

PROGRAM OUTCOME (POs)	
Course Code	M.Sc. MEDICAL BIOTECHNOLOGY
PO1	Apply Biotechnological Knowledge in Medical Sciences: Utilize molecular, cellular, and computational techniques in medical biotechnology for disease diagnosis, treatment, and research.
PO2	Conduct Independent and Collaborative Research: Design and execute experiments, analyze data, and contribute to scientific advancements in medical biotechnology.
PO3	Utilize Advanced Molecular and Analytical Techniques: Demonstrate proficiency in PCR, flow cytometry, sequencing technologies, protein analysis, and bioinformatics tools.
PO4	Solve Complex Biological Problems: Address medical challenges through biotechnological approaches such as genome editing, stem cell therapy, and personalized medicine.
PO5	Demonstrate Ethical and Professional Responsibility: Adhere to bioethical principles, regulatory guidelines, and good laboratory practices in research and industry.
PO6	Communicate Effectively in Scientific and Industrial Settings: Present research findings, write scientific papers, and engage in effective interdisciplinary communication.
PO 7	Adapt to Emerging Trends in Biotechnology: Stay updated with advancements in precision medicine, nanobiotechnology, synthetic biology, and artificial intelligence in healthcare.
PO8	Contribute to Public Health and Biomedical Innovation: Develop cost-effective, innovative solutions for disease prevention, diagnostics, and therapeutics for societal impact
COURSE OUTCOMES (COs)	
Course Code	M.Sc. MEDICAL BIOTECHNOLOGY
SEMESTER I	
MMBT 104 (A) P	Cell Biology
CO1	Apply aseptic techniques and sterilization methods in cell biology laboratories.
CO2	Use microscopy to identify and differentiate various cell types and structures.
CO3	Perform cell counting, staining, and viability assays with accurate interpretation.
CO4	Analyze osmotic behavior and membrane integrity in biological cells.
CO5	Demonstrate knowledge of fixation, tissue processing, and microtomy.
CO6	Identify stages of mitosis and meiosis and relate them to cell cycle regulation.
MMBT 104 (B) P	Immunology
CO1	Identify blood cells and perform haemagglutination-based immunological tests.
CO2	Analyze the microscopic organization of lymphoid organs.
CO3	Demonstrate antigen–antibody interactions using immunodiffusion assays.
CO4	Isolate mononuclear immune cells using density gradient techniques.
CO5	Perform and interpret ELISA and kit-based immunodiagnostic assays.
CO6	Understand serological and protein-based immunodetection methods.
SEMESTER II	
MMBT 110 (A) P	Molecular Biology
CO1	Isolate and purify high-quality genomic DNA and total RNA from biological samples and assess their integrity and purity.
CO2	Quantitatively estimate DNA, RNA, and protein concentrations using colorimetric and spectrophotometric methods.
CO3	Perform conventional PCR amplification and analyze amplified products using agarose gel electrophoresis.
CO4	Interpret experimental data, evaluate results, and troubleshoot common laboratory issues in molecular biology experiments.
CO5	Follow ethical guidelines, biosafety regulations, and good laboratory practices during molecular experimentation.
CO6	Communicate experimental findings effectively through proper documentation, calculations, and scientific reporting.

MMBT 110 (B) P	Analytical Biotechnology
CO1	Perform chromatographic techniques to separate and identify biomolecules from complex mixtures.
CO2	Quantitatively analyze biomolecules using spectrophotometric methods and calibration curves.
CO3	Separate and analyze nucleic acids and proteins using electrophoretic techniques such as AGE and SDS-PAGE.
CO4	Detect and analyze specific proteins using immunoblotting (Western blotting) techniques.
CO5	Interpret analytical data, troubleshoot experimental errors, and ensure reproducibility of results.
CO6	Demonstrate ethical responsibility, GLP compliance, and effective documentation and communication of analytical findings.
MMBT 111 (A) P	Genetic Engineering
CO1	Isolate and purify plasmid DNA from bacterial cells and evaluate its quality for downstream genetic engineering applications.
CO2	Perform restriction digestion and ligation of DNA fragments to construct recombinant DNA molecules.
CO3	Introduce recombinant DNA into bacterial cells and assess transformation efficiency.
CO4	Analyze genetic variation and polymorphism using the RFLP technique.
CO5	Quantitatively evaluate gene expression using real-time PCR and interpret amplification data.
CO6	Demonstrate ethical conduct, biosafety compliance, effective documentation, and scientific communication in genetic engineering experiments.
MMBT 111 (B) P	Bioinformatics
CO1	Retrieve, curate, and perform comparative analysis of biological sequences using public databases and similarity search tools.
CO2	Perform multiple sequence alignment and construct phylogenetic trees to infer evolutionary relationships.
CO3	Generate and evaluate three-dimensional protein structures using homology modeling techniques.
CO4	Conduct molecular docking studies and analyze protein–ligand interactions for functional and therapeutic insights.
CO5	Visualize, statistically analyze, and interpret biological data using appropriate graphical and computational methods.
CO6	Reconstruct and functionally interpret metabolic pathways to understand biological systems and disease mechanisms.



MGM SCHOOL OF BIOMEDICAL SCIENCES, NAVI MUMBAI

(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)

(Deemed University u/s 3 of UGC Act 1956)

Grade “A++” Accredited by NAAC

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CO PO Mapping Program - M.Sc. Medical Biotechnology Semester I and II

PO1	Apply Biotechnological Knowledge in Medical Sciences: Utilize molecular, cellular, and computational techniques in medical biotechnology for disease diagnosis, treatment, and research.
PO2	Conduct Independent and Collaborative Research: Design and execute experiments, analyze data, and contribute to scientific advancements in medical biotechnology.
PO3	Utilize Advanced Molecular and Analytical Techniques: Demonstrate proficiency in PCR, flow cytometry, sequencing technologies, protein analysis, and bioinformatics tools.
PO4	Solve Complex Biological Problems: Address medical challenges through biotechnological approaches such as genome editing, stem cell therapy, and personalized medicine.
PO5	Demonstrate Ethical and Professional Responsibility: Adhere to bioethical principles, regulatory guidelines, and good laboratory practices in research and industry.
PO6	Communicate Effectively in Scientific and Industrial Settings: Present research findings, write scientific papers, and engage in effective interdisciplinary communication.
PO7	Adapt to Emerging Trends in Biotechnology: Stay updated with advancements in precision medicine, nanobiotechnology, synthetic biology, and artificial intelligence in healthcare.
PO8	Contribute to Public Health and Biomedical Innovation: Develop cost-effective, innovative solutions for disease prevention, diagnostics, and therapeutics for societal impact

PO Mapping same with correlation level 3,2,1 The notation of 1 - low, 2 - moderate , 3 - high

Semester	Course / Course Code	Course Outcome	Course Outcome	Apply Biotechnological Knowledge in Medical Sciences	Conduct Independent and Collaborative Research	Utilize Advanced Molecular and Analytical Techniques	Solve Complex Biological Problems	Demonstrate Ethical and Professional Responsibility	Communicate Effectively in Scientific and Industrial Settings	Adapt to Emerging Trends in Biotechnology	Contribute to Public Health and Biomedical Innovation	Average
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	
SEM I	Cell Biology / MMBT 104 (A) P	CO1	Apply aseptic techniques and sterilization methods in cell biology laboratories.	3	2	1	1	3	1	1	1	1.6
		CO2	Use microscopy to identify and differentiate various cell types and structures.	3	2	2	1	1	1	1	1	1.5
		CO3	Perform cell counting, staining, and viability assays with accurate interpretation.	3	3	2	2	1	1	1	1	1.8
		CO4	Analyze osmotic behavior and membrane integrity in biological cells.	3	2	1	2	1	1	1	1	1.5
		CO5	Demonstrate knowledge of fixation, tissue processing, and microtomy.	3	3	2	1	2	1	1	1	1.8
		CO6	Identify stages of mitosis and meiosis and relate them to cell cycle regulation.	3	2	1	2	1	2	1	1	1.6
			Average	3	2.33	1.5	1.50	1.5	1.17	1.00	1.00	1.6
	Immunology / MMBT 104 (B) P	CO1	Identify blood cells and perform haemagglutination-based immunological tests.	3	2	1	1	3	1	1	3	1.9
		CO2	Analyze the microscopic organization of lymphoid organs.	3	2	1	1	1	2	1	1	1.5
		CO3	Demonstrate antigen-antibody interactions using immunodiffusion assays.	3	3	1	1	1	2	1	1	1.6
		CO4	Isolate mononuclear immune cells using density gradient techniques.	3	3	2	2	1	1	1	1	1.8
		CO5	Perform and interpret ELISA and kit-based immunodiagnostic assays.	3	3	3	2	2	2	1	3	2.4
		CO6	Understand serological and protein-based immunodetection methods.	3	3	2	3	2	3	1	3	2.5
			Average	3	2.67	1.67	1.67	1.67	1.83	1	2	1.94
	Molecular Biology / MMBT 110 (A) P	CO1	Isolate and purify high-quality genomic DNA and total RNA from biological samples and assess their integrity and purity.	3	2	2	2	3	1	1	1	1.9
		CO2	Quantitatively estimate DNA, RNA, and protein concentrations using colorimetric and spectrophotometric methods.	3	2	2	2	3	1	1	1	1.9

SEM II		CO3	Perform conventional PCR amplification and analyze amplified products using agarose gel electrophoresis.	3	2	3	3	3	1	2	2	2.4
		CO4	Interpret experimental data, evaluate results, and troubleshoot common laboratory issues in molecular biology experiments.	3	3	2	3	2	2	2	2	2.4
		CO5	Follow ethical guidelines, biosafety regulations, and good laboratory practices during molecular experimentation.	2	1	1	1	3	3	1	2	1.8
		CO6	Communicate experimental findings effectively through proper documentation, calculations, and scientific reporting.	2	2	2	1	1	2	1	1	1.5
		Average		2.67	2	2.00	2	2.5	1.67	1.33	1.5	1.96
	Analytical Biotechnology / MMBT 110 (B) P	CO1	Perform chromatographic techniques to separate and identify biomolecules from complex mixtures.	3	2	2	2	2	1	1	1	1.8
		CO2	Quantitatively analyze biomolecules using spectrophotometric methods and calibration curves.	3	2	3	2	2	2	1	2	2.1
		CO3	Separate and analyze nucleic acids and proteins using electrophoretic techniques such as AGE and SDS-PAGE.	3	2	3	2	2	2	2	2	2.3
		CO4	Detect and analyze specific proteins using immunoblotting (Western blotting) techniques.	3	2	3	3	2	2	2	2	2.4
		CO5	Interpret analytical data, troubleshoot experimental errors, and ensure reproducibility of results.	2	3	2	3	2	1	2	1	2.0
		CO6	Demonstrate ethical responsibility, GLP compliance, and effective documentation and communication of analytical findings.	1	2	2	1	3	3	2	2	2.0
		Average		2.5	2.17	2.50	2.17	2.17	1.83	1.67	1.67	2.1
	Genetic Engineering / MMBT 111 (A) P	CO1	Isolate and purify plasmid DNA from bacterial cells and evaluate its quality for downstream genetic engineering applications.	3	2	2	1	2	1	1	1	1.6
		CO2	Perform restriction digestion and ligation of DNA fragments to construct recombinant DNA molecules.	3	2	3	2	2	2	2	2	2.3
		CO3	Introduce recombinant DNA into bacterial cells and assess transformation efficiency.	3	2	3	2	2	2	1	2	2.1
		CO4	Analyze genetic variation and polymorphism using the RFLP technique.	3	2	3	3	1	2	1	1	2.0
		CO5	Quantitatively evaluate gene expression using real-time PCR and interpret amplification data.	3	3	2	2	2	1	2	2	2.1
		CO6	Demonstrate ethical conduct, biosafety compliance, effective documentation, and scientific communication in genetic engineering experiments.	2	2	2	1	3	3	2	1	2.0
		Average		2.83	2.17	2.50	1.83	2.00	1.83	1.50	1.50	2.0
	Bioinformatics / MMBT 111 (B) P	CO1	Retrieve, curate, and perform comparative analysis of biological sequences using public databases and similarity search tools.	3	2	3	1	2	1	1	1	1.8
		CO2	Perform multiple sequence alignment and construct phylogenetic trees to infer evolutionary relationships.	3	2	2	3	1	1	1	1	1.8
		CO3	Generate and evaluate three-dimensional protein structures using homology modeling techniques.	3	2	3	2	2	1	2	2	2.1
		CO4	Conduct molecular docking studies and analyze protein-ligand interactions for functional and therapeutic insights.	3	3	3	3	2	1	3	3	2.6
		CO5	Visualize, statistically analyze, and interpret biological data using appropriate graphical and computational methods.	3	3	2	2	2	3	2	1	2.3
		CO6	Reconstruct and functionally interpret metabolic pathways to understand biological systems and disease mechanisms.	3	2	2	3	1	1	2	3	2.1
		Average		3	2.33	2.50	2.33	1.67	1.33	1.83	1.83	2.1