computational biology	03
5.	III	V	5.5	MNR-5	BS-BT501	Fundamentals of Genetic engineering	04
6.	III	VI	5.5	MNR-6	BS-BT601	Tissue culture techniques	04
							20

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)Syllabus

B.Sc. Biotechnoology (Minor)

Title of the Course: Industrial Biotechnology								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-3	BS-BT 301	02	01	03	30+30	30	70	100

Learning Objectives:

1. To understand concept of industrial biotechnology.
2. To study different types of bioreactor.
3. To learn role of media components
4. To gain knowledge of large scale manufacturing processes

Course Outcomes (Cos)

1. Students will understand the commercial potential of industrial biotechnology in India
2. Students will acquire knowledge about various basic concepts in industrial biotechnology
3. Students will gain knowledge about concept and types of fermentation based on various criteria
4. Students will understand the production and purification processes of a product.

Detailed Syllabus: **05**

Unit I: Introduction to Industrial Biotechnology

Concept, scope and importance

Commercial potential of industrial biotechnology in India

Historical overview of industrial fermentation process

Traditional and modern biotechnology- A brief survey of organisms, processes, products

Concepts of scale up and scale down processing

Unit II: Fermenter and Bioprocess **08**

Ideal characteristics of fermenter

Types, construction material and parts of fermenter

Concept and types of fermentation based on various criteria

Sterilization of fermenter

Unit III: Isolation, Screening of Industrially important microorganisms and Upstream processing **10**

Types of media- Basal, differential, Selective

Concept of crude medium

Media components

Sterilization of media

Isolation techniques of industrially important microorganisms

Primary and Secondary screening- Concept and methods

Concept of media optimization, inoculum, inoculum build-up

Culture collection centers

Unit IV: Production and Downstream processing **07**

Production and purification of enzyme, organic acids, alcohol, Antibiotics, Vitamins, Steroids, Vaccines (one example of each)

Suggested Readings:

1. Patel, A.H. (2008). Industrial Microbiology. MaCmillan Publication, New Dehli.
2. Stanbuzy,Peter & Whitaker, A. (2008). Principal of Fermentation Technology. Butterworth Heinemann.
3. Casida L.E. (2005). Industrial Microbiology. New age International Publishers.
4. Srivastava, M.L. Fermentation Technology.
5. Singh, B.D. (2008). Biotechnology. New age International.

Practical:

1	Study of laboratory bench-top fermenter	(01)
2	Primary and secondary screening for primary /secondary metabolite	(02)

4	Isolation and morphological characterization of enzyme/ organic acid /Antibiotic/ vitamin producer microorganism (bacteria).	(02)
5	Visit to fermentation industry and report writing with photo documentation	(01)

Title of the Course: Computational Biology								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-4	BS-BT 401	02	01	03	30+30	30	70	100

Learning Objectives:

1. To explore bioinformatics history, applications and database organization with a focus on computer use.
2. To understand types and functions of biological databases like GenBank, UniProt, PDB, and PubMed.
3. To acquire the knowledge of sequence analysis, including alignment, scoring matrices and database searches with BLAST and FASTA.

Course Outcomes (COs):

1. Students will be able to describe the contents and properties of the most important bioinformatics databases.
2. Students will be able to perform sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge.
3. Students will be able to explain the major steps in pairwise and multiple sequence alignment.

Detailed Syllabus:

Unit I - Introduction to Bioinformatics : **10**

Use of computers in biology

Definition, history and applications of bioinformatics

Internet resources, various databases and bioinformatics tools

Organization of databases

Unit II- Biological Databases : **10**

Introduction and types of biological databases

Nucleic acid sequence databases (GenBank)

Protein sequence databases (UniProt)

3D Structure Databases (PDB)

Literature Databases (PubMed)

Unit III- Sequence Analysis : **10**

Sequence file formats

Sequence alignment – Global and Local Alignment

Pair wise and Multiple Sequence Alignment

Scoring matrices

Database Searches (BLAST, FASTA)

Suggested Reading-

1. Mount David W.. Bioinformatics: Sequence and Genome Analysis. Publisher: Cold Spring Harbor Laboratory Press; Latest Edition

2. Baxevanis Andreas D. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Latest Edition. Publisher: New York, John Wiley & Sons, Inc.

3. Teresa Attwood, Parry-Smith David J. Introduction to Bioinformatics. Publisher: Pearson Education (Singapore) Pte.Ltd., Latest Edition

4. Gibas Cynthia, JambeckPer. Developing Bioinformatics Computer Skills. Publisher: Shroff Publishers and distributors O'Reilly Media, Inc., Latest Edition

5. Bourne Philip E., WeissigHelge. Structural Bioinformatics (Methods of Biochemical Analysis, V. 44), 2003. Publisher: Wiley-Liss. ISBN: 0471202002.

6. Forbes Burkowski. Structural bioinformatics: An algorithmic approach. Publisher: CRC Press, 2009. ISBN: 9781584886839.

7. Leach, Andrew. Molecular Modelling: Principles and Applications. Publisher: Prentice Hall. 2001. ISBN: 0582239338

8. Branden ,Tooze John. Introduction to Protein Structure. Publisher: New York, Garland Publishing Inc. 1999. ISBN: 0815323050.

9. Sternberg Michael J. E. Protein Structure Prediction: A Practical Approach. Publisher: USA, Oxford University Press. 1997. ISBN: 0199634953. IV Design, correlation and regression analysis

10. Gasteiger Johann, Engel Thomas. Chemoinformatics: A Textbook. Publisher: Wiley-VCH; 1st edition. 2003. ISBN: 3527306811.

Practicals:

1.	Referencing in Scientific literature using PubMed	**1**
2.	Study of different Biological databases GenBank, UniProt, PDB	**1**
3.	Sequence retrieval from biological databases	**1**
4.	Pair wise sequence alignment - EMBOSS Needle/ Lalign	**1**
5.	Multiple Sequence Alignment – Clustal Omega/ Clustal X/ T-Coffee/ Muscle	**1**
6.	Databases search for homologous sequence using BLAST and FASTA	**1**