M.Sc. Mathematics Course Outcomes Summary Sheet								
Course	**Title**	**Course Outcome 1**	**Course Outcome 2**	**Course Outcome 3**	**Course Outcome 4**	**Course Outcome 5**	**Course Outcome 6**	**Course Outcome 7**
M.Sc.Previous Mathematics	Advanced Abstract Algebra	Demonstrate deep understanding of fundamental abstract algebra concepts.	Apply group theory concepts to solve problems involving direct and internal products, Sylow's theorems, and isomorphism theorems.	Analyze and solve problems involving polynomial rings, linear transformations, dual spaces, and field extensions.	Utilize Galois theory to understand the solvability of polynomial equations and apply it to solve related problems.	Represent linear maps using matrices, calculate eigenvalues and eigenvectors, and apply these concepts to solve various problems.	Analyze real inner product spaces, apply adjoint and orthogonal transformations, and utilize the Principal Axis Theorem.	
M.Sc.Previous Mathematics	Real Analysis and Topology	Apply measure theory concepts to analyze sets of real numbers and measurable functions.	Define and analyze Lebesgue integrals, utilize Fourier series and their coefficients, and apply convergence in measure and Egoroff's theorem.	Understand and apply concepts of L-spaces, Holder-Minkowski inequalities, and topological spaces, including separation axioms.	Analyze continuous mappings and homeomorphisms, apply nets and filters, and utilize separation axioms to categorize topological spaces.	Analyze and characterize compact and locally compact spaces, apply continuity and connectedness properties, and utilize the One-Point Compactification Theorem.		
M.Sc.Previous Mathematics	Differential Equations and Special Functions	Solve non-linear ordinary differential equations of particular forms, including Riccati's equation, and analyze total differential equations and partial differential equations of second order with variable coefficients.	Classify linear partial differential equations of second order, apply Cauchy's method and separation of variables to solve first-order partial differential equations, and analyze Laplace, Wave, and diffusion equations.	Define and analyze functionals and their variations.	Apply Euler's equation and variational principles to solve extremum problems, and utilize the method of Frobenius to solve differential equations near singular points.	Analyze and apply properties of Gauss hypergeometric functions, Bessel functions, Hermite polynomials, and Laguerre polynomials to solve problems.		
M.Sc.Previous Mathematics	Differential Geometry and Tensor Analysis	Analyze space curves and their properties, including curvature, torsion, and osculating circle, and utilize the Serret-Frenet formulae.	Define and analyze the metric of a surface and its fundamental forms, calculate and interpret curvature and torsion of a surface, and understand Weingarten equations.	Analyze normal curvature, principal directions and curvatures, asymptotic lines, and Gauss's formulae.	Define and analyze geodesics, Christoffel symbols, covariant differentiation, Riemann-Christoffel tensor, and covariant curvature tensor.	Understand and apply concepts of tensor analysis, including Kronecker delta, contravariant and covariant tensors, and Riemannian space.		
M.Sc. Final Mathematics	Analysis and Advanced Calculus	Demonstrate a deep understanding of metric spaces, normed linear spaces, and inner product spaces.	Apply concepts of completeness, compactness, separability, and connectedness in metric spaces.	Analyze and apply properties of bounded linear transformations, weak convergence, and dual spaces.	Understand and utilize the Hahn-Banach theorem, open mapping theorem, closed graph theorem, and uniform boundedness theorem.	Analyze Hilbert spaces, their properties, and the structure of a Hilbert space.	Apply concepts of adjoint operators, self-adjoint operators, projections, and spectral theorem.	
M.Sc. Final Mathematics	Fluid Dynamics	Understand and apply fundamental concepts of fluid mechanics and equations.	Analyze vorticity, circulation, similarity, and non-dimensional parameters.	Solve exact solutions for specific flow patterns.	Analyze specific flow types and apply boundary layer concepts.	Apply energy equation to analyze temperature distribution.		
M.Sc. Final Mathematics	Mathematical Programming	Understand and apply fundamental concepts of linear programming and simplex method.	Solve integer programming problems using specific algorithms.	Analyze and solve nonlinear programming problems using specific conditions and algorithms.	Apply quadratic programming techniques using specific methods.	Solve linear programming problems using dynamic programming.		
M.Sc. Final Mathematics	Integral Transform and Integral Equations	Apply Laplace, Fourier, Mellin, and Hankel transforms to solve specific problems.	Solve specific integral equations using various methods.	Understand and apply concepts of convolution theorems, resolvent kernels, and convergence.	Apply concepts to solve specific problems and analyze uniqueness of solutions.			
M.Sc. Final Mathematics	Advanced Numerical Analysis	Apply iterative methods to solve equations and systems.	Solve polynomial equations using specific methods.	Solve systems of linear equations using direct and iterative methods.	Calculate eigenvalues and eigenvectors using specific techniques.	Apply curve fitting and function approximation techniques to solve problems.	Solve ordinary differential equations numerically using specific methods and analyze stability.	Solve boundary value problems for ordinary differential equations using specific methods.

M.Sc. Mathematics Program Summary Sheet:			
S.NO.	**Program Outcomes (POs)**	**Program Specific Outcomes (PSOs)**	**Program Educational Objectives (PEOs)**
PO1/PSO1/PEO1	**Strong foundation in mathematics:** Graduates will demonstrate a deep understanding of fundamental concepts and methodologies in pure and applied mathematics, including algebra, analysis, topology, and differential equations.	**Advanced knowledge and skills in chosen specialization:** Graduates will gain in-depth knowledge and expertise in their chosen area of specialization within mathematics, such as numerical analysis, differential geometry, or mathematical physics.	**Successful careers in mathematics and related fields:** Graduates will be successful in their chosen careers in mathematics and related fields, contributing significantly to their chosen profession and making a positive impact on society.
PO2/PSO2/PEO2	**Problem-solving skills:** Graduates will be able to analyze complex problems, apply mathematical principles and techniques to find solutions, and interpret and communicate results effectively.	**Ability to conduct independent research:** Graduates will develop the skills and knowledge necessary to conduct independent research in mathematics, including formulating research questions, designing experiments, analyzing data, and presenting findings.	**Continual professional development:** Graduates will be committed to continual professional development, staying abreast of current advancements in their field and actively seeking opportunities to expand their knowledge and skills.
PO3/PSO3/PEO3	**Critical thinking and reasoning:** Graduates will develop strong critical thinking and reasoning skills, enabling them to evaluate arguments, identify assumptions, and form sound conclusions.	**Preparation for professional careers in mathematics:** Graduates will be well-prepared for professional careers in various fields that utilize their mathematical skills, such as research, teaching, finance, engineering, and data science.	**Leadership and innovation:** Graduates will be able to take on leadership roles and contribute to the development and implementation of new ideas and solutions in their field.
PO4/PSO4/PEO4	**Analytical and computational skills:** Graduates will acquire proficiency in analytical and computational methods, including numerical analysis, integral transforms, and optimization techniques.	**Effective communication of mathematical concepts:** Graduates will be able to effectively communicate complex mathematical concepts and ideas to both technical and non-technical audiences.	**Social responsibility and ethical behavior:** Graduates will be responsible and ethical individuals, applying their mathematical knowledge and skills to contribute to the solution of societal problems and promote positive change.
PO5/PSO5/PEO5	**Communication and collaboration skills:** Graduates will develop effective communication and collaboration skills, allowing them to clearly present their work, collaborate with others, and contribute to a team environment.	**Ethical conduct and professional responsibility:** Graduates will uphold high ethical standards and demonstrate professional responsibility in their work and interactions with colleagues and the broader community.	**Lifelong learning and intellectual curiosity:** Graduates will maintain a lifelong passion for learning and intellectual curiosity, continuously seeking new knowledge and understanding in mathematics and other disciplines.
PO6/PSO6/PEO6	**Lifelong learning:** Graduates will be committed to lifelong learning, able to adapt to new technologies and advancements in the field of mathematics.	-	-

Mapping of Course Outcomes of all courses of M.Sc. Mathematics with Program Outcomes, Program Specific Outcomes, and Program Educational Objectives

M.Sc. Previous Mathematics Paper-I: Advanced Abstract Algebra

Course Outcomes	Program Outcomes	Program Specific Outcomes	Program Educational Objectives	Level
Demonstrate deep understanding of fundamental abstract algebra concepts.	PO1	PSO1	PEO1, PEO2, PEO3	Understand (High)
Apply group theory concepts to solve problems involving direct and internal products, Sylow's theorems, and isomorphism theorems.	PO2, PO3	PSO2	PEO2	Apply (Medium)
Analyze and solve problems involving polynomial rings, linear transformations, dual spaces, and field extensions.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Analyze (Medium)
Utilize Galois theory to understand the solvability of polynomial equations and apply it to solve related problems.	PO2, PO3	PSO2	PEO2	Apply (High)
Represent linear maps using matrices, calculate eigenvalues and eigenvectors, and apply these concepts to solve various problems.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Apply (Medium)
Analyze real inner product spaces, apply adjoint and orthogonal transformations, and utilize the Principal Axis Theorem.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Analyze (High)
M.Sc. Previous Mathematics Paper-II: Real Analysis and Topology				
Apply measure theory concepts to analyze sets of real numbers and measurable functions.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)
Define and analyze Lebesgue integrals, utilize Fourier series and their coefficients, and apply convergence in measure and Egoroff's theorem.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Analyze (Medium)
Understand and apply concepts of L-spaces, Holder-Minkowski inequalities, and topological spaces, including separation axioms.	PO2, PO3	PSO2	PEO2	Understand (Medium)
Analyze continuous mappings and homeomorphisms, apply nets and filters, and utilize separation axioms to categorize topological spaces.	PO2, PO3	PSO2	PEO2	Analyze (High)
Analyze and characterize compact and locally compact spaces, apply continuity and connectedness properties, and utilize the One-Point Compactification Theorem.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Analyze (High)
M.Sc. Previous Mathematics Paper-III: Differential Equations and Special Functions				

Solve non-linear ordinary differential equations of particular forms, including Riccati's equation, and analyze total differential equations and partial differential equations of second order with variable coefficients.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)
Classify linear partial differential equations of second order, apply Cauchy's method and separation of variables to solve first-order partial differential equations, and analyze Laplace, Wave, and diffusion equations.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Analyze (Medium)
Define and analyze functionals and their variations.	PO2, PO3	PSO2	PEO2, PEO4	Understand (Medium)
Apply Euler's equation and variational principles to solve extremum problems, and utilize the method of Frobenius to solve differential equations near singular points.	PO2, PO3	PSO2	PEO2, PEO4	Apply (High)
Analyze and apply properties of Gauss hypergeometric functions, Bessel functions, Hermite polynomials, and Laguerre polynomials to solve problems.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Apply (Medium)
M.Sc. Previous Mathematics Paper-IV: Differential Geometry and Tensor Analysis				
Analyze space curves and their properties, including curvature, torsion, and osculating circle, and utilize the Serret-Frenet formulae.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Analyze (High)
Define and analyze the metric of a surface and its fundamental forms, calculate and interpret curvature and torsion of a surface, and understand Weingarten equations.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Analyze (High)
Analyze normal curvature, principal directions and curvatures, asymptotic lines, and Gauss's formulae.	PO2, PO3	PSO2	PEO2	Analyze (High)
Define and analyze geodesics, Christoffel symbols, covariant differentiation, Riemann-Christoffel tensor, and covariant curvature tensor.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Understand (High)
Understand and apply concepts of tensor analysis, including Kronecker delta, contravariant and covariant tensors, and Riemannian space.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Understand (Medium)
M.Sc. Final Mathematics Paper-I: Analysis and Advanced Calculus				

Demonstrate a deep understanding of metric spaces, normed linear spaces, and inner product spaces.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Understand (High)
Apply concepts of completeness, compactness, separability, and connectedness in metric spaces.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)
Analyze and apply properties of bounded linear transformations, weak convergence, and dual spaces.	PO2, PO3	PSO2	PEO2, PEO4	Analyze (Medium)
Understand and utilize the Hahn-Banach theorem, open mapping theorem, closed graph theorem, and uniform boundedness theorem.	PO2, PO3	PSO2	PEO2, PEO4	Understand (High)
Analyze Hilbert spaces, their properties, and the structure of a Hilbert space.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Analyze (High)
Apply concepts of adjoint operators, self-adjoint operators, projections, and spectral theorem.	PO1, PO4	PSO1, PSO3	PEO1, PEO3	Apply (High)
M.Sc. Final Mathematics Paper-II: Fluid Dynamics				
Understand and apply fundamental concepts of fluid mechanics and equations.	PO1, PO3	PSO1	PEO1, PEO3	Understand (Medium)
Analyze vorticity, circulation, similarity, and non-dimensional parameters.	PO1, PO3	PSO1	PEO1, PEO3	Analyze (Medium)
Solve exact solutions for specific flow patterns.	PO2, PO4	PSO2	PEO2	Apply (Medium)
Analyze specific flow types and apply boundary layer concepts.	PO2, PO4	PSO2	PEO2	Analyze (Medium)
Apply energy equation to analyze temperature distribution.	PO1, PO4	PSO1	PEO1, PEO3	Apply (Medium)
M.Sc. Final Mathematics Paper-III: Mathematical Programming				
Understand and apply fundamental concepts of linear programming and simplex method.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Understand (Medium)
Solve integer programming problems using specific algorithms.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (High)
Analyze and solve nonlinear programming problems using specific conditions and algorithms.	PO2, PO3	PSO2	PEO2, PEO4	Analyze (High)
Apply quadratic programming techniques using specific methods.	PO2, PO3	PSO2	PEO2, PEO4	Apply (Medium)
Solve linear programming problems using dynamic programming.	PO1, PO4	PSO1	PEO1, PEO3	Apply (Medium)
M.Sc. Final Mathematics Paper-IV: Integral Transform and Integral Equations				
Apply Laplace, Fourier, Mellin, and Hankel transforms to solve specific problems.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)

Solve specific integral equations using various methods.	PO2, PO3	PSO2	PEO2	Apply (Medium)
Understand and apply concepts of convolution theorems, resolvent kernels, and convergence.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Understand (Medium)
Apply concepts to solve specific problems and analyze uniqueness of solutions.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Analyze (Medium)
M.Sc. Final Mathematics Paper-V: Advanced Numerical Analysis				
Apply iterative methods to solve equations and systems.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)
Solve polynomial equations using specific methods.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)
Solve systems of linear equations using direct and iterative methods.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (Medium)
Calculate eigenvalues and eigenvectors using specific techniques.	PO2, PO3	PSO2	PEO2	Apply (Medium)
Apply curve fitting and function approximation techniques to solve problems.	PO2, PO3	PSO2	PEO2	Apply (Medium)
Solve ordinary differential equations numerically using specific methods and analyze stability.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (High)
Solve boundary value problems for ordinary differential equations using specific methods.	PO1, PO4	PSO1, PSO3	PEO1, PEO2, PEO3	Apply (High)