Teaching Plan for M. Sc Mathematics

Academic Year 2019-2020

Programme Outcomes (PO)

PO	Upon completion of M.Sc. Degree Programme, the graduates will be able to
PO - 1	recognize the scientific facts behind natural phenomena.
PO - 2	relate the theory and practical knowledge to solve the problems of the society.
PO - 3	prepare successful professionals in industry, government, academia, research, entrepreneurial pursuits and consulting firms
PO - 4	face and succeed in high level competitive examinations like NET, GATE and TOFEL.
PO - 5	carry out internship programmes and research projects to develop scientific skills and innovative ideas.
PO - 6	utilize the obtained scientific knowledge to create eco-friendly environment.
PO - 7	prepare expressive, ethical and responsible citizens with proven expertise

Programme Specific Outcomes (PSO)

PSO	Upon completion of M.Sc. Mathematics, the graduates will be able to	PO Addressed
PSO - 1	have a strong base in theoretical and applied mathematics.	PO – 2
PSO - 2	sharpen their analytical thinking, logical deductions and rigor in reasoning.	PO – 4
PSO - 3	understand the tools required to quantitatively analyze data and have the ability to access and communicate mathematical information.	PO – 7
PSO - 4	write proofs for simple mathematical results.	PO – 5
PSO - 5	acquire knowledge in recent developments in various branches of mathematics and participate in conferences / seminars / workshops and thus pursue research.	PO – 3
PSO - 6	utilize the knowledge gained for entrepreneurial pursuits	PO – 3
PSO - 7	understand the applications of mathematics in a global, economic, environmental, and societal context.	PO - 6
PSO - 8	use the techniques, skills and modern technology necessary to communicate effectively with professional and ethical responsibility.	PO - 7
PSO - 9	develop proficiency in analyzing, applying and solving scientific problems.	PO - 5

Semester	**: I**	**Major Core I**
Name of the Course	**: Algebra I**	
Course code	**: PM1711**	

No. of hours per week	Credits	Total No. of hours	Marks
6	5	90	100

Objectives:

1. To study abstract Algebraic systems
2. To know the richness of higher Mathematics in advanced application systems

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	understand the concepts of automorphism, inner automorphism, Sylow P- subgroups, finite abelian groups, characteristic, subgroups of groups	PSO - 7	U
CO - 2	analyze and demonstrate examples of various Sylow P- subgroups, automophisms	PSO - 9	An
CO - 3	develop proofs for Sylow's theorems , Fundamental theorem of finite abelian groups, direct products, Cauchy's theorem, automorphisms of groups.	PSO - 4	C
CO - 4	understand various definitions related to rings and ideals and illustrate	PSO - 4	U, Ap
CO - 5	develop the way of embedding of rings and design proofs for theorems related to rings	PSO - 3	C
CO - 6	understand the concepts of Euclidean domain and factorization domain and give illustrations	PSO - 3	U, Ap
CO - 7	compare Euclidean and Unique factorization domains and develop the capacity for proving the concepts	PSO - 2	E, An

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Automorphisms and Conjugate Elements**					
	1	Automorphism: Definition& Examples, Automorhism of a finite cyclic group, an infinite cyclic group	3	To understand the concept of automorphism and find automorphisms of finite and infinite cyclic groups	Lecture	Test
	2	Theorems based on automorphism, Inner automorphism	4	To understand the concept of inner automorphism	Lecture	Test
	3	Problems based on automorphism, Characteristic subgroups: Definition& Examples	3	To understand the concept characteristic sub groups and solve problems based on the concept	Group Discussion	Quiz
	4	Conjugate Elements: Definition and Theorems, Cojugate class: Definition and Cauchy Theorem, Similar Permutation: Definition and Theorems	3	To understand the concepts and give illustrations	Seminar	Formative Assessment Test I
II	**Sylow's Theorems and Direct Products**					
	1	Definition, Theorems and problems based on p-group	3	To understand the concept and give illustrations	Lecture	Test
	2	Sylow's first theorem, Sylow's second theorem, Sylow's third theorem	3	To understand the concept of Sylow P-subgroups and analyze various Sylow P- subgroups	Lecture	Test
	3	Theorems and Problems based on Sylow's theorem	3	To develop proofs for theorems based on Sylow P- subgroups	Lecture	Formative Assessment Test I, II
	4	Direct products: Definition, Examples and Theorems	4	To understand the concept and give illustrations	Seminar	Test
	5	Theorems based on finite abelian groups and invarients	4	To understand the concept and give illustrations	Lecture	Test

III	**Rings**					
	1	Rings: Definition, Examples and Theorems integral domain: Theorems & Problems	3	To understand the concept and practice theorems	Lecture With PPT	Test
	2	Subrings, Quaternion ring, Subdivision ring,: Definition, Examples, & Theorems	3	To understand the concept and develop theorems	Group Discussion	Test
	3	Characteristic of a ring: Definition, Examples, Theorems & Problems	4	To understand the concept and analyze theorems	Lecture	Test
	4	Ideals, sum of ideals, product of ideals and division ring: Definition, Examples, Theorems	5	To understand the concept and demonstrate examples.	Lecture	Formative Assessment Test II
IV	**Homomorphisms and Embedding of Rings**					
	1	Quotient Rings, Homomorphisms: Definition , Examples and Theorems	3	To understand the concepts Quotient Rings, Homomorphisms and give illustrations	Lecture with illustration	Test
	2	Fundamental theorem of ring homomorphism , First theorem of Isomorphism, Second theorem of Isomorphism & Theorems related to ring of ideals	3	To understand the concept and practice theorems related to the concepts.	Lecture	Test
	3	Embedding of rings: Ring into a Ring with unity, Ring into a Ring with endomorphisms, Integral domain embedded into a field and related theorems	4	To develop the way of embedding of rings and design proofs for theorems related to rings	Group Discussion	Test
	4	Comaximal ideals, Maximal ideals and Prime ideals: Definition & Theorems	5	To understand various definitions related to ideals and illustrate	Seminar	Formative Assessment Test III
V	**Euclidean and Factorization Domains**					

	1	Euclidean Domain, Principal ideal domain: Definition and Theorems	5	To understand the concepts of Euclidean domain and factorization domain and give illustrations.	Lecture	Test
	2	Prime and irreducible elements, Polynomial rings: Definitions & Theorems	4	To understand concepts and practice theorems related to the concepts	Lecture	Formative Assessment Test III
	3	Greatest Common Divisor, Unique factorization Domains: Definitions, Examples & Theorems	3	To compare Euclidean and Unique factorization domain and develop the capacity for proving the concepts	Seminar	Assignment
	4	Gauss Lemma, Theorems based on irreducible element and irrudicible polynomial	3	To practice theorems based on this concepts	Lecture	Assignment

Course Instructor **Head of the Department**

Dr. S. Sujitha **Dr. V. M. Arul Flower Mary**

Semester : **I** **Major Core II**

Name of the Course : **Analysis I**

Course code : **PM1712**

No. of hours per week	Credits	Total No. of hours	Marks
6	4	90	100

Objectives:

1. To understand the basic concepts of analysis
2. To formulate a strong foundation for future studies

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO -1	explain the fundamental concepts of analysis and their role in modern mathematics.	PSO - 9	U
CO -2	deal with various examples of metric space, compact sets and completeness in Euclidean space.	PSO - 3	An
CO -3	learn techniques for testing the convergence of sequences and series .	PSO - 8	U
CO -4	understand the Cauchy's criterion for convergence of real and complex sequence and series	PSO - 1	U
CO -5	apply the techniques for testing the convergence of sequence and series	PSO - 3	An
CO -6	understand the important theorems such as Intermediate valued theorem, Mean value theorem, Roll's theorem, Taylor and L' Hospital theorem	PSO - 1	U
CO -7	apply the concepts of differentiation in problems.	PSO - 9	Ap

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Basic Topology**					
	1	Definitions and examples of metric spaces, Theorems based on metric spaces	5	To explain the fundamental concepts of analysis and also to deal with various examples of metric space	Lecture	Test
	2	Definitions of compact spaces and related theorems, Theorems based on compact sets	5	To understand the definition of compact spaces with examples and theorems	Lecture	Test
	3	Weierstrass theorem, Perfect Sets, The Cantor set	3	To understand the concepts of Perfect Sets and The Cantor set	Lecture	Test
	4	Connected Sets and related problems	2	To understand the definition of Connected Sets and practice various problems	Lecture	Formative Assessment Test I
II	**Convergent Sequences**					
	1	Definitions and theorems of convergent sequences, Theorems based on convergent sequences	5	To Learn some techniques for testing the convergence of sequence	Lecture	Test
	2	Theorems based on Subsequences	2	To understand the concept of Subsequences with theorems	Lecture	Formative Assessment Test I, II
	3	Definition and theorems based on Cauchy sequences, Upper and lower limits	5	To Understand the definition and theorems based on Cauchy sequences	Lecture	Test
	4	Some special sequences, Problems related to convergent sequences	3	To Understand the problems related to convergent sequences	Lecture	Test
III	**Series**					

	1	Series, Theorems based on series	3	To Learn some techniques for testing the convergence series and confidence in applying them	Lecture	Test
	2	Series of non-negative terms, The number e	4	To find the number e	Lecture	Assignment
	3	The ratio and root tests – example and theorems, Power series	3	To Understand the ratio and root tests	Lecture	Quiz
	4	Summation of parts, Absolute convergence	2	To apply the techniques for testing the absolute convergence of series	Lecture	Test
	5	Addition and multiplication of series, Rearrangements	3	To find the Addition and multiplication of series	Lecture with group Discussion	Test
IV	**Continuity**					
	1	Definitions and Theorems based on Limits of functions, Continuous functions	4	To explain the fundamental concepts of analysis and their role in modern mathematics	Lecture with PPT	Test
	2	Theorem related to Continuous functions, Continuity and Compactness	3	To Understand the theorem related to Continuous functions	Lecture	Test
	3	Corollary, Theorems based on Continuity and Compactness, Examples and Remarks related to compactness	3	To Understand the concepts of Continuity and Compactness	Lecture	Formative Assessment
	4	Continuity and connectedness, Discontinuities	2	To Understand the definition of Continuity and connectedness	Lecture	Assignment
	5	Monotonic functions, Infinite limits and limits at infinity	3	To Understand the definition of Monotonic functions, Infinite limits and limits at infinity	Lecture	Test
V	**Differentiation**					

	1	The derivative of a real functions - Theorems, Examples	3	To Apply the concepts of differentiation	Lecture	Test
	2	Mean value theorems	3	To Understand the important Mean value theorem	Lecture	Test
	3	The continuity of derivatives, L'Hospital rule, Derivatives of higher order, Taylor's Theorem	4	To Understand the important theorems such as Taylor and L'Hospital theorem	Lecture with group discussion	Quiz
	4	Differentiation of vector valued functions	3	To Understand the concepts of differentiation	Lecture	Formative Assessment
	5	Problems related to differentiation	2	To Apply the concepts of differentiation in problems.	Lecture	Assignment

Course Instructor **Head of the Department**

Sr. S. Antin Mary **Dr. V. M. Arul Flower Mary**

Semester	**: I**	**Major Core III**
Name of the Course	**: Probability and Statistics**	
Course code	**: PM1713**	

No. of hours per week	Credits	Total No. of hours	Marks
6	4	90	100

Objectives:

1. To upgrade the knowledge in Probability theory
2. To solve NET / SET related Statistical problems

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the basic probability axioms, conditional probability, random variables and related concepts	PSO -1	R
CO - 2	compute marginal and conditional distributions and check the stochastic independence	PSO - 3	U, Ap
CO - 3	recall Binomial, Poisson and Normal distributions and learn new distributions such as multinomial, Chi square and Bivariate normal distributions.	PSO - 2	R,U
CO - 4	learn the transformation technique for finding the p.d.f of functions of random variables and use these techniques to solve related problems	PSO - 8	U, Ap
CO - 5	employ the relevant concepts of analysis to determine limiting distributions of random variables	PSO - 5	Ap
CO - 6	design probability models to deal with real world problems and solve problems involving probabilistic situations.	PSO - 7	C,Ap

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Conditional Probability and Stochastic Independence**					
	1	Definition of Conditional probability and multiplication theorem, Problems on Conditional probability, Baye's Theorem	4	Explain the primary concepts of Conditional probability	Lecture with Illustration	Evaluation through appreciative inquiry
	2	Definition and calculation of marginal distributions, Definition and calculation of conditional distributions, Conditional expectations	4	To distinguish between marginal distributions and conditional distributions	Lecture	Evaluation through quizzes and discussions.
	3	The correlation coefficient, Derivation of linear conditional mean Moment Generating function of joint distribution, Stochastic independence of random variables and related problems	4	To understand the theorems based on Stochastic independence of random variables	Lecture with Illustration	Slip Test
	4	Necessary and sufficient conditions for stochastic independence, Pairwise and mutual stochastic independence, Bernstein's example	3	To understand the necessary and sufficient conditions for stochastic independence	Discussion with Illustration	Quiz and Test
II	**Some Special Distributions**					
	1	Derivation of Binomial distribution, M.G.F and problems related to Binomial distribution Law of large numbers Negative Binomial distribution	4	To understand Law of large numbers Negative Binomial distribution	Lecture with Examples	Evaluation through discussions

	2	Trinomial and multinomial distributions, Derivation of Poisson distribution using Poisson postulates, M.G.F and problems related to Poisson distribution, Derivation of Gamma distribution using Poisson postulates	4	To know about Derivation of Poisson distribution using Poisson postulates	Lecture	Evaluation through appreciative inquiry
	3	Chi-Square distribution and its M.G.F, Problems on Gamma and Chi-Square distributions, The Normal distribution	4	To identify Chi-Square distribution and its M.G.F, Problems on Gamma and Chi-Square distributions The Normal distribution	Lecture	Formative Assessment Test
	4	Derivation of standard Normal distribution, M.G.F and problems on Normal distribution, The Bivariate Normal distribution, Necessary and sufficient condition for stochastic independence of variables having Bivariate Normal distribution	4	Relate the Normal distribution and stochastic independence of variables having Bivariate Normal distribution	Group Discussion	Slip Test
III	**Distributions of Functions of Random Variables**					
	1	Sampling theory Sample statistics and related problems, Transformations of single variables of discrete type and related problems	4	Explain the primary concepts of Sampling theory, Sample statistics	Lecture with Illustration	Evaluation through discussions
	2	Transformations of single variables of continuous type and related problems,	4	To understand Transformations of single variables and Transformations of	Lecture with Illustration	Evaluation through appreciative inquiry

		Transformations of two or more variables of discrete type and related problems		two or more variables		
	3	Transformations of two or more variables of continuous type and related problems, Derivation of Beta distribution	3	Explain the derivation of Beta distribution	Lecture	Formative Assessment Test
	4	Derivation of t distribution, Problems based on t distribution Derivation of F distribution, Problems based on F distribution	4	To identify the t distribution and F distribution	Group Discussion	Slip Test
IV	**Extension of Change of Variable Technique**					
	1	Change of variable technique for n random variables, Derivation of Dirichlet distribution Transformation technique for transformations which are not 1-1	4	Explain the primary concepts of Change of variable technique for n random variables	Lecture with Illustration	Evaluation through discussions.
	2	Joint p.d.f. of Order Statistics, Marginal p.d.f. of Order Statistics Problems on Order Statistics	4	To understand the Problems on Order Statistics	Lecture and group discussion	Evaluation through Assignment
	3	The moment generating function technique and related theorems, Problems based on moment generating function technique	3	To know about moment generating function technique and related theorems	Lecture with Illustration	Formative Assessment Test
	4	Distributions of $\bar{x}$ and nS^2/σ^2, Problems based on the distributions of $\bar{x}$ and nS^2/σ^2, Theorems on expectations of	4	To solve the Problems based on the distributions of $\bar{x}$ and nS^2/σ^2	Lecture with Illustration	Slip Test

		functions of Random variables, Problems on expectations of functions of Random variables				
V	**Limiting Distributions**					
	1	Behavior of distributions for large values of n, limiting distribution of n^{th} order statistic, Limiting distribution of sample mean from a normal distribution	3	Explain the behavior of distributions for large values of n	Lecture with Illustration	Evaluation through discussions
	2	Stochastic convergence and convergence in probability, Necessary and sufficient condition for Stochastic convergence, limiting moment generating function	4	To understand necessary and sufficient condition for Stochastic convergence Limiting moment generating function	Lecture with Illustration	Formative Assessment test
	3	Computation of approximate probability, The Central limit theorem	3	To understand The Central limit theorem	Lecture with Illustration	Slip Test
	4	Problems based on the Central limit theorem Theorems on limiting distributions, Problems on limiting distributions	4	To calculate Problems based on the Central limit theorem and Problems on limiting distributions	Lecture with Illustration	Home Assignment

Course Instructor **Head of the Department**

Ms. J. C. Mahizha **Dr. V. M. Arul Flower Mary**

Semester : **I** **Major Core IV**

Name of the Course : **Ordinary Differential Equations**

Course code : **PM1714**

No. of hours per week	Credits	Total No. of hours	Marks
6	4	90	100

Objectives:

1. To study mathematical methods for solving differential equations
2. Solve dynamical problems of practical interest

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the definitions of degree and order of differential equations and determine whether a system of functions is linearly independent using the Wronskian definition.	PSO - 1	R,U
CO - 2	solve linear ordinary differential equations with constant coefficients by using power series expansion	PSO - 9	Ap
CO - 3	determine the solutions for a linear system of first order equations	PSO - 3	U
CO - 4	learn Boundary Value Problems and find the Eigen values and Eigen functions for a given Sturm Liouville Problem	PSO - 3	U
CO - 5	analyze the concepts of existence and uniqueness of solutions of the ordinary differential equations	PSO - 9	An
CO - 6	create differential equations for a large number of real world problems	PSO - 7	C

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Second Order Linear Equations**					
	1	Second order Linear Equations - Introduction	4	Understand the concepts of existence and uniqueness behaviour of solutions of the ordinary differential equations	Lectures, Assignments	Test
	2	The general solution of a homogeneous equations	4	To understand the theorems and identify whether a system of functions is linearly independent using the Wronskian	Lectures, Assignments	Test
	3	The use of a known solution to find another	4	To determine the solutions for the Second order Linear Equations	Lectures, Assignments	Test
	4	The method of variation of parameters, Variation of parameters	4	To determine the solutions using the method of variation of parameters	Lectures, Seminars	Test
II	**Power Series Solutions**					
	1	Review of power series, Series solutions of first order equations	4	To learn about Power Series method	Lectures, Assignments	Test
	2	Power Series solutions for Second order linear equations	3	To determine solutions for Series solutions of first order equations	Lectures, Seminars	Test
	3	Ordinary points, Singular points	3	To understand the concepts Ordinary points and Singular points	Lectures, Group Discussion	Quiz
	4	Regular singular points	5	To solve linear ordinary differential equations with constant coefficients	Group Discussion	Test

				by using Frobenius method		
III	**System of Equations**					
	1	Linear systems - theorems	4	To understand the theorems in Systems of Equations	Lectures, Online Assignments	Test
	2	Linear systems-problems	3	To determine the solutions for a linear system of first order equations	Online Assignments	Test
	3	Homogeneous linear systems with constant coefficients	3	To understand the theorems Homogeneous linear systems with constant coefficients	Seminars	Test
	4	Homogeneous linear systems with constant coefficients, problems	3	To determine the solutions for Homogeneous linear systems with constant coefficients	Group Discussions, Online Assignments	Test
IV	**Picard's Method of Successive Approximations**					
	1	The method of Successive approximations	4	To solve the problems using the method of Successive approximations	Lectures, Assignments	Test
	2	Picard's theorem	3	To understand the Picard's theorem	Lectures	Test
	3	Lipchitz condition	5	To solve problems using Lipchitz condition	Lectures, Group discussion	Quiz
	4	Systems-The second order linear equations	2	To solve the problems in Systems of second order linear equations	Assignments	Assignment
V	**Boundary Value Problems**					
	1	Introduction, definitions and examples	3	To differentiate Boundary Value Problems and initial value problems	Lectures, Group discussion	Quiz
	2	Sturm Liouville problem	3	To find the Eigen values and Eigen functions for a given	Lectures, Assignments	Test

				Sturm Liouville Problem		
	3	Green's functions	4	To understand the theorems on Green's functions and apply in solving problems	Lectures	Test
	4	Non existence of solutions	5	To compare existence and non existence of solutions	Lectures, Seminars	Assignment

Course Instructor **Head of the Department**

Dr. K. Jeya Daisy **Dr. V. M. Arul Flower Mary**

Semester : **I** **Elective I**

Name of the Course : **Numerical Analysis**

Course code : **PM1715**

No. of hours per week	Credits	Total No. of hours	Marks
6	4	90	100

Objectives:

1. To study the various behavior pattern of numbers
2. To study the various techniques of solving applied scientific problems

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the methods of finding the roots of the algebraic and transcendental equations.	PSO - 1	R
CO - 2	derive appropriate numerical methods to solve algebraic and transcendental equations.	PSO - 5	Ap
CO - 3	understand the significance of the finite, forward, backward and central differences and their properties.	PSO - 3	U
CO - 4	draw the graphical representation of each numerical method.	PSO - 5	Ap
CO - 5	solve the differential and integral problems by using numerical methods. (Eg. Trapezoidal rule, Simpson's rule etc.)	PSO - 5	Ap
CO - 6	solve the problems in ODE by using Taylor's series method, Euler's method etc.	PSO - 5	Ap
CO - 7	differentiate the solutions obtained by Numerical methods and exact solutions.	PSO - 3	C
CO - 8	compute the solutions of a system of equations by using appropriate numerical methods.	PSO - 9	Ap

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Solution of Algebraic and Transcendental Equations**					
	1	Bisection Method - Examples and graphical representation, Problems based on Bisection Method	3	Recall about finding the roots of the algebraic and transcendental equations using algebraic methods	Lecture	Evaluation through test
	2	Method of False Position – Examples and graphical representation, Problems based on Method of False Position, Iteration Method – Examples and graphical representation	3	Draw the graphical representation of the each numerical method	Lecture with Illustration	Evaluation through test
	3	Problems based on Iteration Method, Acceleration of Convergence: Aitken's Δ^2 Process,	3	To understand the Acceleration of Convergence	Lecture with Illustration	Test
	4	Newton-Raphson Method and graphical representation, Problems based on Newton-Raphson Method, Generalized Newton's method,	3	To solve algebraic and transcendental equations using Newton-Raphson Method and Generalized Newton's method	Discussion with Illustration	Quiz and Test
	5	Secant Method - Problems based on Secant Method and graphical representation, Muller's Method, Problems based on Muller's Method	3	To understand the methods of Secant and Muller's	Lecture	Test
II	**Interpolation**					
	1	Forward Differences, Backward Differences and Central	3	Understand the significance of the finite, forward,	Lecture	Test

		Differences, Problems related to Forward Differences, Backward Differences and Central Differences, Detection of Errors by use of difference tables		backward and central differences and their properties		
	2	Differences of a polynomial, Newton's formulae for Interpolation, Problems based on Newton's formulae for Interpolation	3	To practice various problems	Lecture	Test
	3	Central Difference Interpolation formulae - Gauss's forward central difference formulae, Problems related to Gauss's forward central difference formulae, Problems related to Gauss's backward formula	3	To solve problems using Gauss's forward central and Gauss's backward formula	Lecture	Formative Assessment Test
	4	Stirling's formulae, Problems related to Stirling's formulae, Bessel's formulae	3	To solve problems using Stirling's formulae	Group Discussion	Test
	5	Problems related to Bessel's formulae, Everett's formulae, Problems related to Everett's formulae	3	To solve problems using Bessel's formulae and Everett's formulae	Group Discussion	Test
III	**Numerical Differentiation and Numerical Integration**					
	1	Numerical Differentiation formula using Newton's forward difference formulae, Numerical Differentiation formula using Newton's backward difference formulae, Numerical	3	To construct various Numerical Differentiation formulae	Lecture Illustration	Quiz

		Differentiation formula using Stirling's formulae				
	2	Problems related to Numerical Differentiation, Errors in Numerical Differentiation	3	To solve problems related to Numerical Differentiation	Lecture with Illustration	Test
	3	Numerical Integration, Trapezoidal rule, Problems related to Trapezoidal rule	3	To solve problems using Trapezoidal rule	Lecture	Test
	4	Simpson's 1/3 rule, Problems related to Simpson's 1/3 rule, Simpson's 3/8 rule	3	To identify the principles and solve problems	Group Discussion	Formative Assessment Test
	5	Problems related to Simpson's 3/8 rule, Boole's rule, Weddle's rule, Problems related to Boole's and Weddle's rule	4	To identify the principles and solve problems	Group Discussion	Formative Assessment Test
IV	**Numerical Linear Algebra**					
	1	Solution of Linear systems – Direct methods: Gauss elimination, Necessity for Pivoting, Problems related to Gauss elimination	3	To understand the Gauss elimination and practice problems based on it	Lecture with Illustration	Quiz
	2	Gauss-Jordan method, Problems based on Gauss-Jordan method, Modification of the Gauss method to compute the inverse	3	To understand Gauss-Jordan method	Lecture and group discussion	Test
	3	Examples to compute the inverse using Modification of the Gauss method, LU Decomposition method and related problems, Solution of Linear systems - Iterative methods	4	To compute the inverse using different methods	Lecture with Illustration	Test

	4	Gauss-Seidal method, Problems related to Gauss-Seidal method, Jacobi's method, Problems related to Jacobi's method	4	To understand the Gauss-Seidal method and Jacobi's method	Lecture with Illustration	Test
V	**Numerical Solution of Ordinary Differential Equations**					
	1	Solution by Taylor's series, Examples for solving Differential Equations using Taylor's series, Picard's method of successive approximations	4	To solve Differential Equations using different methods	Lecture with Illustration	Test
	2	Problems related to Picard's method, Euler's method, Error Estimates for the Euler Method, Problems related to Euler's method	4	To understand the methods Picard's and Euler's and practice problems related to it.	Lecture with Illustration	Formative Assessment test
	3	Modified Euler's method, Problems related to Modified Euler's method, Runge - Kutta methods - II order and III order	3	To solve problems using Modified Euler's method	Lecture with Illustration	Assignment
	4	Problems related to Runge - Kutta II order and III order, Problems related to Fourth-order Runge - Kutta methods	4	To solve problems using Fourth-order Runge - Kutta methods	Lecture with Illustration	Assignment

Course Instructor | **Head of the Department**

Dr. V. Sujin Flower | **Dr. V. M. Arul Flower Mary**

Semester : **III** **Major Core IX**

Name of the Course : **Algebra-III**

Course code : **PM1731**

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	5	90	100

Objectives:

1. To learn in depth the concepts of Galois Theory, theory of modules and lattices
2. To pursue research in pure Mathematics

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the definitions and basic concepts of field theory and lattice theory	PSO - 1	U
CO - 2	express the fundamental concepts of field theory, Galois theory and theory of modules	PSO - 1	U
CO - 3	demonstrate the use of Galois theory to construct Galois group over the rationals and modules	PSO - 9	U
CO - 4	distinguish between free modules , quotient modules and simple modules .	PSO - 2	Ap
CO - 5	interpret distributivity and modularity and apply these concepts in Boolean Algebra	PSO - 3	E
CO - 6	understand the theory of Frobenius Theorem ,four square theorem and Integral Quaternions	PSO - 7	U
CO - 7	develop the knowledge of lattices and establish new relationships in Boolean Algebra	PSO - 8	C

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Galois Theory**					
	1	Fixed Field - Definition, Theorems based on Fixed Field, Group of Automorphism	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory and theory of modules	Lecture with Illustration	Evaluation through: Short Test Formative Assessment I
	2	Theorems based on group of Automorphism, Finite Extension, Normal Extension	4	Express the fundamental concepts of field theory, Galois theory and theory of modules	Lecture with PPT Illustration	
	3	Theorems based on Normal Extension, Galois Group, Theorems based on Galois Group	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory and theory of modules	Lecture with Illustration	
	4	Galois Group over the rationals, Theorems based on Galois Group over the rationals, Problems based on Galois Group over the rationals	3	Express the fundamental concepts of field theory, Galois theory and theory of modules, Demonstrate the use of Galois theory to compute Galois Group over the rationals and modules	Lecture with Illustration	
II	**Finite Fields**					

	1	Finite Fields – Definition, Lemma-Finite Fields, Corollary-Finite Fields	3	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory and theory of modules	Lecture with Illustration	Short Test Formative assessment I, II
	2	Theorems based on Finite Fields	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory and theory of modules	Lecture with PPT Illustration	
	3	Theorems based on Finite Fields, Wedderburn's Theorem on finite division ring	4	Recall the definitions and basic concepts of field theory and lattice theory	Lecture with PPT Illustration	
	4	Wedderburn's Theorem, Wedderburn's Theorem-First Proof	3	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory and theory of modules	Lecture with Illustration	
III	**A Theorem of Frobenius**					
	1	A Theorem of Frobenius-Definitions, Algeraic over a field, Lemma based on Algeraic over a field	3	Understand the theory of Frobenius Theorem, four square theorem and Integral Quaternions	Lecture with Illustration	Short Test Formative assessment II Assignment on lemma based on Algebraic
	2	Theorem of Frobenius, Integral Quaternions, Lemma based on Integral Quaternions	5	Recall the definitions and basic concepts of field theory and lattice theory, Understand the	Lecture with Illustration	

				theory of Frobenius Theorem, four square theorem and Integral Quaternions		
	3	Theorems based on Integral Quaternions, Lagrange Identity, Left division Algorithm	4	Understand the theory of Frobenius Theorem, four square theorem and Integral Quaternions	Lecture with Illustration	
	4	Lemma based on four square Theorem, Theorems based on four square Theorem	4	Recall the definitions and basic concepts of field theory and lattice theory	Lecture with PPT Illustration	
IV	**Modules**					
	1	Modules-Definitions, Direct Sums, Free Modules, Vector Spaces	4	Demonstrate the use of Galois theory to compute Galois over the rationals and modules, Distinguish between free module, quotient modules and simple modules	Lecture with PPT Illustration	Short Test Formative assessment III
	2	Theorems based on Vector Spaces, Quotient Modules, Theorems based on Quotient Modules	4	Distinguish between free module, quotient modules and simple modules	Lecture with Illustration	
	3	Homomorphisms, Theorems based on Homomorphisms, Simple Modules	4	Demonstrate the use of Galois theory to compute Galois over the rationals and modules	Lecture with Illustration	
	4	Theorems based on Simple Modules, Modules over PID's	3	Demonstrate the use of Galois theory to compute Galois over the rationals and modules	Lecture with Illustration	
V	**Lattice Theory**					
	1	Partially ordered set-Definitions, Theorems based on Partially ordered set	3	Recall the definitions and basic concepts of field theory and lattice theory	Lecture with Illustration	Short Test Formative assessment III
	2	Totally ordered set, Lattice, Complete Lattice	4	Recall the definitions and basic concepts of field theory and	Lecture with Illustration	

				lattice theory, Interpret distributivity and modularity and apply these concepts in Boolean Algebra, Develop the knowledge of lattice and establish new relationships in Boolean Algebra		Seminar on Lattice
	3	Theorems based on Complete lattice, Distributive Lattice	3	Interpret distributivity and modularity and apply these concepts in Boolean Algebra, Develop the knowledge of lattice and establish new relationships in Boolean Algebra	Lecture with Illustration	
	4	Modular Lattice, Boolean Algebra, Boolean Ring	4	Develop the knowledge of lattice and establish new relationships in Boolean Algebra	Lecture with PPT Illustration	

Course Instructor **Head of the Department**

Dr. L. Jesmalar **Dr. V. M. Arul Flower Mary**

Semester : **III** **Major Core X**

Name of the Course :**Topology**

Subject code : **PM1732**

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	5	90	100

Objectives:

1. To distinguish spaces by means of simple topological invariants.
2. To lay the foundation for higher studies in Geometry and Algebraic Topology.

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	Understand the definitions of topological space, closed sets, limit points, continuity, connectedness, compactness, separation axioms and countability axioms.	PSO - 3	U
CO - 2	Construct a topology on a set so as to make it into a topological space	PSO - 5	C
CO - 3	Distinguish the various topologies such as product and box topologies and topological spaces such as normal and regular spaces.	PSO - 3	U, An
CO - 4	Compare the concepts of components and path components, connectedness and local connectedness and countability axioms.	PSO - 2	E, An
CO - 5	Apply the various theorems related to regular space, normal space, Hausdorff space, compact space to other branches of mathematics.	PSO - 1	Ap
CO - 6	Construct continuous functions, homeomorphisms and projection mappings.	PSO - 5	C

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Topological Space**					
	1	Definition of topology, discrete and indiscrete topology, finite complement topology, Basis for a topology and examples	3	To understand the definitions of topological space and different types of topology	Lecture with PPT	Test
	2	Comparison of standard and lower limit topologies, Order topology: Definition & Examples, Product topology: Definition & Theorem	4	To compare different types of topology and Construct a topology on a set so as to make it into a topological space	Lecture	Test
	3	Subspace topology: Definition & Examples, Theorems	3	To understand the definition of subspace topology with examples and theorems	Lecture	Test
	4	Closed sets: Definition & Examples, Theorems, Limit points: Definition Examples & Theorems	4	To understand the definitions of closed sets and limit points with examples and theorems	Lecture	Test
	5	Hausdorff Spaces: Definition & Theorems	2	To identify Hausdorff spaces and practice various theorems	Lecture	Test
II	**Continuous Functions**					
	1	Continuity of a function: Definition, Examples, Theorems and Rules for constructing continuous function	3	To understand the definition of continuous functions and construct continuous functions	Lecture	Test
	2	Homeomorphism: Definition & Examples, Pasting lemma & Examples	3	To understand the definition of homeomorphism and prove theorems	Lecture	Formative Assessment Test
	3	Maps into products, Cartesian Product, Projection mapping	3	To practice various Theorems related to Maps into products,	Lecture	Test

				Cartesian Product, Projection mapping		
	4	Comparison of box and product topologies, Theorems related to product topologies, continuous functions and examples	5	To distinguish the various topologies such as product and box topologies and topological spaces	Lecture	Test
III	**Connectedness and Compactness**					
	1	Definitions: connected space open and closed sets, lemma, examples, Theorems	4	To understand the concepts of connected space open and closed sets	Group discussion	Quiz
	2	Product of connected spaces, examples, Components and local connectedness	3	To understand the concept product of connected spaces with examples	Lecture with illustration	Test
	3	Path components, Locally connected: Definitions, Theorems	3	To compare the concepts components and path components, connectedness and local connectedness	Lecture	Test
	4	Compact space: Definition, Examples, Lemma, Theorems and Image of a compact space	3	To understand the concept compact space with examples and theorems	Lecture and Seminar	Assignment
	5	Product of finitely many compact spaces, Tube lemma, Finite intersection property: Definition & Theorem	3	To practice various theorems related to product of finitely many compact spaces, Tube lemma, Finite intersection property	Lecture	Formative Assessment Test
IV	**Compactness, Countability and Separation Axioms**					
	1	Local compactness: Definition & Examples, Theorems	3	To understand the concept local compactness with examples and theorems	Lecture with Illustration	Quiz
	2	One point compactification, First Countability axiom, Second Countability	3	To compare countability axioms	Lecture	Test

		axiom: Definitions, Theorems				
	3	Dense subset: Definitions & Theorem, Examples, Lindelof space : Definition, Examples	3	To understand the definition of dense subset and identify Lindelof space	Lecture and Seminar	Test
	4	Regular space & Normal space: Definitions, Lemma, Relation between the separation axioms	3	To distinguish various topological spaces such as normal and regular spaces	Lecture	Test
	5	Examples based on separation axioms	2	To practice examples based on separation axioms	Group Discussion	Test
V	**Countability and Separation Axioms**					
	1	Theorem based on separation axioms and Metrizable space	3	To practice various Theorems related to separation axioms and Metrizable space	Lecture with Illustration	Quiz
	2	Compact Hausdorff space, Well ordered set	3	To understand the concept compact Hausdorff space, Well ordered set	Lecture	Test
	3	Urysohn lemma	3	To construct Urysohn lemma	Lecture	Formative Assessment Test
	4	Completely regular: Definition & Theorem	2	To understand the concept Completely regular space	Lecture	Assignment
	5	Tietze extension theorem	3	To construct Tietze extension theorem	Lecture	Assignment

Course Instructor **Head of the Department**

Ms. T. Sheeba Helen **Dr. V. M. Arul Flower Mary**

Semester	**: III**	**Major Core XI**
Name of the Course	**: Measure Theory and Integration**	
Course code	**: PM1733**	

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	4	90	100

Objectives:

1. To generalize the concept of integration using measures
2. To develop the concept of analysis in abstract situations

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO – 1	define the concept of measures and Vitali covering and recall some properties of convergence of functions,	PSO - 1	R
CO – 2	cite examples of measurable sets , measurable functions, Riemann integrals, Lebesgue integrals.	PSO - 3	U
CO – 3	apply measures and Lebesgue integrals to various measurable sets and measurable functions	PSO - 9	Ap
CO – 4	apply outer measure, differentiation and integration to intervals , functions and sets.	PSO - 8	Ap
CO – 5	compare the different types of measures and Signed measures	PSO - 3	An
CO – 6	construct L^p spaces and outer measurable sets	PSO - 5	C

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	1	Lebesgue Measure - Introduction, outer measure	4	To understand the measure and outer measure of any interval	Lecture, Illustration	Evaluation through:
	2	Measurable sets and Lebesgue measure	5	To be able to prove Lebesgue measure using measurable sets	cture, Group Discussion	ass test on outer measure and Lebesgue measure
	3	Measurable functions	4	To understand the measurable functions and its uses to prove various theorems	Lecture, Discussion	Quiz
	4	Littlewood's three principles (no proof for first two)	2	To differentiate convergence and pointwise convergence	Lecture, Illustration	Formative assessment- I
II	1	The Lebesgue integral - the Riemann Integral	1	To recall Riemann integral and its importance	Lecture, Discussion	
	2	The Lebesgue integral of a bounded function over a set of finite measure	5	To understand the use of integration in measures	cture, Group Discussion	Formative assessment- I Iultiple choice questions
	3	The integral of a non-negative function	5	To prove various theorems using non-negative functions	Lecture, Illustration	hort test on the integral of a non-negative function
	4	The general Lebesgue integral	4	To understand a few named theorems and proofs	Lecture	Formative assessment-II
III	1	Differentiation and integration-differentiation of monotone functions	4	To recall monotone functions and use them with differentiation and integration	cture, Group discussion	Iultiple choice questions Unit test on functions of bounded variation
	2	Functions of bounded variation	4	To evaluate the bounded variation of different functions	Lecture, Illustration	

	3	Differentiation of an integral	4	To find differentiation of integrals	Lecture	Formative assessment- II
	4	Absolute continuity	3	To differentiate continuity and absolute continuity	Lecture, Illustration	
IV	1	Measure and integration- Measure spaces	3	To understand concepts of measure spaces	cture, Group discussion	Formative assessment- II
	2	Measurable functions	3	To recall measurable functions and use them in measure spaces	Lecture, Discussion	Seminar on measure spaces, measurable functions and integration
	3	Integration	3	To integrate functions in measure spaces	Lecture, Illustration	Assignment on general convergence theorems and signed measures
	4	General convergence theorems	3	To learn various convergence theorems in measure spaces	Lecture, Discussion	
	5	Signed measures	3	To understand signed measures in detail	Lecture	Formative assessment- III
V	1	The L^P spaces	5	To understand L^P spaces	Lecture, Illustration	eminar on outer measure, measurability and extension theorem
	2	Measure and outer measure- Outer measure and measurability	3	To understand outer measure and measurability in L^P spaces	Lecture, Discussion	
	3	The extension theorem	7	To prove various theorems in L^P spaces	cture, Group discussion	ort test on outer measure and measurability Formative assessment- III

Course Instructor **Head of the Department**

Dr. V. M. Arul Flower Mary **Dr. V. M. Arul Flower Mary**

Semester	**: III**	**Elective III**
Name of the Course	**: Algebraic Number Theory**	
Course code	**: PM1734**	

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	4	90	100

Objectives:

1. To gain deep knowledge about Number theory
2. To study the relation between Number theory and Abstract Algebra

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO – 1	recall the basic results of field theory	PSO - 1	R
CO – 2	understand quadratic and power series forms and Jacobi symbol	PSO - 7	U
CO – 3	apply binary quadratic forms for the decomposition of a number into sum of sequences	PSO - 6	Ap
CO – 4	determine solutions of Diophantine equations	PSO - 2	An
CO – 5	detect units and primes in quadratic fields	PSO - 3	An
CO – 6	calculate the possible partitions of a given number and draw Ferrer’s graph	PSO - 8	An
CO – 7	identify formal power series and compare Euler’s identity and Euler’s formula	PSO - 3	U

Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture Hours	Learning Outcomes	Pedagogy	Assessment/ Evaluation
I	**Quadratic Reciprocity and Quadratic Forms**					
	1	Quadratic Residues, definition, Legendre symbol definition and Theorem based on Legendre symbol	3	To understand quadratic and power series forms and Jacobi symbol	Lecture with Illustration	Test
	2	Lemma of Gauss, Definition, theorem based on Legendre symbol	4	To understand quadratic and power series forms and Jacobi symbol and to detect units and primes in quadratic fields	Lecture with Illustration	Test
	3	Quadratic reciprocity, Theorem based on Quadratic reciprocity, The Jacobi symbol, definition	3	To understand quadratic and power series forms and Jacobi symbol	Lecture with PPT Illustration	Quiz and Test
	4	Theorems based on Jacobi symbol	2	To determine solutions of Diophantine equations	Lecture with Illustration	Formative Assessment Test
	5	Theorem based on Jacobi symbol and Legendre symbol	2	To apply binary quadratic forms for the decomposition of a number into sum of sequences	Lecture with Illustration	Evaluation through test
II	**Binary Quadratic Forms**					
	1	Introduction, definition and Theorems based on Quadratic forms	2	To recall the basic results of field theory and to apply binary quadratic forms for the decomposition of a number into sum of sequences	Lecture with PPT Illustration	Test
	2	Definition, theorems based on binary Quadratic forms	4	To understand quadratic and power series forms and Jacobi symbol and to detect units and	Lecture with Illustration	Quiz and Test

				primes in quadratic fields		
	3	Definition, Theorems based on modular group, Definition, theorem based on perfect square	3	To understand quadratic and power series forms and Jacobi symbol and to detect units and primes in quadratic fields	Lecture with Illustration	Test
	4	Theorems based on reduced Quadratic forms	2	To calculate the possible partitions of a given number and draw Ferrer's graph	Lecture with PPT Illustration	Test
	5	Sum of two squares, Theorems based on sum of two squares	2	To apply binary quadratic forms for the decomposition of a number into sum of sequences	Lecture with Illustration	Quiz and Test
III	**Some Diophantine Equation**					
	1	Introduction, The equation ax+by=c, Theorems based on ax+by=c	4	To recall the basic results of field theory and to understand quadratic and power series forms and Jacobi symbol	Lecture with Illustration	Formative Assessment Test
	2	Examples based on ax+by=c, Simultaneous linear equation, Example-3	3	To calculate the possible partitions of a given number and draw Ferrer's graph and to Identify formal power series and compare Euler's identity and Euler's formula	Lecture with PPT Illustration	Test
	3	Examples based on Simultaneous linear equation, Example-5	3	To calculate the possible partitions of a given number and draw Ferrer's graph	Group Discussion	Quiz and Test
	4	Theorem based on Simultaneous linear equation, Definition, Theorems based on integral solution	3	To understand quadratic and power series forms and Jacobi symbol and to detect units and primes in quadratic fields	Lecture with Illustration	Test

	5	Lemma, Theorems based on primitive solution	2	To detect units and primes in quadratic fields	Lecture with Illustration	Test
IV	**Algebraic Numbers**					
	1	Polynomials, Theorem based on Polynomials, Theorem based on irreducible Polynomials, Theorem based on primitive Polynomials	3	To understand quadratic and power series forms and Jacobi symbol and to detect units and primes in quadratic fields	Lecture with Illustration	Test
	2	Gauss lemma, Algebraic numbers definition, Theorem based on Algebraic numbers	4	To recall the basic results of field theory and to detect units and primes in quadratic fields	Lecture with PPT Illustration	Test
	3	Theorem based on Algebraic numbers, Algebraic integers, Algebraic number fields, Theorem based on Algebraic numbers fields, Theorem based on ring of polynomials	4	To apply binary quadratic forms for the decomposition of a number into sum of sequences to detect units and primes in quadratic fields	Lecture with Illustration	Test
	4	Algebraic integers Theorem based on Algebraic integers, Quadratic fields , Theorem based on Quadratic fields , Definition, Theorem based on norm of a product	3	To understand quadratic and power series forms and Jacobi symbol and to determine solutions of Diophantine equations	Lecture with Illustration	Formative Assessment Test
	5	Units in Quadratic fields Theorem based on Quadratic fields , Primes in Quadratic fields	3	To calculate the possible partitions of a given number and draw Ferrer's graph and to Identify formal power series and compare Euler's identity and Euler's formula	Lecture with PPT Illustration	Test
V	**The Partition Function**					

	1	Partitions definitions, theorems based on Partitions	2	To understand quadratic and power series forms and Jacobi symbol	Lecture with Illustration	Test
	2	Ferrers Graphs, Theorems based on Ferrers Graphs	3	To identify formal power series and compare Euler's identity and Euler's formula	Lecture with Illustration	Quiz and Test
	3	Formal power series and identity, Euler formula	2	To apply binary quadratic forms for the decomposition of a number into sum of sequences	Lecture with Illustration	Formative Assessment Test
	4	Theorems based on Formal power series and identity, Euler formula	3	To detect units and primes in quadratic fields	Lecture with Illustration	Test
	5	Theorems based on absolute convergent	3	To understand quadratic and power series forms and Jacobi symbol	Lecture with Illustration	Test

Course Instructor **Head of the Department**

Ms. A. Jancy Vini **Dr. V. M. Arul Flower Mary**