

Meerut Institute of Engineering and Technology, Meerut

Statements of Course Outcomes (COs) and Mapping with Program Outcomes (POs) and Program S

Tech BT Dept. of Biotechnology : 2024-26

(Batch passed-out in 2026; 2024-26) BKL # K1 – Remember, K2 – Understand, K3 – Apply, K4 – A

Create

S. No.	Sub Code	Sem	COx	Statement of Course Outcomes (COs)	Kx	PO 1
				Statement of Course Outcomes (COs) Upon completion of topic concerned, students will be able to :	Blooms Knowledge Level	Independently carry out research /investigation
1	MTBT 101	—	CO-1	Analyze the structure and functions of biomolecules.	K3	3.0
			CO-2	Analyze the bioenergetics of biological processes.	K4	3.0
			CO-3	Illustrate the processes of energy production.	K3	2.0
			CO-4	Illustrate the molecular processes of the central dogma of life.	K3	3.0
			CO-5	Illustrate the role of telomeres and gene regulation.	K3	3.0
			MTBT 101			2.8
2	MTBT102	—	CO-1	Command the principles of fermentation and bioprocess technology for industrial applications.	K3	3
			CO-2	Apply stoichiometric principles to evaluate cell growth, product formation, and energetic efficiencies in microbial fermentation processes.	K3	3
			CO-3	Analyze mass transfer and mixing dynamics in bioprocesses, focusing on oxygen transfer rates, measurement techniques, and scale-up of bioreactors.	K4	3.0
			CO-4	Analyze regulatory mechanisms in microbial metabolism and apply this knowledge to optimize production processes for key metabolites.	K4	3.0
			CO-5	Apply unit operations such as filtration, centrifugation, and chromatography for optimizing separation processes in biotechnology.	K3	3.0
			MTBT102			3.0
3	MTBT 011	—	CO-1	Explain immune system components, antigen-antibody interactions, and MHC functions.	K3	3.0
			CO-2	Describe immunoglobulin structure, antigen presentation, and antibody diversity.	K3	3.0
			CO-3	Understand vaccination types, immunization strategies, and vaccine technologies.	K2	3.0
			CO-4	Differentiate licensed vaccines (viral, bacterial, parasitic) and their applications.	K3	3.0
			CO-5	Analyze vaccine manufacturing, regulations, safety, and legal aspects.	K4	3.0
			MTBT 011			3.0
4	3T 022	—	CO-1	Illustrate the fundamentals of nanoscience, nanotechnology, and biomedical polymers.	K3	3.0
			CO-2	Learn the synthesis of carbon nanotubes, metal/metal oxide nanoparticles.	K2	3.0
			CO-3	Demonstrate the working principles of advanced tools and techniques.	K3	3.0

	MTF		CO-4	Understanding and Application of Nanomedicine in Therapeutics.	K2	3.0
			CO-5	Evaluate toxicity mechanisms in nanomaterials and conduct nanotoxicity studies.	K4	3.0
			MTBT 022			3.0
5	MTCC 101	—	CO-1	Explain the fundamentals of research, its objectives, types, and problem definition.	K2	3.0
			CO-2	Describe research design methodologies, the research process, and literature review techniques.	K3	3.0
			CO-3	Apply appropriate data collection methods, sampling techniques, and ethical considerations in research.	K3	3.0
			CO-4	Analyze and interpret research data using statistical techniques and hypothesis testing.	K4	3.0
			CO-5	Develop research reports, thesis, and scientific papers following proper referencing and ethical guidelines.	K4	3.0
			MTCC 101			3.0
6	MTBT151	—	CO-1	Perform quantitative estimation of biomolecules such as amino acids, proteins, and lipids using standard biochemical techniques.	K3	3.0
			CO-2	Apply spectroscopic methods to study biomolecules and validate Lambert-Beer's law.	K3	3.0
			CO-3	Execute molecular biology techniques such as DNA/RNA isolation and electrophoretic analysis.	K3	3.0
			CO-4	Conduct gene manipulation techniques, including transformation, restriction mapping, and PCR.	K3	3.0
			CO-5	Apply blotting techniques (Southern, Northern) for nucleic acid detection and analysis.	K3	3.0
			MTBT151			3.0
7	MTBT152	—	CO-1	Analyze kinetic parameters for microbial growth, oxygen transfer, and activation energy in bioprocesses.	K4	3.0
			CO-2	Optimize fermentation conditions and enzyme production using experimental design and immobilization techniques.	K3	3.0
			CO-3	Design and evaluate fermenters, including their components, for microbial cell culture applications.	K3	3.0
			CO-4	Conduct fermentative production of industrially relevant products such as antibiotics, enzymes, ethanol, and wine.	K3	3.0
			CO-5	Apply separation and purification techniques for microbial strains, fermentation products, and protein profiling.	K3	3.0
			MTBT152			3.0
8	MTBT 201	=	CO-1	Explain the fundamentals of bioinformatics, including databases and informatics tools used in biological research.	K2	3.0
			CO-2	Apply sequence alignment techniques and database similarity searching tools such as BLAST and FASTA.	K3	3.0
			CO-3	Analyze phylogenetic relationships using tree-building methods and phylogenetic models.	K4	3.0
			CO-4	Utilize bioinformatics tools for restriction mapping, gene construction, and vector analysis.	K3	3.0
			CO-5	Design primers using computational tools and software for genetic and molecular biology applications.	K3	3.0
			MTBT 201			3.0
			CO-1	Understand fundamental concepts in accounting, finance, and legal requirements for starting and managing a venture.	K2	3.0

9	MTBT 202	=	CO-2	Analyze market dynamics, customer needs, and strategies for branding, pricing, and product promotion.	K4	3.0
			CO-3	Apply information technology for business management, financial planning, and operational efficiency.	K3	3.0
			CO-4	Evaluate intellectual property rights (IPR) frameworks and their significance in biotechnology and business.	K5	3.0
			CO-5	Assess biosafety measures, risk management strategies, and national/international regulatory frameworks.	K3	3.0
			MTBT 202			3.0
10	MTBT 031	=	CO-1	Explain DNA structure, labeling, and hybridization techniques.	K2	3.0
			CO-2	Describe cloning vectors and expression systems.	K3	2.0
			CO-3	Apply gene cloning and library construction methods.	K3	1.0
			CO-4	Design and perform PCR-based techniques.	K4	3.0
			CO-5	Evaluate sequencing, gene silencing, and gene therapy approaches.	K4	2.0
			MTBT 031			2.2
11	MTBT 042	=	CO-1	Explain enzyme kinetics, inhibition, immobilization, and industrial enzyme applications.	K3	3.0
			CO-2	Analyze microbial metabolism, stoichiometry, and growth kinetics in biotechnological processes.	K3	3.0
			CO-3	Demonstrate an understanding of bioreactors, sterilization, aeration, and culture-specific reactor design.	K3	3.0
			CO-4	Apply separation and purification techniques like chromatography, precipitation, electrophoresis, and drying.	K3	2.0
			CO-5	Evaluate industrial enzyme applications, enzyme-based biosensors, enzyme engineering, and molecular imprinting.	K5	2.0
			MTBT 042			2.6
12	MTBT 051	=	CO-1	Explain basic animal cell culture techniques, media composition, and physicochemical factors.	K2	3.0
			CO-2	Describe primary, secondary, and continuous cell culture methods and cell growth behavior.	K4	3.0
			CO-3	Apply cell culture techniques in transfection, cloning, and industrial production.	K5	3.0
			CO-4	Explain principles and applications of plant tissue culture and regeneration.	K3	2.0
			CO-5	Perform media preparation, callus culture, protoplast culture, and plant regeneration techniques.	K3	2.0
			MTBT 051			2.6
13	MTBT 251	=	CO-1	Identify and analyze similar sequences of a given protein or DNA using bioinformatics tools.	K3	3.0
			CO-2	Predict the open reading frames (ORFs) and analyze gene structure from a given gene sequence.	K4	3.0
			CO-3	Perform pairwise and multiple sequence alignments to determine evolutionary relationships among sequences.	K3	3.0
			CO-4	Predict and interpret the secondary and tertiary structure of proteins using computational methods.	K4	3.0
			CO-5	Construct homology models and assess structural similarities by calculating RMSD values between aligned proteins.	K4	3.0
			MTBT 251			3.0
			CO-1	Identify and review recent advancements and research trends in biotechnology from scientific literature.	K3	3.0
			CO-2	Analyze and critically evaluate scientific papers, patents, and technical reports related to biotechnology.	K4	3.0

14	MTBT 252	=	CO-3	Develop and deliver an effective oral presentation on a selected research topic using appropriate scientific communication techniques.	K5	2.0
			CO-4	Demonstrate the ability to write a well-structured technical report or review paper with proper citations and references.	K3	2.0
			CO-5	Engage in discussions, answer queries, and defend arguments based on scientific reasoning and logical interpretations.	K4	3.0
			MTBT 252			2.6
15	MTBT 351	≡	CO-1	Conduct an in-depth review of recent scientific literature and emerging technologies in biotechnology.	K4	3.0
			CO-2	Critically assess and synthesize research findings to formulate innovative solutions for complex biotechnological problems.	K5	3.0
			CO-3	Present and defend a scientific research topic using appropriate data visualization and advanced communication strategies.	K5	2.0
			CO-4	Develop a well-structured technical manuscript suitable for journal publication or conference proceedings.	K5	2.0
			CO-5	Engage in peer discussions, respond to expert reviews, and integrate constructive feedback into research work.	K5	3.0
			MTBT 351			2.6
16	MTBT 352	≡	CO-1	Formulate a research problem, review relevant literature, and design a research methodology in the field of biotechnology.	K4	3.0
			CO-2	Conduct independent research, apply modern biotechnological tools, and generate experimental data with accuracy and reproducibility.	K5	3.0
			CO-3	Analyze, interpret, and critically evaluate research data using appropriate statistical and computational tools.	K5	3.0
			CO-4	Write a comprehensive dissertation with a structured methodology, results, discussion, and conclusion following scientific writing standards.	K5	2.0
			CO-5	Present and defend research findings effectively through seminars, conferences, or peer-reviewed publications.	K5	3.0
			MTBT 352			2.8
17	MTBT 451	≧	CO-1	Implement the research plan effectively and conduct experiments with precision using advanced biotechnological techniques.	K5	3.0
			CO-2	Analyze and interpret experimental results critically using computational and statistical tools to derive meaningful conclusions.	K5	3.0
			CO-3	Prepare a well-structured dissertation with high-quality scientific writing, adhering to publication standards and ethical guidelines.	K5	2.0
			CO-4	Present and defend research findings confidently in front of an expert panel, incorporating constructive feedback.	K5	3.0
			CO-5	Publish research findings in peer-reviewed journals or present at national/international conferences to contribute to scientific knowledge.	K5	3.0
			MTBT 451			2.8

Specific Outcomes (PSOs) : M.

Analyze, K5 – Evaluate, K6 –

PO 2	PO 3	PO 4
Write and present a substantial technical report	Demonstrate a degree of mastery over the area as per the specialization of the program	Conduct investigations of complex problems independently & develop innovative solutions
2.0	2.0	3.0
2.0	2.0	3.0
2.0	2.0	3.0
2.0	3.0	3.0
2.0	3.0	3.0
2.0	2.4	3.0
2	3	3
2	3	3
2.0	3.0	3.0
2.0	3.0	3.0
2.0	3.0	3.0
2.0	3.0	3.0
2.0	2.0	2.0
2.0	2.0	2.0
2.0	3.0	2.0
2.0	3.0	3.0
3.0	3.0	3.0
2.2	2.6	2.4
2.0	2.0	1.0
2.0	3.0	2.0
2.0	3.0	3.0

3.0	3.0	3.0
3.0	3.0	3.0
2.4	2.8	2.4
2.0	2.0	1.0
3.0	3.0	2.0
3.0	3.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
2.8	2.8	2.4
2.0	2.0	2.0
2.0	2.0	2.0
3.0	3.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
2.6	2.6	2.6
3.0	3.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
2.0	2.0	3.0
2.8	2.8	3.0
2.0	2.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
3.0	2.0	3.0
3.0	3.0	3.0
2.8	2.6	3.0
2.0	2.0	3.0

3.0	3.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
3.0	3.0	3.0
2.8	2.8	3.0
2.0	3.0	2.0
3.0	2.0	1.0
2.0	3.0	3.0
1.0	2.0	3.0
2.0	1.0	3.0
2.0	2.2	2.4
2.0	3.0	2.0
2.0	3.0	3.0
1.0	3.0	3.0
2.0	3.0	3.0
3.0	2.0	3.0
2.0	2.8	2.8
2.0	3.0	2.0
2.0	3.0	3.0
2.0	3.0	3.0
3.0	2.0	3.0
3.0	2.0	3.0
2.4	2.6	2.8
1.0	2.0	3.0
1.0	3.0	3.0
2.0	3.0	3.0
2.0	3.0	3.0
3.0	3.0	3.0
1.8	2.8	3.0
2.0	3.0	3.0
2.0	3.0	3.0

3.0	2.0	3.0
3.0	2.0	3.0
2.0	3.0	3.0
2.4	2.6	3.0
2.0	3.0	3.0
2.0	3.0	3.0
3.0	2.0	3.0
3.0	2.0	3.0
2.0	3.0	3.0
2.4	2.6	3.0
2.0	3.0	3.0
2.0	3.0	3.0
2.0	3.0	3.0
3.0	2.0	3.0
2.0	3.0	3.0
2.2	2.8	3.0
2.0	3.0	3.0
2.0	3.0	3.0
3.0	2.0	3.0
2.0	3.0	3.0
2.0	3.0	3.0
2.2	2.8	3.0