PEOs for the Institution-PG

PEO1: The graduates use scientific and computational technology to solve social issues and pursue research.

PEO2:. Our graduates will continue to learn and advance their careers in industry both in public and private sectors, government and academia.

PEOs for the PG Departments

Mathematics

PEO3:Our graduates will have the ability to apply analytical and theoretical skills to model and solve mathematical problems and to work as efficient professionals

M.Sc. Mathematics (PO)

PO No.	Upon completion of M.Sc. Degree Programme, the graduates will be able to :
PO - 1	prepare successful professionals in industry, government, academia, research, entrepreneurial pursuits and consulting firms.
PO - 2	face and succeed in high level competitive examinations like NET, GATE and TOFEL.
PO - 3	carry out internship programmes and research projects to develop scientific skills and innovative ideas.
PO - 4	utilize the obtained scientific knowledge to create eco-friendly environment.

M.Sc. Mathematics (PSO)

PSO No.	Upon completion of the M.Sc. DegreeProgramme, the graduates will be able to:	PO addressed
PSO - 1	utilize the knowledge gained for entrepreneurial pursuits.	PO 1
PSO - 2	sharpen their analytical thinking, logical deductions and rigour in reasoning.	PO 2
PSO - 3	use the techniques, skills and modern technology necessary to communicate effectively with professional and ethical responsibilities.	PO 3
PSO - 4	understand the applications of mathematics in a global economic environmental and societal context.	PO 4

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

Name of the Course : **Algebra I**

Course Code : **PM2011**

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 Outcome

CO No.	**Course Outcomes** Upon completion of this course, students will be able to	PSOs addressed	CL
CO -1	understand the fundamental concepts of abstract algebra and give illustrations.	PSO- 1	U
CO -2	analyze and demonstrate examples of various Sylow p-subgroups, automorphisms, conjugate classes, finite abelian groups, characteristic subgroups, rings, ideals, Euclidean domain, Factorization domain.	PSO- 2	An
CO -3	develop proofs for Sylow's theorems, finite abelian groups, direct products, Cauchy's theorem, Cayley's Theorem, automorphisms for groups.	PSO- 2	C
CO -4	develop the way of embedding of rings and design proofs for theorems related to rings, polynomial rings, Division Algorithm, Gauss' lemma and Eisenstein Criterion	PSO- 2	C
CO -5	apply the concepts of Cayley's theorem, Counting principles, Sylow's theorems, Rings and Ideals in the structure of certain groups of small order.	PSO-4	Ap

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,	3	To understand the concept of automorphism and find	Lecture	Test

		Automorhism of a finite cyclic group, an infinite cyclic group		automorphisms of finite and infinite cyclic groups		
	2.	Theorems based on automorphism, Inner automorphism	4	To understand the concept of inner automorphism	Lecture	Test
	3.	Problems based on automorphism,Cayley's Theorem	3	To understand the Cayley's Theorem	Group Discussion	Quiz
	4.	Conjucacy, Cauchy's theorem , Conjugate Classes	3	To understand the concepts and give illustrations	Seminar	Formative Assessment Test I
II	**Sylow's theorems and Direct products**					
	1.	Sylow's first theorem(Second Proof)	3	To understand the concept and give illustrations	Lecture	Test
	2.	*p*-Sylow subgroups	3	To understand Sylow'ssubgroups	Lecture	Test
	3.	Second Part of Sylow's theorem, Third Part of 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	4	To understand the concept and give illustrations	Lecture	Test
III	**Rings**					
	1.	Rings: Definition , Examples and Theorems, Some	3	To understand the concept and practice theorems	Lecture With PPT	Test

		special classes of Rings				
	2.	Characteristic of a Ring,Homomorphisms: Definition, Examples, Theorems	3	To understand the concept and develop theorems	Group Discussion	Test
	3.	Ideals and Quotient Rings: Definition, Examples, Theorems	4	To understand the concept and analyze the theorems	Lecture	Test
	4.	More Ideals and Quotient Rings: Definition, Examples, Theorems	5	To understand the concept Quotient Rings and demonstrate examples.	Lecture	Formative Assessment Test II
IV	**Embedding of Rings**					
	1.	The field of Quotients of an integral domain: Definition , Examples and Theorems	3	To understand the concept the field of Quotients of an integral domain and give illustrations	Lecture with illustration	Test
	2.	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	Lecture	Test
	3.	Euclidean Rings, Unique Factorization theorem	4	To understand the concept and practice theorems related to the concepts.	Group Discussion	Test

	4.	A particular Euclidean Ring, Fermat's Theorem	4	To learn and interpret the concept and theorem	Seminar	Formative Assessment Test III
V	**Polynomial Rings**					
	1.	Polynomial Rings: Definition , Examples and Theorems The Division Algorithm	5	To understand the concept and practice theorems related to the concepts	Lecture	Test
	2.	Polynomials over the Rational Field: Definition , Examples and Theorems	4	To understand the concept and practice theorems related to the concepts	Lecture	Formative Assessment Test III
	3.	Gauss' lemma, The Eisenstein Criterion	3	To learn and understand the theorems	Seminar	Assignment
	4.	PolynomialRings over Commutative Rings, Unique Factorization Domains	3	To practice theorems based on this concept	Lecture	Assignment

Course Instructor(Aided): Dr.J. Befija Minnie HOD(Aided): Dr. V. M. Arul Flower Mary

Course Instructor(SF): Ms.G.Arockia Amala Sherly HOD(SF): Mrs. J. Anne Mary Leema

Semester : I **Major Core II**

Name of the Course : Analysis I

Course Code : PM2012

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 Outcome

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-3	U, Ap
CO -2	deal with various examples of metric space, compact sets and completeness in Euclidean space.	PSO- 2	An
CO -3	utilize the techniques for testing the convergence of sequence and series	PSO-1	Ap
CO -4	understand the important theorems such as Intermediate valued theorem, Mean value theorem, Roll's theorem, Taylor and L'Hospital theorem	PSO-3	U
CO -5	apply the concepts of differentiation in problems.	PSO- 4	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 todeal 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 spaceswith 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 definitionof Connected Setsandpractice various problems.	Lecture	Formative Assessment Test I
II	**Convergent Sequences**					
	1	Definitions andtheorems 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 Subsequence s	2	To understand the concept of Subsequences with theorems	Lecture	Formative Assessment Test I
	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 with PPT	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 theAddition and multiplication of series	Lecture with group disscussion	Formative Assessment Test II
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	Quiz
	3	Corollary, Theorems based on Continuity and Compactness, Examples and Remarks related to compactness	3	To Understand the concepts of Continuity and Compactness	Seminar	Formative Assessment II
	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	Assignment
	2	Mean value theorems	3	To Understand the important	Lecture	Test

				Mean value theorem		
	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(Aided): Dr. M.K. Angel Jebitha HOD(Aided): Dr. V. M. Arul Flower Mary

Course Instructor(SF): Ms. V.G. Michael Florance HOD(SF): Ms. J. Anne Mary Leema

Semester : I Major Core III

Name of the Course : Probability and Statistics

Course Code : PM2013

Course Outcome

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-2	R
CO- 2	compute marginal and conditional distributions and check the stochastic independence	PSO-2	U, Ap

CO- 3	recall Binomial, Poisson and normal distributionsand learn new distributions such as multinomial, Chi square and Bivariate normal distribution	PSO-4	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-1,3	U, Ap
CO -5	employ the relevant concepts of analysis to determine limiting distributions of random variables	PSO-5	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	Definitionof Conditional probability and multiplication theorem Problems on Conditional probability Bayre'stheorem	4	Explain the primary concepts of Conditional probability	Lecture through Google meet.	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 through Google meet	Evaluation through online quiz and discussions.
	3	The correlation coefficient Derivation of linear conditional mean Moment Generating function of joint distribution Stochastic independence of randomVariables and related problems	4	To understandthe theorems based onStochastic independence of random variables	Lecture through Google meet	online Test and Assignment
	4	Necessary conditions for stochastic independence. Necessary andsufficient conditions for stochastic independence, Pairwise and mutual stochastic independence, Bernstein's example.	3	To understandthe necessary and sufficient conditions for stochastic independence	Discussion through Google meet	Online 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 online 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 aboutDerivation of Poisson distribution using Poisson postulates	Lecture through Google meet	Evaluation through appreciative inquiry thro google meet
	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 through Google meet	Formative Assessment Online 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	Discussion Through Google meet	Slip Test through online
III	**Distributions of functions of random variables**					
	1	Sampling theory Sample statistics and related problems Transformations of single variables of discrete typeand related problems	4	Explain the primary concepts of Sampling theory Sample statistics	Lecture through Google meet	Evaluation through discussions.
	2	Transformations of single variables of continuous typeand related problems	4	To understand Transformations of single variables and Transformations of two or more variables	Lecture through Google meet	Evaluation through appreciative inquiry

		Transformations of two or more variables of discrete typeand related problems				
	3	Transformations of two or more variables of continuous typeand related problems Derivation of Beta - distribution	3	Explain the derivation of Beta distribution	Lecture through Google meet	Formative Assessment Test online
	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	Discussion Through Google meet	Slip Test through online
IV	**Limiting distributions**					
	1	Behavior of distributionsfor 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 distributionsfor large values ofn	Lecture through Google meet	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 through Google meet	Evaluation through Assignment online
	3	Computation of approximate probability The Central limit theorem	3	To understand The Central limit theorem	Lecture through Google meet	Formative Assessment Test online
	4	Problems based on theCentral limit theorem Theorems on limiting distributions Problems on limiting distributions	4	To calculate Problems based on theCentral limit theorem and Problems on limiting distributions	Lecture through Google meet	Slip Testonline
V	**Estimation**					
	1	Estimation, Point Estimation	3	Explain the primary concepts of Estimation, Point Estimation	Lecture through Google meet	Evaluation through discussions.

	2	Measures of quality of Estimators, Confidence Intervals for Means	4	Finding the 95% confidence interval for μ	Lecture through Google meet	Formative Assessment test
	3	Confidence intervals for difference of Means	4	Explain about the maximum likelihood estimators and functions	Lecture through Google meet	Slip Test online
	4	Confidence intervals for Variances	4	To understand the variance of unbiased estimators	Lecture through Google meet	online Assignment

Course Instructor(Aided): Ms. J.C. Mahizha HOD(Aided):: Dr. V. M. Arul Flower Mary

Course Instructor(SF): Dr. S.Kavitha HOD(SF): Ms. J. Anne Mary Leema

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

Name of the Course **: Ordinary differential equations**

Course Code **: PM2014**

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 Outcome

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 - 2	R,U
CO - 2	solve linear ordinary differential equations with constant coefficients by using power series expansion.	PSO - 3	Ap
CO - 3	determine the solutions for a linear system of first order equations.	PSO - 2	U
CO - 4	learnproperties of Legendre polynomials and Properties of Bessel Functions.	PSO - 4	U

CO - 5	analyze the concepts of existence and uniqueness of solutions of the ordinary differential equations.	PSO - 2	An
CO - 6	create differential equations for a large number of real world problems.	PSO - 1	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 behavior of solutions of the ordinary differential equations	Lectures, Assignments	Test
	2	The general solution of a homogeneous equation	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	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 – Ordinary Points	3	To determine series solutionsforsecond order equations	Lectures, Seminars	Test
	3	Singular points	3	To understand the concepts of regular singular points and irregular singular points	Lectures, Group Discussion	Quiz
	4	Power Series solutions for Second order linear equations -Regular singular points	5	To solve ordinary linear differential equations with constant coefficients by using Frobenius method	Group Discussion	Test
III	**System of Equations**					
	1	Linear systems-theorems	4	To understand the theorems in Systems of Equations	Lectures, Online Assignmen ts	Test
	2	Linear systems-problems	3	To determine the solutions for a linear system of first order equations	Online Assignmen ts	Test
	3	Homogeneous linear systems with constant coefficients	4	To understand the theorems Homogeneous linear systems with constant coefficients	Seminars	Test
	4	Homogeneous linear systems with constant coefficients– problems	4	To determine the solutions for Homogeneous linear systems with constant coefficients	Group Discussion s, Online Assignmen ts	Test
IV	**Some Special Functions of Mathematical Physics**					
	1	Legendre Polynomials	3	To derive Rodrigues' formula	Lectures, Online Assignmen ts	Test

	2	Properties of Legendre Polynomials	4	To understand Orthogonal property and other properties of Legendre Polynomials	Online Assignments Seminars	Test
	3	Bessel Functions. The Gamma Function	4	To derive Bessel function of the first kind $J_P(x)$, To understand the gamma function and to determine the general solution of Bessel's equation	Online Assignments Seminars	Test
	4	Properties of Bessel Functions	4	To understand properties of Bessel functions and to derive orthogonal property of Bessel Functions	Online Assignments Seminars	Test
V	**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 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

Course InstructorAided): Dr.L.Jesmalar HOD(Aided): Dr. V. M. Arul Flower Mary

Course Instructor(SF): Ms. J. Anne Mary Leema HOD(SF): Ms. J. Anne Mary Leem

Semester : I

Name of the Course : Numerical Analysis **Elective I**

Course Code : PM2015

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

Objectives:

1. To study the various behaviour pattern of numbers.

2. To study the various techniques of solving applied scientific problems.

Course Outcome

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 - 2	R
CO - 2	understand the significance of the finite, forward, backward and central differences and their properties.	PSO - 3	U
CO - 3	learn the procedures of fitting straight lines and curves.	PSO - 2	U
CO - 4	compute the solutions of a system of equations by using appropriate numerical methods.	PSO - 1	Ap
CO - 5	solve the problems in ODE by using Taylor's series method, Euler's method etc.	PSO - 4	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 with Illustration	Evaluation through test
	2	Method of False Position – Examples and graphical representation, Problems based on Method of False Position.	3	Draw the graphical representation of each numerical method.	Lecture with Illustration	Evaluation through test
	3	Ramanujan's Method & Problems based onRamanujan's Method,	3	To solve algebraic and transcendental equations using Ramanujan'sMethod.	Discussion with Illustration	Quiz and Test
	4	Secant Method - Problems based on Secant Method and	3	To understand the methods of Secant.	Lecture with Illustration	Test

		graphical representation.				
	5	Muller’s Method, Problems based on Muller’s Method	3	To understand the methods of Muller’s.	Lecture	Test
II	**Interpolation**					
	1	Forward Differences, Backward Differences and Central Differences, Problems related to Forward Differences, Backward Differences and Central Differences, Detection of Errors by use of difference tables	3	Understand the significance of the finite, forward, backward and central differences and their properties.	Lecture	Test
	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	4	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	4	To solve problems using Bessel’s formulae and Everett’s formulae	Group Discussion	Test
III	**Least squares and Fourier Transforms**					
	1	Least squares Curve Fitting Procedure	2	To understand the Curve Fitting Procedure.	Lecture	Quiz
	2	Fitting a straight line. Problems related to fitting of straight line	3	To solve Problems related to fitting of straight line	Lecture	Test
	3	Multiple Linear Least squares	2	To solve Problems related to Multiple Linear Least squares.	Lecture	Test
	4	Linearization of Nonlinear Laws. Problems related to fitting of nonlinear equation.	4	To solve Problems related to fitting of nonlinear equation.	Group Discussion	Formative Assessment Test
	5	Curve fitting by Polynomials. Problems related to fitting of Polynomials	2	To solve Problems related to fitting of Polynomials.	Lecture	Test
IV	**Numerical Linear Algebra**					
	1	Triangular Matrices, LU Decomposition of a matrix	2	To evaluate the matrix using LU Decomposition method.	Lecture	Test
	2	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
	3	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
	4	Examples to compute the inverse	3	To compute the inverse using different methods	Lecture with	Test

		using Modification of the Gauss method, LU Decomposition method and related problems, Solution of Linear systems - Iterative methods			Illustration	
	5	Gauss-Seidal method, Problems related to Gauss-Seidal method, Jacobi's method, Problems related to Jacobi's method	3	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 toModified Euler's method, Runge - Kutta methods - II order and III order	4	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(Aided): Dr. K. Jeya Daisy HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Ms. V. Princy Kala HOD(S.F) :Ms. J. Anne Mary Leema

Semester : II **Major Core V**

Name of the course : Modules and Vector Spaces

Course code : PM2021

Number of hours per week	Credits	Total number of hours	Marks
6	5	90	100

Objective:

To understand the concept of Modules and the advanced forms of Matrices related to Linear Transformations.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSOs addressed	CL
CO - 1	recall the definitions and properties of Vector Spaces and Subspaces	PSO - 2	R
CO - 2	analyze the concepts Linear Independence, Dependence and Basis	PSO - 2	An
CO - 3	apply the definition and properties of Linear transformation and Matrices of Linear transformation	PSO - 3	Ap
CO - 4	gain knowledge about characteristic polynomial, eigen vectors, eigen values and eigen spaces as well as the geometric and the algebraic multiplicities of an eigen value	PSO - 1	U
CO - 5	learn and apply Jordan form and triangular form for computations	PSO - 4	U

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

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Module**					
	1	Basic definitions and examples	4	Recall the definitions and basic concepts of fields and modules	Lecture with illustration	Evaluation through:

	2	Quotient modules and module homomorphism	4	Express the fundamental concepts of field theory, module theory and theory of quotient modules	Lecture with illustration	Unit Test Quiz Formative assessment I
	3	Generation of Modules	4	Recall the definitions and basic concepts of module theory. Understand the theorems in modules.	Lecture	
	4	Direct sums and Free Modules	3	Demonstrate the use of module theory to compute Direct sums and Free Modules.	Lecture with illustration	
II	**Vector Spaces**					
	1	Elementary basic concepts: Vector space, Subspace, Vector space homomorphism	3	Recall the definitions and basic concepts of Vector spaces and Subspaces.	Lecture with illustration	Unit Test Quiz Problem Solving Formative assessment I
	2	Linear span, Finite dimensional vector space, Linearly dependent, Linearly independent	4	Learn the definition of Linear span and Finite dimensional vector space. Analyze the conceptslinearly dependent and inearly independent.	Lecture	
	3	Basis, dimension	4	Learn the concept of basis and dimension. Use the concept of basis and dimension in finite dimensional vector space	Lecture with illustration	

	4	Dual Spaces	3	Understand the theorems in dual spaces.	Lecture	
III	**Linear Transformations**					
	1	Algebra of Linear Transformation, Regular, Singular, Range, Rank	3	Recall the definition of vector space homomorphism. Understand the concept of Regular, Singular, Range and Rank of Linear Transformations.	Lecture with illustration	Unit Test Quiz Problem Solving Online Assignment on range Formative assessment I, II
	2	Characteristic Root, Characteristic vector, Matrices	5	Gain knowledge about Characteristic root and Characteristic vector. Apply the definition and properties of Linear transformation and Matrices of Linear transformation	Lecture with illustration	
	3	Canonical Forms: Triangular Form, Similar, Invariant subspace	4	Learn and apply triangular form for computations	Lecture	
	4	Canonical Forms: Nilpotent Transformation, Index of nilpotence	4	Recall the definitions and basic concepts of Linear Transformations. Understand the theorems in nilpotent Linear Transformations.	Lecture	
IV	**Canonical Forms**					

	1	Jordan form	4	Learn and apply Jordan form for computations.	Lecture	Unit Test Class Test
	2	Rational Canonical Form, Companion matrix, Elementary divisor, Characteristic polynomial	4	Gain knowledge about Companion matrix, Elementary divisor and Characteristic polynomial.	Lecture	Quiz
	3	Trace	4	Understand the properties of trace and Jacobson Lemma.	Lecture	Seminar on Canonical Forms
	4	Transpose, Symmetric matrix, Adjoint	3	Understand the properties of Transpose, Symmetric matrix and Adjoint.	Lecture	Formative assessment II
V	**Determinants and Quadratic forms**					
	1	Determinants, Secular equation	3	Find determinant of a triangular matrix. Understand Cramer's Rule.	Lecture with illustration	Unit Test
	2	Hermitian, Unitary	4	Recall the properties of real and complex numbers and apply these concepts in Linear transformation. Develop the knowledge of Hermitian and Unitary Linear transformation.	Lecture with illustration	Quiz Problem Solving

	3	Normal Transformation	3	Recall the properties of real and complex numbers and apply these concepts in Normal transformation.	Lecture	Seminar on Quadratic forms
	4	Real Quadratic forms, Congruent	4	Learn and apply Quadratic form for computations.	Lecture	Formative assessment II

Course Instructor(Aided): Dr.T.Sheeba Helen HOD(Aided) :Dr.V.M.Arul Flower Mary

Course Instructor(S.F): Dr.C.Jenila HOD(S.F) :Mrs.J. Anne Mary Leema

Semester : II **Major Core VI**

Name of the Course : Analysis II

Subject code : PM2022

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

Objectives: 1. To make the students understand the advanced concepts of Analysis.

2. To pursue research in Analysis related subjects.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSOs addressed	CL

CO -1	recall the definition of continuity, boundedness and some results on uniform convergence	PSO-1	R
CO -2	recognise the difference between pointwise and uniform convergence of a sequence of functions and Riemann Stieltjes integrals.	PSO-2	An
CO -3	understand the close relation between equicontinuity and uniform convergence of sequence of continuous function and rectifiable curves	PSO-3	U
CO -4	learnParseval's theorem, Stone Weierstrass theorem and know about its physical significance in terms of the power of the Fourier components.	PSO-4	U
CO -5	utilize the definition of differentiation and partial derivative of function of several variables to solve problems	PSO-3	Ap

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

Unit	**Section**	**Topics**	**Lecture hours**	**Learning outcomes**	**Pedagogy**	**Assessment/ evaluation**
I	**Riemann Stieltjes Integral**					
	1	Definition and existence of Riemann Stieltjes integrals	3	To understand the definition existence of Riemann Stieltjes integrals	Lecture with Illustration	Evaluation through test
	2	Theorems related to Riemann Stieltjes integrals	3	To understand the theorems related to Riemann Stieltjes integrals	Lecture	Short Test
	3	Properties of Riemann Stieltjes integrals	3	To understand the properties of Riemann Stieltjes integrals	Lecture with Illustration	Slip Test

	4	Fundamental theorem of Calculus and related problems	3	To understand and apply this theorem in various problems	Lecture with Illustration	Quiz
	5	Rectifiable curves and problems	3	To understand rectifiable curves and able to do the problems related to it.	Lecture with Illustration	Formative Assessment Test
II	**Sequences and series of functions**					
	1	Definition and examples of convergence sequence	3	Recall the definition understand the examples of convergence sequence	Lecture with Illustration	Test
	2	Definition and theorems based on uniform convergence and continuity	5	To distinguish between convergence and uniform convergence	Lecture	Open book assignment
	3	Theorems based on uniform convergence and differentiation	4	To understand the relation between the uniform convergence and differentiation	Lecture	Q&A
	4	Problems based on sequences and series of functions	4	To analyze and solve the problems	Group Discussion	Formative Assessment Test
III	**Equicontinuous families of function**					
	1	Definition and theorems based on equicontinuous families of functions	5	To understand the definition and theorems based on equicontinuous families of functions	Lecture with Illustration	Quiz
	2	Definition of uniformly closed algebra and uniformly closure	4	To understand the concept of uniformly closed algebra in various theorems	Lecture with Illustration	Slip Test

	3	Stone Weierstrass theorem	2	To learn Stone Weierstrass theorem	Lecture	Test
	4	Problems on equicontinuous families of functions	3	To apply the concept of equicontinuousand solve problems	Group Discussion	Brain Stroming
IV	**Some special functions**					
	1	Definition, Theorems and examples of analytic function and power series	4	To learn the concept of power series	Lecture with Illustration	Quiz
	2	The algebraic completeness of the complex field	3	To get the idea of algebraic completeness of the complex field	Lecture and group discussion	Test
	3	Definition and theorems related to Fourier Series	3	To learn the definition and theorems related to Fourier Series	Lecture with Illustration	Quiz and Test
	4	Problems related to Fourier Series and Dirichlet Kernel	2	To understand the significance of Fourier series and apply it in problems	Lecture with Illustration	Formative Assessment Test
	5	Localisation Theorem and Parseval's theorem	2	To learn the concept of trigonometric series	Lecture	Short Test
V	**Differentiation**					
	1	Introduction of differentiation , Definition of total and partial derivative and examples	4	To identify total derivative problems	Lecture with Illustration	Quiz
	2	Theorems and examples based on Partial derivatives	4	To apply the concept of Partial derivatives	Lecture with Illustration	Short Test

	3	Definition of continuously differentiable and related theorems	3	To utilize the concept of continuously differentiable	Lecture with Illustration	Open Book Assignment
	4	Contraction principle and related theorems	2	To interpret the concept of contraction principle	Lecture with Illustration	Assignment
	5	The inverse function theorem and problems	3	To develop the proof technique and solve problems.	Lecture with Illustration	Formative Assessment Test

Course Instructor(Aided): Dr. K. Jeya Daisy HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Ms. C.JoselinJenisha HOD(S.F) :Ms.J. Anne Mary Leema

Semester **: II** **Major Core VII**

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

Course Code **: PM2023**

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

Objectives:

1. To formulate and solve different forms of partial differential equations.
2. Solve the related application oriented problems.

Course Outcome

CO	Upon completion of this course the student will be able to:	PSOs addressed	CL
CO-1	recall the definitions of complete integral, particular integral and singular integrals.	PSO-2	R
CO-2	learn some methods to solve the problems of non- linear first order partial differential equations. homogeneous and non homogeneous linear partial differential equations with constant coefficients and solve related problems.	PSO-1	U

CO-3	analyze the classification of partial differential equations in three independent variables – cauchy's problem for a second order partial differential equations.	PSO-3	An
CO-4	solve the boundary value problem for the heat equations and the wave equation.	PSO-4	Ap
CO-5	apply the concepts and methods in physical processes like heat transfer and electrostatics.	PSO-5	Ap

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

Unit	Section	Topics	Lecture hours	Learning outcomes	Pedagogy	Assessment/ evaluation
I	**Non -linear partial differential equations of first order**					
	1	Explanation of terms, compactible system of first order equations, Examples related to compactible system	3	To Recall the definitions of complete integral, particular integral and singular integral	Lecture	Quiz
	2	Charpit's Method and problems, Problems related to charpit's method	4	ToAnalyzeCharpit's Method and to solve the problems.	Lecture	Assignment
	3	Problems related to charpit's method	2	To Learn Charpit's Method methods to solve the problems	Lecture	Test
	4	Solving problems using charpit's method	3	To Learn Charpit's Method methods to solve the problems	Lecture with group discussion	Test
	5	Problems related to charpit's method	3	To Learn Charpit's Method methods to solve the problems	Lecture	Assignment
II	**Homogeneous linear partial differential equation with constant coefficient**					
	1	Homogeneous and non- homogeneous linear equation with constant coefficient,	2	To Analyze homogeneous linear partial differential	Lecture	Test

		Solution of finding homogeneous equation with constant coefficient, Theorem I, II		equations with constant coefficients		
	2	Method of finding complementary function, Working rule for finding complementary function, Alternative working rule for finding complementary function	2	To Learn some methods to solve the problems of homogeneous linear partial differential equations with constant coefficients	Lecture	Test
	3	Some examples for finding Complementary function	3	To find Complementary function	Lecture	Test
	4	General method and working rule for finding the particular integral of homogeneous equation and some example	3	To find particular integral of homogeneous equation	Lecture	Test
	5	Examples to find the particular integral	3	To find particular integral	Lecture	Test
III	**Non – homogeneous linear partial differential equations with constant coefficient**					
	1	Definition, Reducible and irreducible linear differential operators, Reducible and irreducible linear partial differential equations with constant coefficient, Determination of	2	Analyze non-homogeneous linear partial differential equations with constant coefficients and to solve the problems	Lecture with group discussion	Quiz

		complementary function				
	2	General solution and particular integral of non-homogeneous equation and some examples of type 1	3	To solve problems related to non-homogeneous equations of type 1	Lecture	Assignment
	3	Some examples of type 2	3	To solve problems related to non-homogeneous equations of type 2	Lecture	Assignment
	4	Some problems related to type 3	3	To solve problems related to non-homogeneous equations of type 3	Lecture	Formative Assessment
	5	Examples related to type 4, Miscellaneous examples for the determination of particular integral	4	To solve problems related to non-homogeneous equations of type 4	Lecture	Assignment
IV	**Classification of P.D.E. Reduction to Canonical (or normal) forms.**					
	1	Classification of Partial Differential equations of second order - Classification of P.D.E. in three independent variables	2	To classify Partial Differential equations of second order & of P.D.E. in three independent variables	Lecture	Test
	2	Cauchy's problem for a second order P.D.E. Characteristic equation and Characteristic curves of the second order P.D.E.	2	To solveCauchy's problem for a second order P.D.E.	Lecture	Test
	3	Laplace transformation. Reduction to	4	To reduce hyperbolic equation to its Canonical forms.	Lecture	Assignment

		Canonical (or normal) forms.(Hyperbolic type)				
	4	Laplace transformation. Reduction to Canonical (or normal) forms.(Parabolic type)	4	To reduce Parabolic equation to its Canonical forms.	Lecture	Test
	5	Laplace transformation. Reduction to Canonical (or normal) forms.(Elliptic type)	3	To reduce elliptic equation to its Canonical forms.	Lecture	Test
V	**Boundary Value Problem**					
	1	A Boundary value problem, Solution by Separation of variables, Solution of one dimensional wave equation, D'Alembert's solution, Solution of two dimensional wave equation	3	To Solve the boundary value problems for the wave equations	Lecture	Quiz
	2	Vibration of a circular membrane, Examples related to vibration of a circular membrane	4	To Solve the boundary value problems related to vibration of a circular membrane	Lecture	Test
	3	Solution of one dimensional heat equation, Problems related to solution of one dimensional heat equation	4	To Solve the boundary value problems for the heat equations	Lecture	Formative Assessment

	4	Solution of two dimensional Laplace’s equation	3	To find the Solution of two dimensional Laplace’s equation	Lecture	Test
	5	Solution of two dimensional heat equation	3	To Apply the concepts and methods in physical processes like heat transfer and electrostatics	Lecture	Assignment

Course Instructor(Aided): Ms.J.C.Mahizha HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Ms. V. Princy Kala HOD(S.F) :Ms. J. Anne Mary Leema

Semester : II **Major Core VIII**

Name of the Course : Graph Theory

Course Code : PM2024

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

Objectives:

1. To introduce the important notions of graph theory.

2. Develop the skill of solving application oriented problems.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	identify cut vertices and understand various versions of connectedness of a graph.	PSO-1	An
CO - 2	understand the concept of Digraphs and characterize Eulerian Digraphs.	PSO-4	U,C
CO - 3	recall the definitions of Matchings and design proof for characterization of graphs containing a 1-factor.	PSO-1	R

CO - 4	solve problems involving coloring and learn necessary conditions for planar graphs.	PSO-2,3	Ap
CO - 5	learn the basic definitions of domination and review the concept of distance in a graph.	PSO-4	U

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

Unit	**Section**	**Topics**	**Lecture hours**	**Learning outcomes**	**Pedagogy**	**Assessment/ evaluation**
I	**Connectivity**					
	1	Cut vertices - Definitions and Examples, Theorems based on Cut vertices, Theorems based on Cut vertices	4	Recall the basic definitions and fundamental concepts of graph theory	Lecture with illustration	Test
	2	Blocks - Definition and Example, Theorem based on nonseparable, Properties of blocks in a nontrivial connected graph, Connectivity - Definitions and Examples	3	Identify blocks and understand various versions of connectedness of a graph	Lecture	Test
	3	Hassler Whitney’s Theorem, Theorems based on Connectivity, Connectivity and edge-connectivity number for the cubic graph	4	Solve problems involving connectivity	Lecture with Group Discussion	Test
	4	Harary graphs, Theorems based on Harary graphs,	4	Understand the concept of Harary graphs and Geodetic Sets.	Lecture	Test

		Geodetic Sets - Definitions and Examples, Theorem based on Geodetic Sets				
II	**Digraphs**					
	1	Strong Digraphs - Definitions and Examples, The First Theorem of Digraph Theory, Theorems related to Digraphs	3	To understand the definition of Strong Digraphs and prove theorems related to Digraphs	Lecture	Test
	2	Theorems related to Eulerian, Theorem related to Strong orientation	3	To prove theorems related to Eulerian and Strong orientation	Lecture	Formative Assessment Test
	3	Tournaments - Definitions and Examples, Theorem related to Tournaments	3	To practice various Theorems related to Tournaments	Lecture	Test
	4	Theorem based on Tournament and Hamiltonian path, Theorem based on strong tournament	3	Understand the concept of Hamiltonian path, and strong tournament	Lecture	Test
III	**Matchings and Factorization**					
	1	Matchings - Definitions and Examples, Theorem related to matching, Theorem related to system of distinct representatives	3	Identify Matchingsand prove theorems	Lecture	Quiz

	2	The Marriage Theorem, Theorem based on perfect matching, Gallai identities	3	To practice various Theorems	Lecture with illustration	Test
	3	Factorization - Definitions and Examples, Tutte’s Theorem, Petersen’s Theorem	3	To understand the concept Factorization with examples and theorems	Lecture with group discussion	Test
	4	Theorem based on 1- factor, Theorem based on 2-factorable, Hamiltonian Factorization, Theorem based on Hamiltonian Factorization	3	To compare the concepts 1- factor and 2-factorable, Hamiltonian and Factorization	Lecture	Assignment
	5	Theorem based on Kirkman triple system, Theorem based on Hamiltonian cycles and 1-factor, Decompositions and Graceful Labelings-Definitions and examples, Theorems related to Graceful labeling	3	To understand the definitions of Hamiltonian cycles, Decompositions and Graceful Labelings.		Formative Assessment Test
IV	**Planarity and Coloring**					
	1	Planar Graphs Planar Graphs - Definitions and Examples, The Euler Identity, Consequence of Euler Identity,	3	Cite examples of planar and nonplanar graphs	Lecture with illustration	Quiz

		Theorems related to Planar Graphs				
	2	Necessary condition for a graph to be planar, Kuratowski's Theorem, Vertex Coloring - Definitions and Examples, The Four Color Theorem	3	Learn necessary conditions for planar graphs	Lecture	Test
	3	Theorems and Examples related to chromatic number, An upper bound for the chromatic number of a graph in terms of its maximum degree, Brook's Theorem, Theorem based on triangle - free graph	3	To practice various Theorems	Lecture	Test
	4	Theorem based on triangle - free graph, Edge Coloring-Definitions and Examples, Vizing's Theorem, Theorems related to edge chromatic number	3	Understand the concept of Edge Coloring and edge chromatic number	Lecture	Test
	5	The Five Color Theorem, The Heawood Map Coloring Theorem and it's corollary	3	To practice various Theorems	Lecture with group discussion	Test
V	**Distance and Domination**					

	1	Distance - The center of a graph, Definitions and examples	3	To identify the center of a graph	Lecture	Assignment
	2	Theorems based on center of a graph, Distant Vertices, Periphery of the graph.	3	To practice various Theorems	Lecture with illustration	Assignment
	3	Theorems based on eccentricity, Theorems based on boundary vertex .Definition of interior vertex and related theorem .	3	To practice various Theorems	Lecture	Test
	4	The domination number of a graph-Definitions and Examples. Theorems related to domination number of a graph. Bounds for domination number.	3	To understand the concepts of domination and to practice various theorems	Lecture with illustration	Assignment
	5	Stratification. Definition of stratified graph. Definition of F domination number and F coloring. Theorems related to Fdomination number and F coloring	3	To understand the facts of Stratification and to practice various Theorems	Lecture with group discussion	Assignment

Course Instructor(Aided): Dr.V.Sujin Flower HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Dr.J.C.Eveline HOD(S.F) :Ms. J. Anne Mary Leema

Semester : **II** **Elective II**

Name of the Course : **Classical Dynamics**

Course Code : **PM2025**

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

Objectives:

1. To gain deep insight into concepts of Dynamics.
2. To do significant contemporary research.

Course Outcome

CO	Uponcompletion ofthiscoursethestudents Willbeableto:	PSO addressed	CL
CO–1	recall the concepts of Newton's laws of motion, momentum, acceleration, motion of a particle.	PSO-4	R
CO–2	understanding the generalized co-ordinates of the Mechanical system.	PSO-1	U
CO–3	apply D'Alembert's Principle to solve the problems involving System of particles.	PSO-2	Ap
CO-4	Solve the Newton's equations for simple configuration using Various methods.	PSO-1	C
CO-5	transforming the Lagrangian equations to Hamiltonian equations.	PSO-2	U
CO-6	define the canonical transformations and Lagrange and Poisson brackets.	PSO-4	R

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

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**The Mechanical System**					
	1	Introduction on the Mechanical System, equations	3	Understanding the generalized co-ordinates,	Lecture	Short Test

		of motion, generalized coordinates , degrees of freedom, configuration space		degrees of freedom, configuration space of the Mechanical system.		
	2	Holonomic constraints, Nonholonomic constraints, Unilateral constraints and examples	3	To define Holonomic constraints, Nonholonomic constraints, Unilateral constraints with illustration	Lecture and group discussion	Test
	3	Virtual displacement and virtual work, Principle of virtual work, D' Alembert's Principle,	3	To identify virtual displacement and virtual work, Principle of virtual work, D' Alembert's Principle,	Lecture	Test
	4	Generalized force and examples, Potential energy, work and kinetic energy, Conservation of energy	3	Define Generalized force with examples, Potential energy, work and kinetic energy, Conservation of energy	Lecture	Test
	5	Equilibrium and stability, angular momentum, generalized momentum and examples.	3	To study generalized momentum, angular momentum and examples.	Lecture	Test

II	**Derivation of Lagrange's equations**					
	1	Problems using Lagrange's equation, Form of the equations of motion, Nonholonomic systems.	3	To solve problems using Lagrange's equation, Form of the equations of motion and Non holonomic systems.	Lecture	Test
	2	Spherical pendulum, Double pendulum, Lagrange Multiplier and constraint forces	3	To define Spherical pendulum, Double pendulum, Lagrange Multiplier and constraint forces	Lecture and discussion	Test
	3	Particle in whirling tube, A particle with moving support,	3	To understand particle in whirling tube, and the particle with moving support,	Lecture	Formative Assessment
	4	Rheonomic constrained system, Ignorable coordinates, Example based on the Kepler Problem	3	To define rheonomic constrained system, Ignorable coordinates and example based on the Kepler Problem	Lecture	Test
	5	Routhian Function, Conservative systems, Natural systems, Liouville'ssystem	3	To understand Routhian Function, Conservative systems, Natural systems	Lecture	Test

				and Liouville's system		
III	**Hamilton's Principle**					
	1	Stationary values of afunction, Constrained Stationary values, Stationary value of a definite integral.	3	To define stationary values of a function, Constrained Stationary values and stationary value of a definite integral.	Lecture and discussion	Test
	2	Solving The Brachistochrone problem and Geodesic path Case of n independent variables	3	To solve the Brachistochrone problem and Geodesic path Case of n independent variables	Lecture	Test
	3	Multiplier Rule, Derivation of Hamilton's Equations The form of the Hamiltonian function	3	To understand Multiplier Rule, and Derivation of Hamilton's Equations and the form of the Hamiltonian function	Lecture and discussion	Test
	4	Legendre transformation The form of the Hamiltonian function Problems based on Hamilton's Equations	3	To evaluate the form of the Hamiltonian function Problems based on Hamilton's Equations	Lecture	Test
	5	Modified Hamilton's Principle Principle	3	To understand Modified Hamilton's	Lecture	Formative Assessment

		of least action, Problems based on other Variational Principles		Principle ,Principle of least action and Problems based on other Variational Principles		
IV	**Hamilton's Principal function**					
	1	Introduction on Hamilton's Principal function The canonical integral Pfaffian differential forms	3	To understand the foundation of Hamilton's Principle and differential forms.	Lecture	Test
	2	The Hamilton - Jacobi equation, Illustration of the Hamilton- Jacobi equation	3	To understand The Hamilton - Jacobi equationwith Illustration	Lecture	Test
	3	Any complete solution of the Hamilton - Jacobi equation leads to a solution of the Hamilton Problem	3	Evaluating any complete solution of the Hamilton - Jacobi equation	Lecture	Test
	4	Kepler's Problem. Jacobi's theorem, Conservative systems	3	To learn Kepler's Problem. Jacobi's theorem and Conservative systems	Lecture	Test
	5	Ignorable coordinates, Modified Hamilton - Jacobi equation Examples on	3	To understand Ignorable coordinates, Modified Hamilton - Jacobi equation with Examples	Lecture and discussion	Test

		Ignorable coordinates				
V	**Canonical Transformations**					
	1	Introduction to Differential forms and generating functions, Canonical Transformations Principle form of generating functions	3	To understand Differential forms generating functions, Canonical Transformations and Principle form of generating functions	Lecture	Test
	2	Further comments on the Hamilton-Jacobi method, Examples on Canonical Transformations, Some simple transformations	3	To identify the Hamilton-Jacobi method with Examples on Canonical Transformations and some simple transformations	Lecture	Test
	3	Homogenous canonical transformations, Point transformations, Momentum transformations	3	To understand Homogenous canonical transformations, Point transformations, Momentum transformations	Lecture	Test
	4	. Examples based on Special transformations,	3	To identify examples based on Special transformations	Lecture	Test
	5	Introduction to Lagrange and Poisson brackets, Problems based on	3	To understand Lagrange and Poisson brackets,	Lecture	Formative Assessment

		Lagrange and Poisson brackets, The bilinear Covariant		Problems based on Lagrange and Poisson brackets and the bilinear Covariant		

Course Instructor(Aided): Ms. J. Befija Minnie HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Ms. V.G. Michael Florance HOD(S.F) :Ms. J. Anne Mary Leema

Semester : III

Name of the course : Field Theory and Lattices Major Core IX

Course code : PM2031

Number of hours/ Week	Credits	Total number 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 Outcome

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 - 2	U
CO - 2	express the fundamental concepts of field theory, Galois theory	PSO - 2	U
CO - 3	demonstrate the use of Galois theory to construct Galois group over the rationals and modules	PSO - 3	E
CO - 4	distinguish between field theory and Galois theory	PSO - 3	Ap
CO - 5	interpret distributivity and modularity and apply these concepts in Boolean Algebra	PSO - 4	Ap

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

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	Extension fields					
	1	Extension field - Definition, Finite extension- Theorems on finite extension	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory	Lecture with illustration	Evaluation through: Short Test Formative assessment I
	2	Theorems and corollary on algebraic over Fields and understand about subfields of an extension	4	Express the fundamental concepts of field theory, Galois theory	Lecture with PPT illustration	
	3	To understand about adjunction of an element to a field, subfields, Theorems.	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory	Lecture with illustration	
	4	Algebraic extension- Theorems on algebraic extension- algebraic number- transcendental number	3	Express the fundamental concepts of field theory, Gain knowledge in algebraic extension in fields.	Lecture with illustration	
II	Roots of Polynomials					
	1	Definition- root, Remainder theorem, Definition- multiplicity	3	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory	Lecture with illustration	Short Test Formative assessment I, II

	2	Theorems based on roots of polynomials, Corollary and lemma based on roots of polynomials.	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	Definition- splitting field. Theorems based on isomorphism of fields, Theorems based on splitting field of polynomials	4	Recall the definitions and basic concepts of field theory , Galois theory and lattice theory.	Lecture with PPT illustration	
	4	Definition- derivative, Lemmas on derivative of polynomials, Simple extension, Theorems on simple extension.	3	Understand the concept of Galois theory, irreducibility, splitting fields, derivative of polynomials	Lecture with illustration	
III	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	Lecture with illustration	Short Test Formative assessment II Assignment on lemma based on Algebraic
	2	Theorems based on group of Automorphism, Finite Extension, Normal Extension	5	Express the fundamental concepts of field theory, Galois theory	Lecture with illustration	
	3	Theorems based on Normal Extension, Galois Group, Theorems based	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental	Lecture with illustration	

		on Galois Group		concepts of field theory, Galois theory		
	4	Galois Group over the rationals, Theorems based on Galois Group over the rationals, Problems based on Galois Group over the rationals	4	Express the fundamental concepts of field theory, Galois theory, Demonstrate the use of Galois theory to compute Galois Group over the rationals	Lecture with PPT illustration	
IV	Finite fields					
	1	Finite Fields – Definition, Lemma-Finite Fields, Corollary-Finite Fields	4	Recall the definitions and basic concepts of field theory and lattice theory, Express the fundamental concepts of field theory, Galois theory	Lecture with PPT illustration	Short Test Formative assessment III
	2	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, Express the fundamental concepts of field theory, Galois theory	Lecture with illustration	
	3	Wedderburn’s Theorem, Wedderburn’s Theorem-First Proof	4	Recall the definitions and basic concepts of field theory and lattice theory	Lecture with illustration	
	4	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	
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 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	Lecture with illustration	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(Aided): Dr. S. Sujitha HOD(Aided):Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Dr. J. C. Eveline HOD(S.F): Ms. J. Anne Mary Leema

Semester : III Major Core X

Name of the Course : Topology

Course code : PM2032

No. of Hours per Week	Credit	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 Outcome

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 - 4	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 - 4	C

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

Unit	Section	Topics	Lecture hours	Learning outcomes	Pedagogy	Assessment/ evaluation
I	**Topological space and Continuous functions**					
	1	Definition of topology, discrete and indiscrete topology, finite complement	3	To understand the definitions of topological space and different types of topology	Lecture with PPT	Test

		topology, Basis for a topology and examples, Comparison of standard and lower limit topologies				
	2	Order topology: Definition & Examples, Product topology on XxY: Definition & Theorem	3	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	The 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 , Hausdorff Spaces: Definition & Theorems	5	To understand the definitions of closed sets and limit points with examples and theorems and identify Hausdorff spaces and practice various theorems	Lecture	Test
	5	Continuity of a function: Definition, Examples, Theorems, Homeomorphism: Definition & Examples, Rules for constructing continuous function, Pasting lemma &	3	To understand the definition of continuous functions and construct continuous functions	Lecture	Test

		Examples, Maps into products				
II	**The Product Topology, The Metric Topology & Connected Spaces**					
	1	The Product Topology: Definitions,Comparison of box and product topologies, Theorems related to product topologies, Continuous functions and examples	3	To understand the definition of homeomorphism and prove theorems and practice various Theorems related to Maps into products, Cartesian Product, Projection mapping and distinguish the various topologies such as product and box topologies and topological spaces	Lecture	Test
	2	The Metric Topology: Definitions and Examples, Theorems, Continuity of a function, The sequence lemma, Constructing continuous fuctions, Uniform limit theorem, Examples and Theorems	5	To understand the concept of metric topology and prove the theorems	Lecture	Class Test
	4	Connected Spaces: Definitions, Examples, Lemmas and Theorems, Connected Sub space of the real lines: Definitions and Examples, Theorems, Intermediate value	5	To understand the concepts of connected space open and closed sets and to practice the various theorems	Group discussion	Quiz

		theorem, connected space open and closed sets, lemma, examples, Theorems.				
	5	Components and Local Connectedness: Definitions, Path components, Locally connected, Locally path connected: Definitions and Theorems	3	To compare the concepts components and path components, connectedness and local connectedness	Lecture	Test
III	**Compactness**					
	1	Compact space: Definition, Examples, Lemma, Theorems and Image of a compact space, Product of finitely many compact spaces, Tube lemma, Finite intersection property: Definition & Theorem	4	To understand the concept compact space with examples and theorems. To practice various theorems related to product of finitely many compact spaces, Tube lemma, Finite intersection property	Lecture and Seminar	Assignment
	2	Compact Subspaces of the Real Line: Theorem, Characterize compact subspaces of R^n, Extreme value theorem, The Lebesgue number lemma, Uniform continuity theorem	3	To characterize the compact subspace and prove various theorems	Lecture	Formative Assessment Test

	3	Limit Point Compactness: Definitions, Examples and Theorems, Sequentially compact	2	To under the concept of limit point compactness and analyze the sequentially compactness	Lecture with group discussion	Test
	4	Complete Metric Spaces: Definitions, Examples and Theorems, Isometric embedding	3	To analyze the concept of completeness of metric space to be complete, and to understand that every metric space can be imbedded isometrically in a complete metric space	Lecture	Test
	5	Compactness in Metric spaces: Totally bounded, Pointwise bounded, Equicontinuous, Definitions, Lemmas, Theorems	3	To understand the concept of compactness in metric spaces.	Lecture	Class 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	First Countability axiom, Second Countability axiom: Definitions, Theorems, Dense subset: Definitions & Theorem, Examples, Lindelof space : Definition , Examples	3	To compare countability axioms and understand the definition of dense subset and identify Lindelof space	Lecture	Test

	3	The Separation Axioms: Regular space & Normal space: Definitions, Lemma, Relation between the separation axioms, Examples based on separation axioms, Theorem based on separation axioms and Metrizable space	4	To distinguish various topological spaces such as normal and regular spaces. To practice examples and theorems based on separation axioms	Lecture	Test
	4	Normal Spaces: Theorems and Examples	2	To understand the concept of Normal Spaces	Group discussion	Test
	5	Urysohn lemma	3	To constuct Urysohn lemma	Lecture	Formative Assessment Test
V	**Urysohn Metrization Theorem, Tietze Extension Theorem,& The Tychonoff Theorem**					
	1	Urysohn metrization theorem, Imbedding theorem	3	To construct the Urysohn metrization theorm and Imbedding theorem	Lecture with illustration	Quiz
	2	Tietze extension theorem	3	To constuct Tietze extension theorem	Lecture	Assignment
	3	The Tychonoff Theorem	3	To understand and analyze the The Tychonoff Theorem	Lecture	Test
	4	The Stone-Cech Compactification: Defintions, Lemmas, Theorems	3	To understand the concept of Stone-Cech Compactification	Lecture	Test

Course Instructor (Aided): Dr. M.K. Angel Jebitha HoD(Aided): Dr. V.M. Arul Flower Mary

Course Instructor (S.F): Ms. R.N. Rajalekshmi HoD(S.F): Ms. J. Anne Mary Leema

Semester : **III**

Name of the Course : **Measure Theory and Integration** **Major Core XI**

Course Code :**PM2033**

Number of hours/ week	Credits	Total number of hours	Marks
6	5	90	100

Objectives: 1. To generalize the concept of integration using measures.

2. To develop the concept of analysis in abstract situations.

Course Outcome

CO	Upon completion of this course thestudents will be able to :	PSOs addressed	CL
CO - 1	define the concept of measures and Vitali covering and recall some properties of convergence offunctions,	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 - 2	Ap
CO - 4	apply outer measure, differentiation and integration to intervals , functions and sets.	PSO - 2	Ap
CO - 5	compare the different types of measures and Signed measures	PSO - 3	An

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

Unit	Section	Topics	Lecture hours	Learning Outcome	Pedagogy	Assessment Evaluation
I	**Lebesgue Measure**					
		Lebesgue Measure - Introduction, outer measure	4	To understand the measure and outer measure of any interval	Lecture, Illustration	Evaluation through : Class test on outer measure and Lebesgue measure Quiz
		Measurable sets and Lebesgue measure	5	To be able to prove Lebesgue measure using measurable sets	Lecture, Group discussion	

		Measurable functions	4	To understand the measurable functions and its uses to prove various theorems	Lecture, Discussion	Formative assessment- I
		Littlewood's three principles (no proof for first two).	2	To differentiate convergence and pointwise convergence	Lecture, Illustration	
II	**The Lebesgue integral**					
	1.	The Lebesgue integral - the Riemann Integral	1	To recall Riemann integral and its importance	Lecture, Discussion	Formative assessment- I Multiple choice questions
	2.	The Lebesgue integral of a bounded function over a set of finite measure	5	To understand the use of integration in measures	Lecture, Group discussion	Short test on the integral of a non-negative function
	3.	The integral of a non-negative function	5	To prove various theorems using non-negative functions	Lecture, Illustration	Formative assessment-II
	4.	The general Lebesgue integral	4	To understand a few named theorems and proofs	Lecture	
III	**Differentiation and integration**					
		Differentiation and integration- differentiation of monotone functions	4	To recall monotone functions and use them with differentiation and integration	Lecture, Group discussion	Multiple choice questions Unit test on functions of bounded variation
		Functions of bounded variation	4	To evaluate the bounded variation of different functions	Lecture, Illustration	
		Differentiation of an integral	4	To find differentiation of integrals	Lecture	
		Absolute continuity	3	To differentiate continuity and absolute continuity	Lecture, Illustration	Formative assessment- II
IV	**Measure and integration**					
	1.	Measure and integration-	3	To understand concepts of measure spaces	Lecture, Group	Seminar on measure

		Measure spaces			discussion	spaces, measurable functions and integration. Short test on general convergence theorems and signed measures Formative assessment- II
	2.	Measurable functions	3	To recall measurable functions and use them in measure spaces	Lecture, Discussion	
	3.	Integration	3	To integrate functions in measure spaces	Lecture, Illustration	
	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	
V	**The L^p spaces and Measure and outer measure**					
	1.	The L^p spaces	5	To understand L^p spaces	Lecture, Illustration	Seminar on outer measure, measurability and extension theorem Short test on outer measure and measurability
	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 based on σ-algebra	Lecture, Group discussion	

Course Instructor(Aided): Dr. V. M. Arul Flower Mary HOD(Aided) :Dr. V. M. Arul Flower Mary
Course Instructor(S.F): Ms. C.Joselin Jenisha HOD(S.F) :Ms. J. Anne Mary Leema

Semester : III **Elective III**

Name of the Course: Algebraic Number Theory and Cryptography

Course code : PM2034

No. of Hours per Week	Credit	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.

3. To know the concepts of Cryptography.

Course Outcome

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 - 2	U
CO - 3	apply binary quadratic forms for the decomposition of a number into sum of sequences	PSO - 3	Ap
CO - 4	determine solutions using Arithmetic Functions	PSO - 3	Ap
CO - 5	calculate the possible partitions of a given number and draw Ferrer's graph	PSO - 2	An
CO - 6	identify the public key using Cryptography	PSO - 4	An

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

Unit	Sections	Topics	Lecture hours	Learning Outcome	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 definition and examples of quadratic residues and Legendre symbol and theorems on Legendre symbol.	Lecture with Illustration	Question and Answer
	2	Lemma of Gauss, Theorem based on Legendre symbol	4	To understand quadratic and power series forms and Lemma of Gauss, Theorem based on Legendre symbol .	Lecture with Illustration	Test
	3	Quadratic reciprocity law, Theorem based on Quadratic reciprocity.	3	To understand quadratic and power series and Quadratic reciprocity law, Theorem based on Quadratic reciprocity	Lecture with PPT Illustration	Quiz and Test
	4	The Jacobi symbol definition and examples, Theorems	2	To understand the concept of Jacobi symbol and	Lecture with Illustration	Assignment

		based on Jacobi symbol		theorems based on Jacobi symbol.		
	5	Theorem based on Jacobi symbol and Legender symbol	2	To understand theorem based on Jacobi symbol and Legender symbol.	Lecture with Illustration	Evaluation through test
II	**Binary Quadratic forms**					
	1	Definition and examples of quadratic form, definite, indefinite and semidefinite form.	2	To recall the basic results of field theory and to understand the concept of quadratic form.	Lecture with PPT Illustration	Test
	2	Theorems based on binary Quadratic forms	4	To understand the quadratic and power series forms and Theorems based on binary Quadratic forms	Lecture with Illustration	Quiz and Test
	3	Definition and Theorems based on modular group, Definition, theorem based on perfect square	3	To understand the Definition and Theorems based on modular group and perfect square.	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	Formative Assessment 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 Functions of Number Theory**					
	1	Definition and examples based on Arithmetic functions, Multiplicative function and theorems on arithmetic and multiplicative function.	3	To understand the definition and examples of Arithmetic function and to determine solutions using Arithmetic Functions.	Lecture with Illustration	Formative Assessment Test
	2	Definition and theorem of Mobius function, The Mobius Inversion Formula and theorem on Mobius function and Multiplicative function.	3	To understand the definition and theorem on Mobius function, The Mobius Inversion Formula and to determine solutions using Arithmetic Functions.	Lecture with PPT Illustration	Test
	3	Definition and examples of Diophantine Equations, theorem on	3	To understand the definition and examples of Diophantine equations and	Group Discussion	Quiz and Test

		finding solutions of Diophantine Equations and solving problems on Diophantine equation.		find the solutions of Diophantine equations.		
	4	Definition and examples of Pythagorean triangle, Lemma on perfect square and theorem and problems for finding primitive solutions.	3	To understand the Pythagorean triangle and problems for finding primitive solutions.	Lecture with Illustration	Test
IV	**The partition Function**					
	1	Partitions definitions, theorems based on Partitions	2	To understand the Partitions definitions, theorems based on Partitions and to Calculate the possible partitions of a given number	Lecture with Illustration	Question and Answers
	2	Ferrers Graphs, Theorems based on Ferrers Graphs	3	To understand the Ferrers Graphs, Theorems based on Ferrers Graphs and how to draw the Ferrer's graph	Lecture with Illustration	Quiz and Test
	3	Formal power series and identity Euler formula.	2	To understand the Formal power series and identity and Euler formula.	Lecture with Illustration	Formative Assessment Test
	4	Theorems on Euler identity and bounds on p(n).	3	To understand theorems on Euler identity and bounds on p(n).	Lecture with Illustration	Test
	5	Theorems based on Euler formula converges of power series and absolute convergent.	3	To understand Theorems based on Euler formula ,converges of power series and absolute convergent.	Lecture with Illustration	Assignment
V	**Public Key Cryptography**					
	1	Definition and examples of Cryptography, the concepts of Public Key Cryptography with examples	2	To understand the concept of Cryptography	Lecture with Illustration	Question and Answer
	2	The idea of classical vesus public key, Authentication, Hash functions, key exchange and probabilistic Encryption.	3	To understand the idea of public key Cryptography and to Identify the public key using Cryptography	Lecture	Quiz

	3	RSA Cryptosystem with examples, Discrete log cryptosystem with examples, The Diffie – Hellman key exchange system and assumption with examples.	4	To understand and apply the concept of RSA cryptosystem and Diffie – Hellman key exchange system	Lecture with illustration	Test
	4	The Massy- Omura cryptosystem for message transmission, the ElGamal cryptosystem, the Digital Signature Standard, Algorithm for finding discrete log in finite fields with example and index calculus algorithm for discrete logs	4	To understand and apply the idea of Massy- Omura cryptosystem, ElGamal cryptosystem and solve the problem on discrete log using Silver Pohlig Hellman algorithm.	Lecture with illustration	Formative Assignment Test
	5	Basic facts of Elliptic curves, Elliptic curves over the reals, complexes and rationals, Points of finite order with examples.	4	To understand the concept of Elliptic curves and solve the problems on points of finite order	Lecture	Quiz
	6	Analog of the Diffie-Helman key exchange, Analog of Massey - Omura, Analog of ElGamal, reducing a global modulo p with examples.	5	To understand the concept of Elliptic curve Cryptosystem and Analog of all cryptosystem.	Lecture with illustration	Assignment

Course Instructor: Dr. V.Sujin Flower HOD(Aided): Dr. V. M. Arul Flower Mary

Course Instructor: Dr.S.Kavitha HOD (SF) : Ms. Anne Mary Leema

Semester : IV Major Core XII

Name of the Course : Complex Analysis

Course Code : PM2041

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

Objectives: 1. To impart knowledge on complex functions.

2. To facilitate the study of advanced mathematics.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Understand the fundamental concepts of complex variable theory	PSO - 1	U
CO - 2	Effectively locate and use the information needed to prove theorems and establish mathematical results	PSO - 3	R
CO - 3	Demonstrate the ability to integrate knowledge and ideas of complex differentiation and complex integration	PSO - 4	U
CO - 4	Use appropriate techniques for solving related problems and for establishing theoretical results	PSO - 3	Ap
CO - 5	Evaluate complicated real integrals through residue theorem	PSO – 2, 4	E
CO - 6	Know the theory of conformal mappings which has many physical applications and analyse its concepts	PSO – 3, 4	An

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

Unit	Section	Topics	Lecture hours	Learning outcomes	Pedagogy	Assessment /evaluation
I	**Power series**					
	1	Abel's theorem,Abel's limit theorem	3	To understand the concept and practice theorems	Lecture	Quiz
	2	The periodicity	2	The periodicity and solve problems based on the concept	Lecture with Group disscussion	Test

	3	Conformality: Arcs and closed curves, Analytic Functions in Regions	4	To understand the definition of Arcs and closed curves& Analytic Functions in Regions	Lecture with illustration	Test
	4	**Conformal Mapping**	3	To understand the concept of Conformal Mapping	**Lecture**	Test
	5	Length and Area	2	To understand the concepts and give illustrations	Lecture	Quiz
II	**Complex Integration – Fundamental theorems**					
	1	Cauchy's Theorems for a Rectangle, Cauchy's Theorem in a Disk	5	To practice theorems based on this concepts	Lecture	Test
	2	Cauchy's integral formula, The Index of a Point with Respect to a Closed Curve	3	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Test
	3	The Integral Formula, Higher Derivatives	3	To solve problems using this concepts.	Lecture	Formative Assessment Test II &III
	4	Local Properties of Analytic Functions - Removable singularties and Taylor's theorem, Zeros and poles.	4	To understand the concepts and give illustrations& practice theorems	Seminar	
III	**Complex Integration**					
	1	The local mapping, The maximum principle, The General Form of Cauchy's Theorem	5	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Assignment
	2	Chains and Cycles, Simple Connectivity, Homology	4	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Quiz
	3	The General Statement of Cauchy's Theorem (statement only),Calculus of Residues	3	To understand the concept about Calculus of Residues.	Lecture	Test
	4	The Residue Theorem, The Argument Principle	2	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Formative Assessment Test III
	5	Evaluation of Definite Integrals.	2	To solve problems related to Definite Integrals.	Video	Test
IV	**Series and Product developments**					

	1	Partial Fractions and Entire Functions, Partial Fractions, Infinite products, Canonical products	3	To understand the concept and practice theorems	Lecture with illustration	Test
	2	Gamma functions, Jensen's formula, Hadamard's Theorem	4	To practice theorems based on this concepts	Lecture	Test
	3	Riemann Theta Functions and Normal Families, product development, Extension of $\zeta(s)$ *to* the whole plane	3	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Test
	4	The zeros of zeta functions, Equicontinuity, Normality and compactness	2	To solve problems using this concepts.	Lecture	Formative Assessment Test II &III
	5	Arzela's theorem, Families of analytic functions, The classical Definitions	3	To understand the concepts and give illustrations& practice theorems	Seminar	
V	**Conformal Mappings**					
	1	Riemann mapping theorem, Statement and proof, Boundary Behaviour, Use of the Reflection principle	5	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Assignment
	2	Conformal mappings of Polygons, Behaviour at an angle	3	To understand the concept and practice theorems related to this concepts.	Lecture with illustration	Quiz
	3	Schwarz-Christoffel formula, Mapping on a rectangle	3	To understand the concept about mapping on a rectangle	Lecture	Test
	4	Harmonic Functions, Functions with mean value Property, Harnack's Principle	4	To understand the concept about Harmonic functions	Lecture with illustration	Formative Assessment Test III

Course InstructorAided): Dr. A. JancyVini HOD(Aided) :Dr. V.M. Arul Flower Mary

Course Instructor(S.F): V.G. MichealFlorance HOD(S.F) :Ms. J. Anne Mary Leema

Semester **: IV** **Major Core XIII**

Name of the Course **: Functional Analysis**

Course code **: PM2042**

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

Objectives: 1. To study the three structure theorems of Functional Analysis and to introduce Hilbert Spaces and Operator theory

2. To enable the students to pursue research.

Course Outcome

CO	Upon completion of this course thestudents will be able to :	PSOs addressed	CL
CO – 1	learn and understand the definition of linear space , normed linear space, Banach Space and their examples	PSO - 1	R
CO – 2	explain the concept of different properties of Banach Spaces, Hahn Banach theorem	PSO -2	U
CO – 3	compare different types of operators and their properties, Natural imbedding	PSO - 2	Ap
CO – 4	explain the ideas needed for open mapping theorem , Open Mapping theorem	PSO - 1	C
CO – 5	construct the idea of projections , the spectrum of an operator and develop problem solving skills , Matrices, Determinants	PSO - 1	Ap

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

Unit	Section	Topics	Lecture hours	Learning outcomes	Pedagogy	Assessment/ evaluation
I	**Banach Spaces**					
	1.	Definition and, examples of a normed linear space and a Banach Space, Small preliminary results and theorem on Normed linear space.	3	To understand the concept of normed linear space and Banach space	Lecture	Question and Answer

	2.	Properties of a Closed unit sphere, Holder's Inequality and Minkowski's Inequality.	3	To understand the Properties of a Closed unit sphere and Holder's Inequality, Minkowski's Inequality	Lecture with illustrations	Group Discussion
	3.	Equivalent conditions theorem on continuous linear transformations, $B(N,N^1)$is a Banach space, Functionals and it's properties.	4	To understand the concept of Functionals and it's properties and Equivalent conditions theorem on continuous linear transformations	Lecture	Test
	4.	Definition of an Operator and small results on operators, Side result of Hahn Banach theorem and Hahn Banach theorem, Theorem based on functional in N*, Problems based on Normed linear spaces	5	To understand the concept of an Operator and Hahn Banach theorem	Lecture with illustration	Test and Assignment
II	**Conjugate space**					
	1.	Definitions of second conjugate space, induced functional, weak topology, weak* topology, Strong topology,	4	To understand the definition of conjugate space, weak* topology, strong topology.	Lecture	Test
	2.	Theorem on isometric isomorphism of Open mapping theorem and Open mapping theorem	4	To apply the definition and Lemma to prove the Open mapping theorem theorem.	Lecture	Q&A
	3.	Definition of Projection and Theorem on Projection, Closed Graph Theorem,	4	To understand the concepts of Projection and to practice theorems related to this concepts.	Lecture with illustration.	Formative Assessment Test
	4.	The conjugate of an operator , the Uniform , Boundedness theorem and theorem on	3	Applying theorem on conjugate of an operator	Lecture	Assignment

		isometric isomorphism				
III	**Hilbert Space**					
	1.	Definition and examples, Properties of a Hilbert Space, Schwarz Inequality, Parallelogram law Theorem on Convex subset of a Hilbert Space	3	To understand the Definition of a Hilbert Space and Schwarz Inequality, Parallelogram law, Theorem on Convex subset of a Hilbert Space	Lecture with illustration	Quiz
	2.	Theorem on Orthogonal Complements and theorem on closed linear subspaces	3	To apply the laws to prove the theorem	Lecture with illustration	Test
	3.	Definition and examples of orthonormal set and Bessel's Inequality, Theorems on Orthonormal Sets	5	To understand the definition and examples of orthonormal set and apply the Bessel's Inequality on Theorems	Lecture with group discussion	Brain storming
	4.	Gram –Schmidt Orthogonalization Process Theorem on Conjugate Space H*	4	To understand the concept of Schmidt Orthogonalization Process	Lecture with illustration	Assignment, Test
IV	**Adjoint operator**					
	1.	Definition and small results, Theorem on the properties of an adjoint operator	3	Acquire the knowledge about properties of an adjoint operator	Lecture with illustration	Quiz, Group discussion
	2.	Theorem-The set of all self adjoint operators is a real Banach space, Theorems on self adjoint operators	3	Applying theorems on self adjoint operators	Lecture	Q&A
	3.	Properties on Normal and Unitary Operators , Theorems on Normal and Unitary Operators,	3	Acquire the knowledge about Normal and Unitary Operators	Lecture	Slip Test
	4.	Projections-Definition and preliminaries,	3	To understand the definition and examples of projections and apply	Lecture with illustration	Brain Storming

		Theorems on Projections and Theorems on invariant subspace		the concept of invariant subspace on theorems		
	5.	Spectral theory, Definition of Spectrum of an operator and spectral theorem	3	To understand the concept of spectral theory and spectral theorem.	Lecture	Formative Assessment Test
V	**General Preliminaries on Banach Algebras**					
	1.	The definition and some examples of Banach algebra	3	To understand the definition and examples of Banach algebra	Lecture with illustration	Quiz
	2.	Theorems on Regular and Singular elements	4	To understand the regular and singular elements on Theorems	Lecture with illustration	Test
	3.	The definition and theorems on spectrum	4	To know the definition and theorems on spectrum	Lecture	Slip Test, Quiz
	4.	The formula and Theorems on Spectral radius	4	To understand the definition and theorems on Spectral radius	Lecture with illustration	Assignment

Course Instructor(Aided): Dr. V. M. Arul Flower Mary HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Dr. S.Kavitha HOD(S.F) :Ms. J. Anne Mary Leema

Semester : **IV** **Major Core XIV**

Name of the course : **Operations Research**

Course code : **PM2043**

Number of hours/ Week	Credits	Total number of hours	Marks
6	5	90	100

Objectives: 1. To learn optimizing objective functions.

2. To solve life oriented decision making problems.

Course Outcome

CO	Upon completion of this course thestudents will be able to :	PSO addressed	CL
CO - 1	explain the fundamental concept of DP model , Inventory model and Queuing model	PSO - 2	U
CO - 2	relate the concepts of Arrow (Network)diagram representations, in critical path calculations and construction of the Time chart	PSO - 3	U
CO - 3	distinguish deterministic model and single item	PSO - 3	E
CO - 4	interpret Poisson and Exponential distributions and apply these concepts in Queuing models	PSO - 4	Ap
CO - 5	solve life oriented decision making problems by optimizing the objective function	PSO - 1	C

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

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Elements of DP model**					
	1	Elements of the DP Model, The Capital Budgeting Example	4	Recall the definitions and basic concepts of linear programming.	Lecture with illustration	Short Test Formative assessment I
	2	More on the definition of the state	3	Express the fundamental	Lecture with illustration	

				concepts of dynamic programming		Test
	3	Examples of DP models and computation	3	Understand the significance and application of Reliability problem and compute it	Lecture discussion	
	4	Solution of linear programming by dynamic programming	2	Formulate and solve LPP by dynamic programming	Lecture with illustration	
	5	Game theory	3	Express the fundamental concepts of Game theory	Lecture discussion	Assignment
II	**Arrow (Network) Diagram**					
	1	Introduction Arrow (Network) ,Diagram Representations	3	Recall the definitions and basic concepts Arrow (Network) ,Diagram Representations	Lecture with illustration	Short Test Formative assessment I, Seminar on Arrow (Network) Diagram Quiz
	2	Critical Path Calculations, Problem based on critical Path Calculations, Determination of floats	4	Understand the significance and application of Critical Path Calculations, Problem based on critical Path Calculations, Determination of floats	Lecture with PPT illustration	
	3	Construction of the Time Chart	4	Understand the construction of the	Lecture with PPT illustration	

		and Resource Leveling, Problems based on Time Chart and Resource Leveling		Time Chart and Resource Leveling, Problems based on Time Chart		
	4	Probability and Cost Considerations in Project Scheduling .	2	Understand the properties of Probability and Cost Considerations in Project Scheduling	Lecture with discussion	
III	**Generalized Inventory model**					
	1	Introduction, Generalised Inventory model, Types of Inventory Models	4	Understand the theory of Inventory model	Lecture with illustration	Short Test Formative assessment II Seminar on Generalised Inventory model
	2	Deterministic Models, Single Item Static Model, Problems based on Single Item Static Model	4	Understand the significance and application of Single Item Static Model	Lecture with illustration	
	3	Single Item Static ,Model with Price Breaks, Problems based on Single Item Static Model	3	Understand the theory of Single Item Static Model with Price Breaks	Lecture with illustration	

		with Price Breaks				
	4	Multiple - Item static Model with Storage Limitations, Problems based on Multiple - Item static Model with Storage Limitations	2	Understand the theory of Multiple - Item static Model with Storage Limitations	Lecture with PPT illustration	
	5	Single – Item static Model with Storage Limitations.	2	Understand the theory of Single – Item static Model with Storage Limitations and apply it in problems	Lecture with discussion	
IV	**Queuing Model**					
	1	Basic Elements of the Queuing Model, Roles of Poisson Distributions, Roles of Exponential Distributions	3	Understand the theory of Queuing Model	Lecture with PPT illustration	Short Test Formative assessment II
	2	Arrival process, Examples of arrival process	2	Recall the definitions and basic concepts of Poisson Distributions and Exponential Distributions	Lecture with illustration	

	3	Departure process, Queue with Combined Arrivals and Departure	3	Understand the theory of Queue with Combined Arrivals and Departure	Lecture with illustration	Quiz
	4	Problems based on Queue with Combined Arrivals and Departure	2	Formulate and solve Problems based on Queue with Combined Arrivals and Departure	Lecture with illustration	
	5	Queuing Models of Type : (M/M/1): (GD/∞/∞), Problems based on: (M/M/1): (GD/∞/∞)	3	Understand the theory of Queuing Models of Type : (M/M/1): (GD/∞/∞)	Lecture with discussion	
	6	Queuing Models of Type (M/M/1): (GD/N/∞) , Problems based on (M/M/1): (GD/N/∞)	3	Understand the theory of Queuing Models of Type : (M/M/1): (GD/N/∞)	Lecture with discussion	
V	**Types of Queuing Models**					
	1	Queuing Model (M/G/1): (GD/∞/∞), (M/M/C) : (GD/∞/∞), The Pollaczek-Khintchine Formula	4	Recall the definitions and basic concepts of Queuing Model	Lecture with illustration	Short Test

	2	Problems based on(M/M/C) : (GD/∞/∞), (M/M/∞) : (GD/∞/∞) Self service Model	4	Develop the knowledge of solving problems based on (M/M/C) : (GD/∞/∞), (M/M/∞) : (GD/∞/∞) model	Lecture with illustration	Assignment based on the queueing models
	3	(M/M/R) : (GD/K/K) R < K - Machine Service, Problems based on(M/M/R) : (GD/K/K) R < K - Machine Service	4	Develop the knowledge of solving problems based on (M/M/R) : (GD/K/K) R < K - Machine Service model	Lecture with illustration	
	4	Tandem or series queues	3	Develop the knowledge of Tandem or series queues	Lecture with illustration	

Course Instructor(Aided): Dr. L. Jesmalar HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Ms. C. JoselinJenisha HOD(S.F) :Ms. J. Anne Mary Leema

Semester : IV **Major Core XV**

Name of the course : Algorithmic Graph Theory

Course code : PM2044

Number of hours/ Week	Credits	Total number of hours	Marks
6	4	90	100

Objectives:

1. To instill knowledge about algorithms.

2. To write innovative algorithms for graph theoretical problems.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand basic algorithms and write algorithms for simple computing	PSO - 1	U E
CO - 2	analyze the efficiency of the algorithm	PSO - 2	An
CO - 3	understand and analyze algorithmic techniques to study basic parameters and properties of graphs	PSO - 2	R An
CO - 4	use effectively techniques from graph theory, to solve practical problems in networking and communication	PSO - 3	Ap

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

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**The Role of Algorithms in Computing and Getting Started**					
	1	Role of algorithms in computing- Algorithms, Data structures, Technique, Hard problems, Parallelism	4	Recall the definitions and understand the basic concepts of algorithms	Lecture with illustration	Evaluation through: Short Test Formative assessment I
	2	Algorithms as a technology- Efficiency, Algorithms and other technologies	2	Analyze the efficiency of algorithms. Use algorithm as a technology	Lecture with illustration	

	3	Insertion sort and its algorithm, Pseudocode conventions	3	Understand the algorithm of Insertion Sort. Express the fundamental concepts of pseudocode	Lecture with PPT illustration	
	4	Analyzing Algorithms- Worst-case and average-case analysis,	3	Express the fundamental concepts of algorithms, Demonstrate the use of algorithms in worst case and average case analysis	Lecture with illustration	
	5	Designing Algorithms -The divide-and-conquer approach and its algorithm, Analysis of merge Sort	3	Understand the divide-and-conquer approach and its algorithm. Analyze the Merge Sort Algorithm	Lecture with illustration	
II	**Elementary Graph Algorithms**					
	1	Representation of graphs – adjacency list representation, adjacency matrix representation	3	Recall the definitions and basic concepts of graph theory. Express the fundamental concepts of adjacency matrix representation	Lecture with illustration	Short Test Formative assessment I, II
	2	Definitions and Breadth first Search algorithms, Shortest paths and related Lemmas,	3	Recall the definitions and basic concepts of graph theory. Understand the algorithm of BFS	Lecture with PPT illustration	

		Corollary and correctness of Breadth first Search theorem				
	3	Breadth-first trees, related Lemma, Definitions and Depth first search algorithms	3	Recall the definitions and basic concepts of graph theory, Understand the algorithm of DFS	Lecture with PPT illustration	
	4	Parenthesis theorem, Corollary on nesting of descendant's intervals, White-path theorem	3	Understand the properties of DFS, Distinguish between BFS and DFS	Lecture with illustration	
	5	Topological Sort, Strongly Connected Components and related Lemmas and Theorems	4	Understand the algorithms of Topological Sort and Strongly Connected Components	Lecture with illustration	
III	**Growing a minimum spanning tree and The algorithms of Kruskal and Prim**					
	1	Theorem, Corollary related to Growing a minimum spanning tree	3	Understand the theory of spanning tree	Lecture with illustration	Short Test Formative assessment II Assignment on minimum spanning tree
	2	Kruskal's algorithm	3	Recall the definitions and basic concepts of graph theory. Understand the theory of Kruskal's algorithm	Lecture with illustration	

	3	Prim’s algorithm, The execution of Prim’s algorithm on the graph	4	Understand the theory of Prim’s algorithm	Lecture with illustration	
	4	Problems based on minimum spanning tree	3	Recall the definitions and basic concepts of algorithms	Lecture with PPT illustration	
IV	**The Bellman – Ford algorithm and Dijkstra’s algorithm**					
	1	Lemma and Corollary based on correctness of the Bellman-Ford algorithm	3	Understand the theory of Bellman-Ford algorithm	Lecture with PPT illustration	Short Test Formative assessment III
	2	Theorem and definition related to Single-source shortest paths in directed acyclic graphs	3	Recall the definitions and basic concepts of graph theory	Lecture with illustration	
	3	Dijkstra’s algorithm, The execution of Dijkstra’s algorithm	3	Understand the theory of Dijkstra’salgorithm	Lecture with illustration	
	4	Corollary and analysis of Dijkstra’s algorithm	4	Understand the execution of Dijkstra’s algorithm	Lecture with illustration	
	5	Difference Constraints and Shortest Paths-Systems of Difference Constraints, Constraint	3	Understand the concept of Difference Constraints and Shortest Paths	Lecture with illustration	

		graphs, Solving Systems of Difference Constraints				
V	**Shortest paths and Matrix multiplication, The Floyd-Warshall algorithm**					
	1	Computing the shortest-path weights bottom up algorithm	3	Recall the definitions and basic concepts of graph theory	Lecture with illustration	Short Test
	2	Algorithm for matrix multiplication, Improving the running time and technique of repeated squaring	3	Develop the knowledge of shortest paths and establish new relationship in matrix multiplication	Lecture with illustration	Formative assessment III Seminar on shortest paths
	3	The structure of a shortest path, A recursive solution to the all-pairs shortest paths problem	3	Develop the knowledge of shortest paths and establish new relationship in matrix multiplication	Lecture with illustration	
	4	Computing the shortest-path weights bottom up algorithm, Transitive closure of a directed graph algorithm	4	Develop the knowledge of shortest paths and establish new relationship in matrix multiplication	Lecture with PPT illustration	
	5	Johnson's Algorithm for Sparse Graphs-Preserving shortest paths by	2	Understand the theory of Johnson's Algorithm for Sparse Graphs	Lecture with illustration	

		reweighting and related Lemma				

Course Instructor(Aided): Dr. J. Befija Minnie HOD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F): Mrs.J.Anne Mary LeemaHOD(S.F) :Ms. J. Anne Mary Leema

Semester : IV Elective IV (a)

Name of the Course : Combinatorics

Course Code : PM2045

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

Objectives: 1. To do an advanced study of permutations and combinations.

2. Solve related real life problems.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	discuss the basic concepts in permutation and combination, Recurrence Relations, Generating functions, The Principle of Inclusion and Exclusion	PSO - 1	U
CO - 2	distinguish between permutation and combination, distribution of distinct and non-distinct objects	PSO - 2	An
CO - 3	correlate recurrence relation and generating function	PSO - 2	An
CO -4	solve problems by the technique of generating functions, combinations, recurrence relations, the principle of inclusion and exclusion	PSO - 3	Ap
CO - 5	interpret the principles of inclusion and exclusion, equivalence classes and functions	PSO - 4	An E

Total contact hours: 90 (Including assignments and tests)

Unit	Section	Topics	Lecture hours	Learning Outcome	Pedagogy	Assessment Evaluation
I	1.	Permutations and combinations	1	To understand Permutations and combinations	Lecture, Illustration	Evaluation through : Class test Quiz Formative assessment- I
	2.	TheRules of sum and product	6	To define theRules of sum and product and to apply those definitions to solve problems	Lecture, Illustration, Group discussion, Problem Solving	
	3.	Permutations	4	To understand Permutations in detail and to apply the concepts to solve problems	Lecture, Illustration, Discussion, Problem Solving	
	4.	Combinations	3	To understand Combinations in detail and to apply the concepts to solve problems	Lecture, Illustration, Problem Solving	
	5.	Distribution of Distinct Objects and Distribution of Non distinct Objects	1	To understand the distribution of distinct and nondistinct objects	Lecture, Illustration	
II	1.	Generating Functions	4	To understand generating functions and their types	Lecture, Discussion	Formative assessment- I Multiple choice questions Class test
	2.	Generating Functions for Combinations	4	To understand the generating functions for combinations and use them to solve problems	Lecture, Group discussion, Problem Solving	

	3.	Enumerators for Permutations.	4	To understand the Enumerators for Permutations and use them to solve problems	Lecture, Illustration, Problem Solving	Formative assessment-I
		Distribution of distinct objects into nondistinct cells	1	To derive some results on the distribution of distinct objects into nondistinct cells	Lecture, Illustration, Problem Solving	
		Partitions of integers	1	To understand the concept and derive the partition of integers	Lecture, Illustration, Problem Solving	
		The Ferrers graph	1	To derive some results using Ferrers graph	Lecture, Illustration, Problem Solving	
III	1.	Recurrence Relations	5	To understand the recurrence relations	Lecture, Group discussion, Problem Solving	Multiple choice questions
	2.	Linear Recurrence Relations with Constant Coefficients	5	To understand the linear recurrence relations with constant coefficients and use them to solve problems	Lecture, Illustration, Problem Solving	Unit test Group Discussion
	3.	Solution by the Technique of Generating Functions	5	To solve problems by the technique of generating functions	Lecture, Problem Solving	Formative assessment- II
IV	1.	The Principle of Inclusion and Exclusion	1	To understandthe principle of inclusion and exclusion	Lecture, Group discussion	Formative assessment- II

	2.	The General Formula	1	To understandthe general formula	Lecture, Discussion	Seminar on permutations with restrictions on relative positions Assignment on derangements and the Rook polynomials Formative assessment- II
	3.	Derangements	5	To dearrange objects and to solve related problems	Lecture, Illustration, Problem Solving	
	4.	Permutations with Restrictions on Relative Positions	4	To learn permutations with restrictions on relative positions	Lecture, Discussion, Problem Solving	
	5.	The Rook Polynomials	4	To understand the Rook polynomials and to solve related problems	Lecture, Problem Solving	
V	1.	Polya's Theory of Counting	1	To understand Polya's theory of counting	Lecture, Illustration	Seminar on equivalence classes under a permutation group and functions Short test Formative assessment- II
	2.	Equivalence Classes under a Permutation Group	5	To understand equivalence classes under a permutation group	Lecture, Discussion, Problem Solving Problem Solving	
	3.	Equivalence classes of Function	4	To understand equivalence classes of function	Lecture, Group discussion, Problem Solving	
	4.	Weights and Inventories of Functions	4	To understand weights and inventories of functions	Lecture, Illustration, Problem Solving	
	5.	Polya's Fundamental Theorem.	1	To understand and prove Polya's fundamental theorem	Lecture	

Course Instructor(Aided): Dr. S. Sujitha HoD(Aided) :Dr. V. M. Arul Flower Mary

Course Instructor(S.F) : Ms. R.N.Rajalekshmi HoD(SF) :Ms. J. Anne Mary Leema