DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics

Core

SEMESTER 1

ME010101	**Abstract Algebra**	**Credits: 4**
CO1	Analyse the concepts of sets, binary operations, number system and permutation	
CO2	Discuss the basic concepts about Group, Ring and field and the basic properties of these algebraic structures	
CO3	Construct Group table for finite groups.	
CO4	Explain Group Homomorphism by using relationship between groups	
CO5	Comment the basic information about Cyclic group, Alternate group, Permutation Group, Direct product of groups and Cosets	

ME010102	**Linear Algebra**	**Credits: 4**
CO1	Demonstrate the basic concepts of vector space, basis, dimension and computations concerning subspaces	
CO2	Explain the concepts of linear transformation, linear functionals, dual of a functional and their role in studying matrices	
CO3	Analyze the concepts of isomorphism in vector space and apply the definition in different areas of Mathematics	
CO4	Describe about determinants and apply the result as permutation and uniqueness of determinants	
CO5	Evaluate the characteristic polynomial, eigen values and vectors, annihilating polynomials and minimal polynomial	

ME010103	**Basic Topology**	**Credits: 4**

CO1	Analyse the concept of topological space with illustration. Identify the transition from metric space to topological space. Describe two general constructions for topological space
CO2	Explain the concepts closure, interior and boundary in topological space and the construction of a topological space using these operators. Study the continuity in topological space
CO3	Identify that homeomorphism is the basic equivalence relation by which objects are classified in topology.
CO4	Mention some general problems in topology and realise that quotient spaces as the solution to one of them
CO5	Describe topological spaces with special properties. Illustrate connectedness in topological space and also distinguish between connected spaces and disconnected spaces
CO6	Develop the knowledge of separation axioms with sufficient examples

ME010104	**Real Analysis**	**Credits: 4**
CO1	Discuss and analyze functions of bounded variation and rectifiable curves.	
CO2	Explain the definition and properties of monotonic functions, functions of bounded Variation, total variation, additive property of total variation, functions of bounded variation expressed as the difference of increasing functions, continuous functions of bounded variation	
CO3	Develop an understanding of curves and paths, rectifiable path and arc length, additive and continuity properties of arc length, equivalence of paths and change of parameter	
CO4	Definition and existence of the Riemann-Stieltjes integral, properties of the integral, integration and differentiation, integration of vector valued functions.	
CO5	Identify Sequence and Series of Functions with illustrations	
CO6	Analyze the definition Uniform convergence, study the relation between Uniform convergence and Continuity, Uniform convergence and Integration, Uniform convergence and Differentiation	
CO7	Discuss Some Special Functions with properties- the exponential functions, logarithmic functions and trigonometric functions	
ME010105	**Graph Theory**	**Credits: 4**
CO1	Explain basic concepts of Graphs and directed graphs	
CO2	Analyse some operations on graphs	
CO3	Discuss vertex connectivity and edge connectivity	
CO4	Apply algorithms to find minimum weight spanning trees and	

CO5	Describe Eulerian and Hamiltonian graphs
CO6	Apply graph colouring in various real-life situations
CO7	Comment on the difference between planar and nonplanar graphs

ME010201	**Advanced Abstract Algebra**	**Credits: 4**
CO1	Analyse the definitions extension fields, algebraic extensions, Geometric Constructions Finite fields	
CO2	Discuss and analyze unique factorization domains and Euclidean domains with examples	
CO3	Explain Gaussian integers and multiplicative norm on an integral domain with properties	
CO4	Discuss the automorphism of fields and demonstrate Splitting fields	
CO5	Analyze , derive and apply the conjugation isomorphism theorem and the isomorphism extension theorem	
CO6	Discuss and derive Galois Theory with Illustrations	

ME010202	**Advanced Topology**	**Credits: 4**
CO1	Explain the concept of compactness, the connection between compactness and separation axioms.	
CO2	Discuss the importance of Urysohn's lemma and Tietze characterization of normality with its derivation	
CO3	Extend the study to the products of arbitrary families of topological spaces. Understand product topology and related theorems	
CO4	Develop the knowledge of evaluating functions into products. Describing evaluation function and its major properties	
CO5	Derive the classical theorems - Tychonoff embedding theorem and Urysohn's metrization theorem in general topology	

CO6	Study on the concept of a net, as a generalization of a sequence and explain its convergence. Get a knowledge of homotopy of paths

ME010203	**Numerical Analysis with Python**	**Credits: 4**
CO1	Summarise the basic knowledge about Python, use IDLE to develop programmes	
CO2	Acquire object oriented skills in python. Create simple python programme for solving mathematical problems	
CO3	Define symbols and symbolic operators and using sympy solve problems on factor finding, summing a series and solving inequalities.	
CO4	Discuss curve fitting, polynomial interpolation, Lagranges method, Newtons method and its limitations	
CO5	Explain the numerical method for finding the roots of equation by using bisection and Newton Raphson method	
CO6	Create programs for curve fitting, interpolation, roots of mathematical equations using python programming	
CO7	Create python programs on numerical integration	
ME010204	**Complex Analysis**	**Credits: 4**
CO1	Explain spherical representation and stereographic projection	
CO2	Analyse different types of linear transformations in complex plane	
CO3	Discuss the fundamental theorems in complex integration	
CO4	Apply fundamental theorems to evaluate complex integration	
CO5	Describe local properties of analytic functions	

ME010205	**Measure Theory and Integration**	**Credits: 4**
CO1	Explain the basic concepts of Real Analysis	
CO2	Define Sigma algebra of sets	
CO3	Discuss the basic concepts of Lebesgue measure and Measurable functions	
CO4	State some theorems on Measure theory	
CO5	Analyse the properties of General Measure space	
CO6	Explain product measure and properties	

ME010301	Advanced Complex Analysis	Credits: 4
CO1	Explain basic properties of harmonic functions	
CO2	Describe Dirichlet’s problem	
CO3	Analyse general properties of sequences of analytic functions	
CO4	Discuss partial fractions and factorization	
CO5	Describe Riemann Zeta function	
CO6	Study normality, compactness and Reimann Mapping Theorem	

ME010302	Partial Differential Equations	Credits: 4
CO1	Study the method of finding the orthogonal trajectories of a system of curves on a surface	
CO2	Explain pfaffian differential forms, its equations and related theorems. Solve problems of pfaffian differential equations in two and three variables	
CO3	Solve linear and nonlinear PDE of first order. Using the theory of linear PDE, determine the systems of surfaces orthogonal to a given system of surfaces	
CO4	Explain compatible system of first order PDE and find their solutions, Charpit's method and solve related problems	
CO5	Illustrate Jacobi' s method. Describe the origin of second order PDE and find the solution of such problems	
CO6	Find the solution of second order PDE using the method of separation of variables. Illustrate Monge's method	
ME010303	**Multivariate Calculus and IntegralTransforms**	**Credits: 4**
CO1	Explain Different forms of integral transforms and convolutions	
CO2	Discuss and derive the Weirstrass theorem, the Fourier integral theorem and the convolution theorem for Fourier transforms	
CO3	Explain the relation between directional derivatives and continuity, the total derivative in terms of partial derivatives	
CO4	Discuss the matrix of a linear function and The Jacobian matrix, Implicit functions and extremum problems	
CO5	Analyze and derive a sufficient condition for differentiability, equality partial derivatives, the inverse function theorem.	

CO6	Analyze the extrema of real valued functions of one variable and generalise it to functions of several variables	
CO7	Discuss primitive mappings, partitions of unity and effect of change of variables on a multiple integral	
ME010304	**Functional Analysis**	**Credits: 4**
CO1	Explain the meaning of functions and functionals with example. A background in linear algebra and ordinary calculus, is sufficient as a prerequisite	
CO2	Analyse different spaced like metric space, normed space and inner product space and the relevance of this in subspace, compactness etc	
CO3	Discuss the concepts of orthogonal complement, direct sum, orthonormal and the comparison with Linear Algebra	
CO4	Define the better feeling for the difficulties encouraged in the transition from a Hilbert space to general Banach Space.	
CO5	Describe the Hilbert adjoint operator and was suggested by problems in matrices and linear differential and integral equations.	
CO6	Discuss three important class of equation, self-adjoint, unitary and normal operators which play a key role in various applications.	
ME010305	**Optimization Technique**	**Credits: 4**
CO1	Formulate Optimization problems	
CO2	Solve linear programming problem using various methods	
CO3	Solve integer programming problem.	
CO4	Explain 0-1 variables and goal programming	
CO5	Explain minimum path problem and maximum flowproblem	
CO6	Discuss basic concepts of non linear programming and Identify the methods and solve programming problems when the objective function or constraints are non linear.	

ME010401	**Spectral Theory**	**Credits: 4**

CO1	Explain the fundamentals of functional analysis which originate from classical analysis	
CO2	Analyse the concepts behind the category theory. Define uniform boundedness theorem, Baire's theorem and application in Fourier series.	
CO3	Explain the three types of convergence in operator which turn out to be of theoretical as well as practical value	
CO4	Discuss the concepts of resolvent set and spectrum of operators, their properties and define the spectral mapping theorem. Explain the use of complex analysis in spectral theory	
CO5	Define the compact linear operator on normed space and their spectrum which play a central role in the theory of integral equations and various problems of mathematical physics.	
CO6	Study spectral theory of bounded self-adjoint linear operators, its properties, positive operators and projection operators	
ME010402	**Analytic Number Theory**	**Credits: 4**
CO1	Explain the Arithmetic functions, Dirichlet product, Dirichlet inverses and convolutions, Generalized convolutions $\mu(n)$, $\phi(n)$, $\Lambda(n)$, $\lambda(n)$,	
CO2	Discuss and derive the relation connecting μ and ϕ , the Möbius inversion formula with generalization	
CO3	Identify Multiplicative functions and completely Multiplicative functions with their inverses	
CO4	Compute Average order of Arithmetical functions and apply it to the distribution of lattice points visible from the origin	
CO5	Apply partial sums of Dirichlet product to $\mu(n)$ and $\Lambda(n)$.	
CO6	Discuss the relation connecting Chebyshev's functions, equivalent forms of Inequalities for $\pi(n)$ Shapiro's tauberian theorem	
CO7	Analyse the definitions and basic properties of congruences, Residue classes and complete residue system, Linear congruences, Reduced residue system and Polynomial congruences modulo p	
ME800401	**Differential Geometry**	**Credits: 3**
CO1	Explain the importance of level sets and graph of a function. Find and sketch level curves and graph of certain functions and explain its geometrical interpretation.	
CO2	Illustrate vector fields and its applications in other fields. Establish existence and uniqueness theorem for integral curves. Study the relation connecting level set and tangent space	

CO3	Describe n-surface with illustration and derive Lagrange multiplier theorem. Study vector field on n- surface and its orientation. Understand gauss map. Find the spherical image of the compact connected oriented n- surface	
CO4	Develop a knowledge of geodesic in an n- surface with examples. Discuss the concept parallel transport and derive the property that the parallel transport is invariant under isometrics	
CO5	Describe Weingarten map with two major properties and its geometrical interpretation	
CO6	Find the curvature of plane curves and verify that the parametrization of plane curves can be used to evaluate integrals over the curve. Discuss differential 1-forms and their integrals	
CO7	Study on normal curvature, gauss Kronecker curvature and principal curvature with illustration	
ME800402	**Algorithmic Graph Theory**	**Credits: 3**
CO1	Analyse the basic concepts of graphs	
CO2	Discuss various types of graphs	
CO3	Explain different graph algorithms	
CO4	Find complexity of various algorithms	
CO5	Define trees, distance, and matchings	
CO6	Explain networks	
ME800403	**Combinatorics**	**Credits: 3**
CO1	Analyse the concepts of permutation and combination	
CO2	Apply injection and bijection principle for solving problems	
CO3	Evaluate arrangements and selections with repetitions	
CO4	Apply Pigeonhole principle for solving problems	
CO5	Describe Ramsey numbers and bounds for Ramsey numbers	
CO6	Apply generalised principle of inclusion and exclusion for solving problems	
CO7	Discuss dearangements	