

Branch Name:	M.Sc. Biotechnology/ Microbiology
Program Code:	SC201 / SC202
Course Name:	Contemporary Developments in Biological Sciences
Course Code:	3SC2000202
Pre-requisite Course:	

Course Objectives:

- Provide understanding of recent advances in molecular biology and high-throughput technologies in microbiology.
- Familiarize students with modern diagnostic techniques, including molecular and automated methods.
- Develop knowledge of emerging infectious diseases, antimicrobial resistance, and therapeutic strategies.
- Introduce nanotechnology concepts and their applications in microbiology and medicine.
- Enhance analytical and application skills for integrating advanced technologies in research and healthcare.

Teaching and Examination Scheme:

Teaching Scheme(Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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Subject Contents:

Unit	Content	Lectures	Weightage
1	Molecular Advances in Biological Sciences Overview of recent advances in Biological Sciences. • Biological data and High-throughput technologies • Next generation sequencing (NGS) technologies and applications. • Gene editing technologies: CRISPR-Cas systems and genome engineering. • Artificial Intelligence in Biology: Use of machine learning and AI in biology	15	25%
2	Advances in diagnosis • Overview of clinical laboratory diagnosis • Conventional techniques for diagnosis: Culture techniques, Biochemical tests, Serological tests, Antibiotic Sensitivity Testing, Basics hematology tests • Conventional techniques for diagnosis of mutations: Ames test, Comet Assay (Single-Cell Gel Electrophoresis), Phenotypic Marker Assays in Microorganisms	15	25%
3	• Molecular Diagnosis of disease: PCR, RT-PCR, real-time PCR, RFLP • Automated diagnostics (MALDI-TOF) • Discovering New Pathogens and rapid diagnostics of emerging diseases like COVID-19, Mucormycosis, Swine flu • Overview and Current status of Anti-HIV, Anti Malaria, Anti Tuberculosis and Anti-Cancer treatment. • Multidrug resistance and Tackling Antimicrobial Resistance (AMR)	15	25%

4	Nanotechnology • Overview of Nanotechnology and types of nanoparticles • Methods of synthesis: physical, chemical, and biological (green synthesis) • Nanotechnology in microbial diagnostics (Nanosensors) • Antimicrobial activity of nanoparticles and role in Antimicrobial Resistance • Nano drug delivery systems • Applications in biofilm control, environment, and food microbiology Advantages, limitations, and safety concerns	15	25%
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Text books:

- Madigan, M.T., Martinko, J.M. and Parker, J., 1997. *Brock biology of microorganisms* (Vol. 11, pp. 1-10). Upper Saddle River, NJ: Prentice hall.
- McNeil, S.E., 2005. Nanotechnology for the biologist. *Journal of leukocyte biology*, 78(3), pp.585-594.

Reference Books:

- Sandy B. Primrose, Richard Twyman (2004), *Genomics : Applications in Human Biology*. Wiley and Sons.
- Industrial Pharmaceutical Biotechnology by Heinrich
- Bio safety in Microbiological and Biomedical Laboratories by Richmond
- Drugs: From Discovery to Approval by Rick
- Handbook of Pharmaceutical Biotechnology by Gad
- Biopharmaceuticals Biochemistry and Biotechnology by Walsh
- Pharmaceutical Microbiology, Blackwell scientific Publications by Hugo 12. Molecular Biotechnology by Glick

List of Open Source Software/learning website:

- <https://www.youtube.com/watch?v=uMDh74xGiNM>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Students will be able to describe recent advances in microbiology and life sciences, including high-throughput biological data acquisition and next-generation sequencing technologies, and explain their significance in research and clinical applications.	1 Remember 2 Understand
CLO2	Students will be able to explain the principles and applications of gene editing technologies, including CRISPR-Cas systems and other genome engineering methods, and assess their potential in research and therapeutic intervention	2 Understand 3 Apply
CLO3	Students will be able to evaluate the role of artificial intelligence and machine learning in analyzing biological data, predicting outcomes, and improving diagnostics and research efficiency.	2 Understand 3 Apply 4 Analyze
CLO4	Students will be able to compare conventional and molecular diagnostic techniques, including PCR-based methods, automated systems like MALDI-TOF, and rapid pathogen detection approaches, to identify infectious diseases and genetic mutations.	2 Understand 3 Apply 4 Analyze
CLO5	Students will be able to analyze current strategies for treatment of infectious diseases (HIV, malaria, tuberculosis, cancer) and discuss the challenges of multidrug resistance and approaches to tackle antimicrobial resistance.	3 Apply 4 Analyze 5 Evaluate

CLO6	Students will be able to describe different types of nanoparticles, their synthesis, and their applications in microbial diagnostics, antimicrobial therapies, drug delivery, and biofilm control, while critically evaluating associated advantages, limitations, and safety concerns.	3Apply 5 Evaluate 6 Create
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Mapping of CLO s with POs & PSOs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	2	3	3		2	2			2	2					1		1	2	2
CLO2	2	3	3		2	2			2	3					1		2	2	3
CLO3	3	3	3		3	3			2	3					1		1	2	1
CLO4	3	3	3		3	3			2	3					2		1	1	1
CLO5	3	3	3		3	3			2	3					2			1	
CLO6	3	3	3		3	3			3	3					2			2	

3: High, 2: Medium, 1: Low