GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS)
KUMBAKONAM

DEPARTMENT OF MATHEMATICS

Programme : M.Sc., Mathematics

Programme Code : PSMA

SYLLABUS

2023 – 2024 ON WARDS

Programme Outcomes(PO)

On successful completion of M.Sc., Mathematics programme, the Post graduate students will be able to:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an Post graduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

PO4: Analytical & Scientific Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

PO5: Research related skills: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned research perspective; Sense of inquiry and capability for asking relevant questions / problem arising / synthesizing / articulating / ability to recognize cause and effect relationships / define problems. Formulate hypothesis, Test / analyse / Interpret the results and derive conclusion, formulation and designing mathematical models

PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

Programme Specific Outcomes:

PSO1: Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

PSO2: Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

PSO3: To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions.

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

To encourage practices grounded in research that comply with employment laws, leading the organization towards growth and development.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)can be carried out accordingly, assigning the appropriate level in the grids:

	POs							PSOs		
	1	2	3	4	5	6	…	1	2	…
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										

GOVERNMENT COLLEGE FOR WOMEN(AUTONOMOUS), KUMBAKONAM
(Common course structure – PG (2023 - 2024)
Department :Mathematics Programme Code: PSMA

SEMESTER – I

Part	Course Type	Course Code	Title of the Course	Hrs	Credits
I	CC – I	P23MC101	ABSTRACT ALGEBRA	6	5
I	CC – II	P23MC102	REAL ANALYSIS - I	6	5
I	CC – III	P23MC103	ORDINARY DIFFERENTIAL EQUATIONS	6	4
I	EC – I	P23MDE1	NUMBER THEORY AND CRYPTOGRAPHY	5	3
		P23MDE2	NUMERICAL ANALYSIS		
I	EC – II	P23MDE3	FUZZY SETS AND THEIR APPLICATIONS	5	3
		P23MDE4	FLUID DYNAMICS		
II	SEC – I	P23M1SE1	MATHEMATICAL DOCUMENTATION USING LATEX - PRACTICAL	2	2
			Total	**30**	**22**

SEMESTER – II

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits
I	CC – IV	P23MC204	LINEAR ALGEBRA	6	5
I	CC – V	P23MC205	REAL ANALYSIS – II	6	5
I	CC –VI	P23MC206	PARTIAL DIFFERNTIAL EQUATIONS	6	4
I	EC – III	P23MDE5	DISCRETE MATHEMATICS	5	3
		P23MDE6	WAVELETS		
I	EC – IV	P23MDE7	ELEMENTS OF STOCHASTIC PROCESSES	5	3
		P23MDE8	MECHANICS		
II	SEC – II	P23M2SE2	PROGRAMMING IN SCI LAB - PRACTICAL	2	2
II	ECC – I		Moocs/Swayam Courses	-	**2/3**
			Internship/Industrial training*		
			Total	**30**	**22**

***Internship/industrial training during summer vacation. The credits shall be awarded in Semester III statement of marks.**

SEMESTER – III

Part	Course Type	Title of the Course	Hrs/ Week	Credits
I	CC – VII	COMPLEX ANALYSIS	6	5
I	CC – VIII	TOPOLOGY	6	5
I	CC –IX	GRAPH THEORY	6	5
I	CC - X	MATHEMATICAL METHODS	6	4
I	EC – V	1. PROGRAMMING IN C++ - PRACTICAL 2. COMMUTATIVE ALGEBRA	4	3
II	SEC – III	INTRODUCTION TO SAGEMATH - PRACTICAL	2	2
II	ECC – I	Moocs/Swayam Courses	-	2/3
II	AEC	Internship/Industrial training	-	2
		Total	**30**	**26**

SEMESTER – IV

Part	Course Type	Title of the Course	Hrs/ Week	Credits
I	CC – XI	FUNCTIONAL ANALYSIS	6	5
I	CC – XII	DIFFERENTIAL GEOMETRY	6	5
I	CC –XIII	PROJECT WITH VIVA VOCE	8	5
I	EC – VI	1. AUTOMATA THEORY 2. MATHEMATICAL STATISTICS	5	3
II	SEC - IV	MATHEMATICAL SCIENCES	5	2
II	EA	Extension Activity	-	2
		Total	**30**	**22**

LIST OF CORE COURSES : (CC)

1. ABSTRACT ALGEBRA
2. REAL ANALYSIS – I
3. ORDINARY DIFFERENTIAL EQUATIONS
4. LINEAR ALGEBRA
5. REAL ANALYSIS –II
6. PARTIAL DIFFERENTIAL EQUATIONS
7. COMPLEX ANALYSIS
8. TOPOLOGY
9. GRAPH THEORY
10. MATHEMATICAL METHODS
11. FUNCTIONAL ANALYSIS
12. DIFFERENTIAL GEOMETRY

LIST OF ELECTIVE COURSES (EC)

1. NUMBER THEORY AND CRYPTOGRAPHY
2. NUMERICAL ANALYSIS
3. FUZZY SETS AND THEIR APPLICATIONS
4. FLUID DYNAMICS
5. DISCRETE MATHEMATICS
6. WAVELETS
7. ELEMENTS OF STOCHASTIC PROCESSES
8. MECHANICS
9. PROGRAMMING IN C++ - PRACTICAL
10. COMMUTATIVE ALGEBRA
11. AUTOMATA THEORY
12. MATHEMATICAL STATISCS

SKILL ENHANCEMENT COURSES (SEC)

1. MATHEMATICAL DOCUMENTATION USING LATEX - PRACTICAL
2. PROGRAMMING IN SCI LAB – PRACTICAL
3. INTRODUCTION TO SAGEMATH – PRACTICAL
4. MATHEMATICAL SCIENCES

CC – 1 ABSTRACT ALGEBRA

Theory Hours : 6	**Course Code : P23MC101**
Exam Hours : 3	**Credits : 5**
	Internal : 25
	External : 75

Objectives:

1. The objective of this course is to introduce the basic ideas of counting principle, Sylow subgroups, finite abelian groups, field theory and Galois Theory and to see its application to the solvability of polynomial equations by radicals.

UNIT I: Sylow's Theorem: Another Counting Principle – 1^{st}, 2^{nd} and 3^{rd} parts of Sylow's Theorems – double coset – the normalizer of a group.

UNIT II: Finite Abelian Groups : External and Internal direct Products – structure theorem for finite abelian groups – non iso-morphic abelian groups - polynomial rings.

UNIT III: Splitting Field: Polynomials over rational fields – the Eisenstein criterion - extension fields – roots of polynomials – splitting fields.

UNIT IV: Galois Theory: More about roots – simple extension – separable extension – fixed fields – symmetric rational functions – normal extension - Galois group – fundamental theorem of Galois theory.

UNIT V: Solvability by radicals: Solvable group – the commutator subgroup – Solvability by radicals - finite fields- Wedderburn Theorem.

TEXT BOOK :

[1] I.N. Herstein, Topics in Algebra, 2^{nd} Edition, John Wiley and Sons, New York, 1975.

UNIT I : Chapter 2 (Sections 2.11 & 2.12)
UNIT II : Chapters 2 and 3 (Sections2.13, 2.14, 3.9)
UNIT III : Chapters 3 and 5 (Sections 3.10,5.1,5.3)
UNIT IV : Chapter 5 (Sections 5.5, 5.6)
UNIT V : Chapters 5 and 7 (Sections 5.7, 7.1)

REFERENCES :

1. S. Lang, *"Algebra"*, 3^{rd} Edition, Addison-Wesley, Mass, 1993.
2. John B. Fraleigh, *"A First Course in Abstract Algebra",* Addison Wesley, Mass, 1982.
3. M. Artin, *"Algebra",* Prentice-Hall of India, New Delhi, 1991.
4. V. K. Khanna and S.K. Bhambri, *"A Course in Abstract Algebra"*, Vikas Publishing House Pvt Limited,1993.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: To find the number of Sylow subgroups
CLO2: To find the number of non isomorphic abelian groups.
CLO3: To find the splitting field, Galois group of the given polynomial.
CLO4: To check whether the given polynomial is solvable by radicals or not .
CLO5: To find the commutator subgroup.

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓	✓	✓		✓	✓
CLO2	✓	✓	✓		✓		✓		
CLO3	✓				✓			✓	✓
CLO4	✓	✓	✓	✓	✓		✓		✓
CLO5	✓		✓	✓	✓	✓		✓	

Question Paper Pattern

SECTION A1 $10 \times 1 = 10$ (Each Unit Carries TWO Questions)
SECTION A2 $5 \times 2 = 10$ (Each Unit Carries ONE Questions)
SECTION B $5 \times 5 = 25$ (Each Unit Carries TWO Questions (Either or Type))
SECTION C $3 \times 10 = 30$ (Each Unit Carries ONE Questions)

Total = 75

CC - II REAL ANALYSIS – I

Theory Hours : 6	**Course Code : P23MC102**
Exam Hours : 3	**Credits : 5**
	Internal : 25
	External : 75

Objectives:

1. Aim of this course is to enable the students to learn the basic concepts of real analysis and proof techniques in Analysis to well prepared for the advanced courses like Functional Analysis and Advanced Analysis.

UNIT - I: Real number system and its order completeness. Sequences and series of real numbers : Sequences - convergence - subsequences - Cauchy sequences – Upper and Lower Limits- some special sequences - Tests of convergence - Absolute convergence - Rearrangements.

UNIT - II: Metric spaces : Basic concepts, continuous functions, completeness, Baire category Theorem, Contraction mapping Theorem.

UNIT - III: Connectedness, intermediate Value Theorem, Compactness, Heine-Borel Theorem.

UNIT - IV: Differentiation, Taylor's Theorem, Riemann integral and its properties, improper integral.

UNIT - V: Sequences and series of functions, Uniform convergence, power series Weierstrass approximation theorem, Equi - continuity , Arzela- Ascoli theorem.

TEXT BOOK :

[1] Walter Rudin, Principles of Mathematical Analysis, Tata McGraw- Hill, New York, 1988.

[2] Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.

UNIT I : Chapter 1 (Page No. 1 to 5) and Chapter 3 (Page No. 47 to 58,71 ,72, 75 to 78)[1]

UNIT II : Chapter 2 (Page No. 30 to 36, 85 to 88) [1]

UNIT III: Chapter 2 (Page No. 36 to 43) [1]

UNIT IV : Chapter 5 (Page No. 103 to 107, 110 to 111) and Chapter 6 (Page No. 120-133) [1]

UNIT V: Chapter 7 (Page No. 143 to 148), Chapter 9 (Page No. 226 to 228) [2] and Chapter 11 (Page No.322) [2]

REFERENCE BOOKS:

1. Walter Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill, New York, 1988.
2. Kenneth A. Ross, Elementary Analysis: The theory of Calculus, Springer, New York, 2004.
3. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, New York, 1982.
4. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing co. Pvt. Ltd., New Delhi 1970.
5. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
6. S. Kumaresan, Topology of Metric Spaces, 2nd Edition, Narosa Publishing House, 2011.
7. S. Ponnusamy, Foundations of Mathematical Analysis, Springer Birkhauser, 2012.
8. S. C. Malik and Savita Arora, Mathematical Analysis, Wiley Eastern Ltd., New Delhi, 1991.
9. S. K. Mappa, Introduction to Real Analysis, 7th Edition, Sarat Book Distributors, Kolkatta, 2015.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Analyze and evaluate functions of bounded variation and Rectifiable Curves.

CLO2: Describe the concept of Riemann-Stieltjes integral and its properties.

CLO3: Demonstrate the concept of step function, upper function, Lebesgue function and their integrals.

CLO4: Construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem.

CLO5: Formulate the concept and properties of inner products, norms and measurable functions

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓		✓		✓		✓	✓
CLO2	✓		✓		✓		✓		
CLO3	✓		✓		✓			✓	
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)

SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)

SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))

SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

CC – III ORDINARY DIFFERENTIAL EQUATIONS

Theory Hours :	**Course Code : P23MC103**
Exam Hours : 3	**Credits : 4**
	Internal : 25
	External : 75

Objectives:

1. To develop a strong background on finding solutions to linear differential equations with constant
2. To develop a strong background on finding solutions to linear differential equations with variable coefficients and also with regular singular points.

UNIT I:

Linear equations with constant coefficients: Introduction - Second order homogenous equations - Initial value problem for second order equations - Linear dependence and independence - A formula for Wronskian.

UNIT II:

Linear equations with constant coefficients: (Cont'd.) The Non - homogenous equations of order two - homogenous and Non - homogenous equations of order n - Initial value problems for n^{th} order equations- Annihilator method to solve non- Homogenous equation.

UNIT III:

Linear equations with variable coefficients: Initial value problem - Existence and uniqueness theorem - The Wronskian and linear independence - Reduction of the order of a homogenous equation -The non- Homogenous equation - Homogenous equations with analytic coefficients - The Legendre equations

UNIT IV:

Linear equations with regular singular points: The Euler equations - Second order equations with regular singular points - Exceptional cases - The Bessel equation – The Bessel equation contd.

UNIT V:

Existence and uniqueness of solutions to first order equations: Equations with variable separated - Exact equations - The method of successive approximation - The Lipschitz Condition - Convergence of the successive approximation - Non-local existence of solutions - Approximations to and uniqueness of solutions.

TEXT BOOK :

[1] Earl A. Coddington, An Introduction to Oridinary Differential Equations – Prentice Hall of India Private Limited, New Delhi 2008.

UNIT I : Chapter 2 (sections 1 to 5)
UNIT II : Chapter 2 (Sections 6 to 10)
UNIT III: Chapter 3 (Sections 1 to 8)
UNIT IV : Chapter 4 (Sections 1,2,3, 6,7,8)
UNIT V: Chapter 5 (sections 1 to 8)

REFERENCE BOOKS:

1. George F. Simmons, Differential Equations with Application And Historical Notes, Tata McGraw Hill, New Delhi 1974.

2. Earl A. Coddington, An Introduction to Oridinary Differential Equations – Prentice – Hall of India Private Limited, New Delhi 2008.

3. Williams E. Boyce and Richard C. Diprima Elementary Differential Equations and Boundary Value Problems, 10th edition John Wiley and Sons, New York 2012

4. M.D. Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd., New Delhi 2012

5. B. Rai, D.P. Choudhury and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House Pvt. Ltd, New Delhi 2012.

6. Ravi P. Agarwal and Ramesh C. Gupta, Essentials of Ordinary Differential Equations, McGraw Hill, New York, 1991.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Establish the qualitative behavior of solutions of systems of differential equations .
CLO2: Recognize the physical phenomena modeled by differential equations and dynamical systems.
CLO3: Analyze solutions using appropriate methods and give examples.
CLO4: Formulate Green's function for boundary value problems.
CLO5: Understand and use various theoretical ideas and results that underlie the mathematics in this course.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓	✓		✓	✓	
CLO2	✓		✓	✓			✓		✓
CLO3	✓		✓	✓			✓		
CLO4		✓	✓		✓			✓	✓
CLO5	✓		✓	✓		✓	✓		

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – I NUMBER THEORY AND CRYPTOGRAPHY

Theory Hours : 5	**Course Code : P23MDE1**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. To expose the students to the fascination, facts and touch in the world of numbers.
2. To highlight some of the Applications of the Theory of Numbers.

UNIT I: Divisibility and Euclidean algorithm - Congruences, Euler's theorem, Wilson's Theorem, Chinese Remainder Theorem, Primitive roots,
UNIT II: Quadratic residues.- Quadratic reciprocity – The Jacobi symbol
UNIT III: Arithmetic functions – The Moebius Inversion formula – Multiplication of arithmetic functions.
UNIT IV: Linear Diophantine equations – Sum of Four and Five Squares – Sum of Fourth Powers - Sum of Two Squares.
UNIT V: Public key Cryptography – Concepts of public key Cryptography – Modular arithmetic – RSA – Discrete logarithm – Elliptic curve Cryptography

TEXT BOOK :

[1] George E. Andrews, Number theory, Dover Publication, INC, New York, Reprint 2013
[2] Ivan Nivan and Herberts Zucherman, An Introduction to Theory of Numbers by Third Edition, 1972, Wiley Eastern Limited, New Delhi
[3] Cryptograpy and Network Security Principles and Practice by William Stallings, Prentice Hall, Fifth Edition, New Delhi, 2011.

UNIT I : Chapter 2 (section 2.1,2.2) , Chapter 4(sections 4.1)Chapter 5(Section 5.1 – 5.3)and chapter 7(Section 7.1,7.2) [1]
UNIT II : Chapter 9 (sections 9.1to 9.3) [1]
UNIT III: Chapter 6 (Sections 6.1 to 6.3) [1]
UNIT IV : Chapter 5 (section 5.1,5.2,5.7,5.9,5.10) [2]
UNIT V: Chapter 4 (section 4.2,4.3),Chapter 8(section 8.5), Chapter 9 (section 9.1,9.2) and Chapter10 (section 10.4) [3]

REFERENCES :

1. Tom Apostol, Introduction to Analytic Number theory, Narosa Publications, New Delhi
2. David M.Burton,ElementaryNumberTheory,Wm.C.Brown Publishers, Dubuque, Iowa, 1989.
3. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York,1987.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Understand and work numerous problems on concepts of divisibility and primes.
CLO2: Gain expertise in Euler's, Fermat's and Wilson theorems and work on applications illustrating them.
CLO3: Solve congruence's as application of Chinese remainder theorem.
CLO4: Discuss quadratic reduce and Jacobi symbol and work on sum of two square problems.
CLO5:. Understand the Concepts of public key Cryptography, Modular arithmetic and Elliptic curve Cryptography

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓	✓	✓		✓	
CLO2	✓		✓	✓	✓		✓	✓	✓
CLO3	✓		✓	✓			✓		
CLO4		✓	✓		✓	✓		✓	
CLO5	✓	✓	✓	✓	✓				✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – I NUMERICAL ANALYSIS

Theory Hours : 5	**Course Code : P23MDE2**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. The objective of this course is to develop Numerical computational skills and to study their applications.
2. This course focuses on the topics Interpolation by polynomials, the solution of nonlinear equations, Numerical differentiation and Numerical Integration. On the successful completion of the course, students will be able to learn various tools in solving numerical problems and prepare competitive examinations like CSIR-NET, SLET, etc.

UNIT I: Number Systems and Errors: The Representation of Integers -The Representation of Fractions - Floating point arithmetic- Loss of Significance and Error Propagation – Computational Methods for error estimation-Some comments on convergence of sequences-Some mathematical preliminaries.

UNIT II: Interpolation by polynomials: Polynomial forms- Existence and Uniqueness of the Interpolating polynomial-The divided difference table- The error of the interpolating polynomial-Interpolation in a function table based on equally spaced points.

UNIT III: The solution of nonlinear equations: A survey of iterative methods-Fixed point iteration-Polynomial Equations: Real roots-Complex roots and Muller's Method.

UNIT IV: Matrices and Systems of Linear equations: The solution of linear systems by elimination-The pivoting strategy - The triangular factorization.

UNITV:Differentiation and Integration: Numerical differentiation- Numerical Integration: Some basic rules-Composite rules.

TEXT BOOK :

[1] Elementary Numerical Analysis-An algorithmic approach by Samuel D. Conte and Carl de Boor

UNIT I : Chapter 1 (Sections 1.1 to 1.7)
UNIT II : Chapter 2 (Sections 2.1, 2.2, 2.3, 2.5, 2.6)
UNIT III: Chapter 3 (Sections 3.1,3.3, 3.6, 3.7)
UNIT IV : Chapter 4 (Sections 4.2 to 4.4)
UNIT V: Chapter 7 (Sections7.1, 7.2,7.4)

REFERENCE BOOKS:

1. Azmysackleh et al, Classical and modern Numerical Analysis, CRC Press,
2. S.S Sastry, Introductory methods of Numerical Analysis, Prentices Hall of India Pvt.Limited,2001,Third Edition.
3. E. Kendall, Atkinson, An Introduction to Numerical Analysis, II Edition, John wiley& Sons, 1989.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Learn the numerical methods to find our solution of algebraic equations using different methods.
CLO2: Understand the various interpolation methods and finite difference concepts.
CLO3: Apply numerical methods to obtain approximate solutions to mathematical problems.
CLO4: Work numerically on the ordinary differential equations using different methods through the theory of finite differences.
CLO5: Apply Taylor series and Runge kutta methods to find the solution of the equations.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓	✓		✓	✓	
CLO2	✓		✓	✓		✓	✓		✓
CLO3	✓		✓	✓			✓		
CLO4		✓	✓		✓	✓		✓	✓
CLO5	✓		✓	✓			✓		

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – II FUZZY SETS AND THEIR APPLICATIONS

Theory Hours : 5	**Course Code : P23MDE3**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. Fuzzy is one of the latest topic in Mathematics that has real life applications. Hence it is essential for the students to learn this topic. This topic introduces the concept of uncertainty and fuzziness in logic that will enable the student to develop their intuitive mind further.
2. The two years M.Sc. program is to prepare every student to face the competitive world outside.It will help them to acquire sufficient knowledge and skill in the subject that will make them competent in various areas of mathematics.

UNIT I:

Crisp sets and fuzzy sets: Overview of Classical Sets, Membership Function, Height of a fuzzy set – Normal and sub normal fuzzy sets – Support – Level sets, fuzzy points, α–cuts – Decomposition Theorems, Extension Principle.

UNIT II :

Operation on fuzzy sets: Standard fuzzy operations – Union, intersection and complement – properties De. Morgan's laws - α–cuts of fuzzy operations.

UNIT III :

Fuzzy relations: Cartesian Product, Crisp relations – cardinality – operations and properties of Crisp and Fuzzy relations. Image and inverse image of fuzzy sets - Various definitions of fuzzy operations – Generalizations – Non interacting fuzzy sets, Tolerance and equivalence relations.

UNIT IV :

Decision making in Fuzzy environments: General Discussion – Individual Decision making – multi person decision

making – multi criteria decision making – multi stage decision making – fuzzy ranking methods – fuzzy linear programming.

UNIT V :

Applications: Medicine – Economics – Fuzzy Systems and Genetic Algorithms – Fuzzy Regression – Interpersonal Communication – Other Applications.

TEXT BOOK :

[1] George J.Klir and Bo Yuan , Fuzzy sets and Fuzzy Logic Theory and Applications, PHI Leaning Private Limited, New Delhi(2013).

UNIT I : Chapter 1 Sections(1.3,1.4) and Chapter2 Sections(2.1,2.2,2.3)
UNIT II : Chapters 3 Sections(3.1 to 3.5)
UNIT III: Chapters 5 Sections(5.1 to 5.8)
UNIT IV : Chapter 15 Sections(15.1 to 15.7)
UNIT V: Chapter 17 Sections(1 7.1 to 17.7)

REFERENCE BOOKS:

1. A.K.Bhargava;FuzzySetTheory, FuzzyLogic and their Applications, published by S. Chand Pvt. Limited (2013).
2. K.Pundir and R.Pundir, Fuzzy sets and their application, Published by A Pragati edition (2012)
3. H.J.Zimmermann, Fuzzy set theory and its applications, Springer (2012).

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: To develop analytical mind so that the students can sharpen their mind better.
CLO2: To provide with sufficient practical oriented application thus the students can face the competitive world.
CLO3: To enable the students to have a thorough exposure to the differen branches of Mathematics so as to gain a comprehensive knowledge of Mathematics.
CLO4: To mold the students in research/teaching or to find better placement in corporate sectors.
CLO5: To develop – Fuzzy Systems and Genetic Algorithms and Interpersonal Communication

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓			✓		✓	✓	
CLO2		✓				✓	✓		✓
CLO3	✓		✓	✓		✓			
CLO4	✓	✓	✓	✓	✓		✓	✓	✓
CLO5	✓			✓	✓	✓	✓		✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – II FLUID DYNAMICS

Theory Hours : 5	**Course Code : P23MDE4**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. To give the students an introduction to the behavior of fluids in motion.
2. To give the students a feel of the applications of Complex Analysis in the analysis of flow of fluids.

UNIT I:

Real Fluids and Ideal fluids – Velocity of a Fluid at a point – Streamlines and path lines; steady and Unsteady Flows – The velocity potential – The Vorticity vector – Local and Particle Rates of Change - The Equation of continuity – Worked examples- Acceleration of a Fluid – Pressure at a point in a Fluid at Rest – Pressure at a point in Moving Fluid – Conditions at a Boundary of Two Inviscid Immiscible Fluids – Euler's Equations of motions – Bernoulli's equation – Worked examples.

UNIT II:

Some Flows Involving Axial Symmetry – Some special Two – Dimensional Flows – Impulsive Motion. Some three-dimensional Flows: Introduction – Sources, Sinks and Doublets – Images in a Rigid Infinite Plane – Axi – Symmetric Flows: Strokes stream function.

UNIT III:

Some Two-Dimensional Flows: Meaning of a Two-Dimensional Flow – Use of cylindrical Polar Coordinates – The stream function – The Complex Potential for Two-Dimensional, Irrotational, Incompressible Flow – Complex velocity potentials for Standard Two-Dimensional Flows – Some worked examples – The Milne-Thomson circle theorem and applications – The Theorem of Blasius.

UNIT IV:

The use of Conformal Transformation and Hydrodynamical Aspects – Stress components in a Real Fluid – Relations between Cartesian components of stress – Translational Motion of Fluid Element – The Rate of Strain Quadric and Principal Stresses – Some Further Properties of the Rate of Strain Quadric-Stress Analysis in Fluid motion -Relations between Stress and Rate of strain – The coefficient of viscosity and Laminar Flow–The Navier – Stokes equations of Motion of a Viscous Fluid.

UNIT V:

Some solvable problems in Viscous Flow – Steady Viscous Flow in Tubes of Uniform cross section – Diffusion of Vorticity – Energy Dissipation due to Viscosity – Steady Flow past a Fixed Sphere – Dimensional Analysis; Reynolds Number – Prandtl's Boundary Layer.

TEXT BOOK:

[1] F. Chorlton, Textbook of Fluid Dynamics, CBS Publishers & Distributors, New Delhi, Reprint 2004.

UNIT I : Chapter 2 (Sections 2.1 to 2.9), and Chapter 3 (Sections 3.2 to 3.6)
UNIT II : Chapter 3 (Sections 3.9to3.11) and Chapter4 (Sections 4.1,4.2,4.3 and 4.5)
UNIT III : Chapter 5 (Sections 5.1 to 5.9) (omit 5.7)
UNIT IV : Chapter 5 (Section 5.10), and Chapter 8 (Sections 8.1 to 8.9)
UNIT V : Chapter 8 (Sections 8.10 to 8.16)

REFRENCES:

[1] J.D.Anderson,ComputationalFluid Dynamics,The Basics with Applications, McGraw Hill, 1995.

[2] R.K.Rathy,AnIntroduction to Fluid Dynamics, Oxford and IBG Publishing Co., New Delhi, 1976.

[3] S.W.Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Pvt Ltd.,NewDelhi,1976.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Understand the basic mechanical concepts related to real fluids and ideal fluids.
CLO2: Determine the nature of two dimensional and three dimensional flows.
CLO3: Use the important definitions and introductory concept the Milne - Thomson circle theorem.
CLO4: Classify the motion of a mechanical system using the Navier – Stokes equations of motion of a Viscous Fluid.
CLO5: Understand the concept of the Prandtl's Boundary Layer.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓		✓		✓		✓	✓
CLO2	✓		✓		✓		✓		✓
CLO3	✓		✓		✓			✓	
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

SEC – I MATHEMATICAL DOCUMENTATION USING LATEX – PRACTICAL

Theory Hours : 2	**Course Code : P23M1SE1**
Exam Hours : 2	**Credits : 2**
	Internal : 40
	External : 60

Objectives:

1. To make the students learn the art of typing mathematics text on their own.

2. To inculcate professional training required to become a scholar in mathematics.

UNIT I :

Basic Structure of Latax 2e – Input file structure – Layout – Editors – Forward search – Inverse Search – Compling – Conversion to various formats.

UNIT II :

Typesetting simple documents – sectioning – Titles – page layout – listing – enumerating – quote letter formats.

UNIT III :

Using package amsmath typing equations labeling and refreing.

UNIT IV:

Figure inclusion – Table inclusion.

UNIT V:

Bibliography – Intex typing – Beamer presentation Styles.

TEXT BOOK:

[1] Leslie Lamport, LATEX: A Document preparation System, Addison – Wesley, Reading,Massachusetts, second edition, 1994.

REFERENCES:

[1] Tobias Oetiker, Hubert Partl, Irence hyna and Elisabeth Schlegl., The (Not So) Short Introduction to LATEX2e, Samurai Media Limited (or available online at http:// mirrors,ctan.org/info/lshort/English/lshort.pdf)

[2] LATEX Tutorials – A Primer, Indian Tex Users Group, available online at https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf)

[3]H.J.Greenberg. A Simplified introduction to LATEX, available online at http://www.ctan.org/tex-archive/info/simplified-latex/

[4]Using Kile – KDE Documentation, https://docs.kde.org/trunk4/en/extragear-office/klie/quick_using.html

Question Paper Pattern

ANSWER ALL THE QUESTIONS:

2×15 = 30 Marks

1× 20 = 20 Marks

Record = 5 Marks

Viva – voce = 5 Marks

Total = 60 Marks

CC – IV LINEAR ALGEBRA

Theory Hours : 6	**Course Code : P23MC204**
Exam Hours : 3	**Credits : 5**
	Internal : 25
	External : 75

Objectives:

1. The objective of this course is to develop a strong foundation in linear algebra that provide a basic for advanced studies not only in mathematics but also in other branches like engineering, physics and computers, etc.
2. Particular attention is given to canonical forms of linear transformations, diagonalizations of linear transformations, matrices and determinants.

UNIT I:

Linear transformations: Linear transformations – Isomorphism of vector spaces – Representations of linear transformations by matrices – Linear functionals.

UNIT II:

Algebra of polynomials: The algebra of polynomials –Polynomial ideals - The prime factorization of a polynomial - Determinant functions.

UNIT III:

Determinants: Permutations and the uniqueness of determinants – Classical adjoint of a (square) matrix – Inverse of an invertible matrix using determinants – Characteristic values – Annihilating polynomials.

UNIT IV:

Diagonalization: Invariant subspaces – Simultaneous triangulations – Simultaneous diagonalization – Direct-sum decompositions – Invariant direct sums – Primary decomposition theorem.

UNIT V:

The Rational and Jordan forms: Cyclic subspaces – Cyclic decompositions theorem (Statement only) – Generalized Cayley – Hamilton theorem - Rational forms – Jordan forms.

TEXT BOOK :

[1] Kenneth M Hoffman and Ray Kunze, Linear Algebra, 2nd Edition,

Prentice-Hall of India Pvt. Ltd, New Delhi, 2013.

UNIT I : Chapter 3 (Sections 3.1 to 3.5)
UNIT II : Chapters 4 and 5 (Sections 4.1, 4.2, 4.4, 4.5 and 5.1,5.2)
UNIT III: Chapters5 and 6 (Sections 5.3 ,5.4 and 6.1 to 6.3)
UNIT IV : Chapter6 (Sections 6.4 to 6.8)
UNIT V: Chapter7 (Sections 7.1 to 7.3)

REFERNCES:

1. M. Artin, *"Algebra"*, Prentice Hall of India Pvt. Ltd., 2005.
2. S.H. Friedberg, A.J. Insel and L.E Spence, *"Linear Algebra"*, 4th Edition, Pritice-Hall of India Pvt. Ltd., 2009.
3. I.N. Herstein, *"Topics in Algebra"*, 2nd Edition, Wiley Eastern Ltd, New Delhi, 2013.
4. J.J. Rotman, *"Advanced Modern Algebra"*, 2nd Edition, Graduate Studies in Mathematics, Vol. 114, AMS, Providence, Rhode Island, 2010.
5. G. Strang, *"Introduction to Linear Algebra"*, 2ndEdition, Prentice Hall of India Pvt. Ltd, 2013.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Discuss in detail the basic concept of linear system of equations, Vector spaces, Bases and Dimension.
CLO2: Learn linear Transformations and double dual structure.
CLO3: Understand the algebra of polynomials and various properties of determinant.
CLO4: Evaluate Characteristic values and Direct-sum decompositions.
CLO5: Capture the idea of cyclic decompositions and the rational form.

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓		✓		✓	✓
CLO2	✓		✓		✓		✓		
CLO3	✓		✓		✓			✓	✓
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

CC – V REAL ANALYSIS – II

Theory Hours : 6	**Course Code : P23MC205**
Exam Hours : 3	**Credits : 5**
	Internal : 25
	External : 75

Objectives:

1. Aim of this course is to enable the students to learn the basic concepts of real analysis.
2. To proof of techniques in Analysis to well prepared for the advanced courses like Functional Analysis and Advanced Analysis.

UNIT – I :

Functions of bounded variation: Introduction- properties of monotonic functions – Functions of bounded variation- Total variation - Additive property of total variation – Total variation of [a, x] as a function of x - function of bounded variation expressed as the difference of two increasing functions. Riemann – Stieltjes Integral: Definition and Existence – Properties – Integration and Differentiation – Integration of vector valued functions – Rectifiable curves.

UNIT – II :

Functions of several variables: Linear transformation – Differentiation – The inverse function theorem – The implicit function theorem.

UNIT – III :

Determinants- Derivatives of higher order- Differentiation of integrals.

UNIT – IV :

Lebesgue measure: Outer measure – Measurable sets and Lebesgue measure – Non –measurable sets – Measurable functions – Little wood's three principles.

UNIT – V :

The Lebesgue integral: The Lebesgue integral of a bounded function over a set of finite measure – The integral of a nonnegative function – The general Lebesgue integral – Lebesgue's Monotone Convergence Theorem and Dominated Convergence Theorem.

TEXT BOOK :

[1] Walter Rudin, Principles of Mathematical Analysis, Tata McGraw- Hill, New York, 1988.

[2] G. de Barra, Measure Theory and Integration, Wiley Eastern Ltd., New Delhi 1981.

UNIT I: Chapter6 (Sections 6.1 to 6.12) [1]
UNIT II: Chapter9 (Sections 9.1,9.2,9.4,9.5) [1]
UNIT III: Chapter9 (Sections 9.7 to 9.9) [1]
UNIT IV : Chapter2 (Sections 2.1,2.2,2.4) [2]
UNIT V: Chapter3 (Sections 3.1,3.2) [2]

REFERENCES:

1. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
2. H. L. Royden, Real Analysis, Third Edition, Macmillan Publishing Company, New Delhi, 1988.
3. Inder K. Rana, An Introduction to Measure and Integration, 2nd Edition, Narosa Publishing House, 2015.
4. Gelbaum, B. R. and J. Olmsted, Counter Examples in Analysis, Holden day, San Francisco, 1964.
5. Burkill. J. C , The Lebesgue Integral, Cambridge University Press, 1951.
6. Munroe. M. E, Measure and Integration, Addison- Wesley, Mass, 1971.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Analyze integrals of given real valued function through limits and gain the knowledge of Riemann integration of real valued functions.
CLO2: Solve the problems of convergence and divergence of sequences and series.
CLO3: Explain the applications and the usefulness of these special functions.
CLO4: Understand purpose and functions of the Inverse Function and Implicit Function.
CLO5: Evaluate the special functions of using in the Integration of Differential Forms.

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓		✓		✓	
CLO2	✓		✓		✓		✓		✓
CLO3	✓		✓		✓			✓	
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

CC –VI PARTIAL DIFFERNTIAL EQUATIONS

Theory Hours : 6	**Course Code : P23MC206**
Exam Hours : 3	**Credits : 4**
	Internal : 25
	External : 75

Objectives:

1. To develop a strong background on finding solutions to linear differential equations with constant and variable coefficients and also with regular singular points.

UNIT I:

Linear equations with constant coefficients: Introduction - Second order homogenous equations - Initial value problem for second order equations – Linear dependence and independence - A formula for Wronskian

UNIT II:

Linear equations with constant coefficients (cont'd.) The Non- homogenous equations of order two-homogenous and Non - homogenous equations of order n - Initial value problems for n^{th} order equations-
Annihilator method to solve non- Homogenous equation.

UNIT III:

Linear equations with variable coefficients: Initial value problem - Existence and uniqueness theorem - The Wronskian and linear independence - Reduction of the order of a homogenous equation -The non- Homogenous equation - Homogenous equations with analytic coefficients - The Legendre equations

UNIT IV:

Linear equations with regular singular points: The Euler equations - Second order equations with regular singular points - Exceptional cases - The Bessel equation – The Bessel equation contd.

UNIT V:

Existence and uniqueness of solutions to first order equations: Equations with variable separated - Exact equations - The method of successive approximation - The Lipschitz Condition - Convergence of the successive approximation - Non-local existence of solutions - Approximations to and uniqueness of solutions.

TEXT BOOK :

[1] Earl A. Coddington, An Introduction to Oridinary Differential Equations – Prentice – Hall of India Private Limited, New Delhi 2008.

UNIT I : Chapter2 (Sections 1 to 4,7,8,10,12,13)
UNIT II : Chapter3 (Sections 1,4,5,9 to 11)
UNIT III: Chapter4 (Sections2 to 6, 8)
UNIT IV : Chapter5 (Sections1 to 6)
UNIT V: Chapter 6 (Sections 3 to 6)

REFERENCES:

1. Williams E. Boyce and Richard C. Diprima Elementary Differential Equations and Boundary Value Problems, 10th edition John Wiley and Sons, New York 2012
2. M.D. Raisinghania, Advanced Differential Equations, S. Chand & Company Ltd., New Delhi 2012
3. George F. Simmons, Differential Equations with Application And Historical Notes, Tata McGraw Hill, New Delhi 1974
4. B. Rai, D.P. Choudhury and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House Pvt. Ltd, New Delhi 2012.
5. Ravi P. Agarwal and Ramesh C. Gupta, Essentials of Ordinary Differential Equations, McGraw Hill, New York, 1991.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Classify first order partial differential equation and their solutions.
CLO2: Solve first order equations and non linear partial differential equation using various methods.
CLO3: Identify and solve the three main classes of second order equations, elliptic, parabolic and hyperbolic.
CLO4: Solve the Dirichlet Problem for the upper half plane.
CLO5: Solve the Laplace equation and green's function.

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓	✓	✓		✓	
CLO2	✓		✓		✓		✓		
CLO3	✓		✓		✓			✓	✓
CLO4		✓	✓	✓	✓		✓		✓
CLO5	✓		✓	✓	✓	✓		✓	✓

Question Paper Pattern

SECTION A1 $10 \times 1 = 10$ (Each Unit Carries TWO Questions)
SECTION A2 $5 \times 2 = 10$ (Each Unit Carries ONE Questions)
SECTION B $5 \times 5 = 25$ (Each Unit Carries TWO Questions (Either or Type))
SECTION C $3 \times 10 = 30$ (Each Unit Carries ONE Questions)

Total = 75

EC – III DISCRETE MATHEMATICS

Theory Hours : 5	**Course Code : P23MDE5**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. To Prepare students to develop mathematical foundations to understand and create mathematical arguments.
2. To motivate students how to solve practical problems using Discrete mathematics.

UNIT I:

THE FOUNDATIONS: LOGIC & PROOFS: Propositional Logic - Applications of Propositional Logic - Propositional Equivalences- Predicates and Qunatifiers – Nested Quantifiers. Algorithms: The Growth of Functions

UNIT II:

COUNTING & ADVANCED COUNTING TECHNIQUES**:**The Basics of Counting - The Pigeonhole Principle - Permutations and Combinations - Generalized Permutations and Combinations - Generating Permutations and Combinations - Applications of Recurrence Relations - Solving Linear Recurrence Relations - Generating Functions

UNIT III:

BOOLEAN ALGEBRA & MODELING COMPUTATIONS**:**Boolean: Functions - Representing Boolean Functions - Logic Gates- Minimization of Circuits Finite- State machines with Output - Finite - State machines with No Output - Turing Machines.

UNIT IV:

CODING THEORY: Introduction to Coding - Linear Codes- Cyclic codes- Special Cyclic codes

UNIT V:

FURTHER APPLICATIONS OF ALGEBRA:

Semi group- Semigroup and Automata - Semigroup and formal Languages- Linear Recurring sequences.

TEXT BOOK :

[1] . Kenneth H. Rosen, Discrete Mathematics and it's Applications, 7th Edition/ McGraw Hill Education, New York, 2012 Units I, II, III.

[2]. Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra 2nd Edition Springer, 1997 Units IV & V .

UNIT I : Chapter 1 (Sections1.1 to 1.5) [1] and Chapter 3 (Sections 3.1,3.2) ([1])

UNIT II : Chapter 6 (Sections 6.1 to 6.3, 6.5 to 6.6) [1] and Chapter 8 (Sections 8.1,8.2,8.4) [1]

UNIT III: Chapter 12 (Sections 12.1 to 12.4) [1] and Chapter 13 (Sections 13.2,13.3,13.5) [1]

UNIT IV : Chapter 4 (Sections 16 to 19) [2]

UNIT V: Chapter 7 (Sections 28 to 30,33) [2]

REFERENCES:

1. J.P. Tremblay & R. Manohar, A First Course in Discrete Structures with Applications to Computer Science, McGraw Hill, 1987.
2. T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hills Publishing Company Limited, 7th Reprint, 2008
3. Liu C.L, Elements of Discrete Mathematics, McGraw Hill, New York, 1978
4. Grimaldi R.P and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, 2004

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Solve recurrence relation, linear equations and generating functions.

CLO2: Understand the techniques of coding and decoding systems.

CLO3: Gain the knowledge of logic and normal forms.

CLO4: Have exposure to the inference theory and predicate calculus.

CLO5: Have an efficiency in solving problems in matrix theory.

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓	✓	✓		✓		✓	✓
CLO2	✓		✓		✓		✓		
CLO3	✓		✓		✓			✓	
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – III WAVELETS

Theory Hours : 5	**Course Code : P23MDE6**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1.Wavelet analysis has drawn much attention from both mathematicians and engineers alike. The emphasis of the course is on spline wavelets and time-frequency analysis. The only pre-requisite is a basic knowledge of function theory and real analysis.

2.The outcome of the course is to enable the learner to apply the pure mathematics in signal processing and image analysis.

UNIT I :

An Overview **:** Fourier to Wavelets – Integral Wavelets Transform and Time frequency analysis – Inversion formulas and duals – Classification of Wavelets – Multi-resolution analysis – Spines and Wavelets.

Fourier Analysis **:** Fourier and Inverse Fourier Transformation – Continuous Time Convolution – The delta function – Fourier Transformation of square integrable functions.

UNIT II :

Fourier Analysis (contd): Fourier Series – Basic Convergence Theory – Poisson Summation Formula.

Wavelet Transforms and Time Frequency Analysis : The Gabor Transforms – Short time Fourier Transforms and the uncertainty principle – The integral Wavelet Transform – Dyadic Wavelets – Inversion Frames – Wavelet Series.

UNIT III :

Cardinal Spline Analysis : Cardinal Spline spaces – B-splines and their basic properties – The time scale relation and an interpolating graphical display algorithm – B-Net representations and computation of cardinal splines - Constructions of cardinal splines – constructions of spline application formulas – Construction of Spline interpolation formulas.

UNIT IV :

Scaling functions and Wavelets : Multi-resolution analysis – Scaling functions with finite two scale relation – Direction sum Decompositions of $L^2(R)$ - Wavelets and their duals.

UNIT V :

Cardinal Splines Wavelets : Interpolating splines wavelets – Compactly supported spline – Wavelets – Computation of Cardinal spline Wavelets – Euler – Frebenious Polynomials.

Orthogonal Wavelets **:** Examples of orthogonal Wavelets - Identification of orthogonal two scale symbols - Construction of compactly supported orthogonal wavelets.

TEXT BOOK :

[1] . Charles K. Chui, An introduction to Wavelets, Academic Press, New York, 1992.

UNIT I : Chapter 1 (Sections 1.1 to 1.5)
Chapter 2 (Sections 2.1 to 2.3)
UNIT II : Chapter 2 (Sections 2.4,2.5) and Chapter3 (Sections 3.1 to 3.6)
UNIT III: Chapter 4 (Sections 4.1 to 4.6)
UNIT IV : Chapter 5 (Sections 5.1 to 5.4)
UNIT V: Chapter 6 (Sections 6.1 to 6.4) and Chapter 7 (Sections 7.1 to 7.3)

REFERENCES:

1. Chui C. K. (ed), Approximation theory and Fourier Analysis, Academic Press Boston, 1991.
2. DaribechiesI,Wavelets,CBMS-NSFSeriesinAppl,SIAM Philadelphia, 1992.
3. Schurnaker L, L. Spline Functions : Basic Theory, Wiley, New York, 1981.
4. Nurnberger G, Applications to Spline Functions, Springer Verlag, New York, 1989

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Solve Integral Wavelets Transform and Time frequency analysis.

CLO2: Understand Wavelet Transforms and Time Frequency Analysis.
CLO3: Gain the knowledge of the time scale relation and an interpolating graphical display algorithm.
CLO4: Have exposure the Scaling functions and Wavelets.
CLO5: Have an efficiency in Identification of orthogonal two scale symbols.

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓		✓		✓		✓	
CLO2	✓		✓		✓		✓		✓
CLO3	✓		✓		✓			✓	
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – IV ELEMENTS OF STOCHASTIC PROCESSES

Theory Hours : 5	**Course Code : P23MDE7**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. Mathematics is the core subject for all science. Therefore every student is expected to have sufficient knowledge in Mathematics. The two years M.Sc. program is to enable every student to face the touch situation in the world.
2. The study of stochastic process is precisely to give comparative knowledge to every student.

UNIT I:

Continuous Time Markov Chain, Examples, Transient Analysis, Occupancy Times, Limiting Behaviour.

UNIT II:

Renewal Process, Cumulative Process, Semi-Markov Process, Examples and Long term Analysis

UNIT III:

Queueing Systems, Single-Station Queues, Birth and Death queues with Finite and Infinite Capacity

UNIT IV:

M/G/1 and G/M/1 Queues and Network of Queues.

UNIT V:

Standard Brownian Motion, Brownian Motion and First Passage Times

TEXT BOOK :

[1] V.G. Kulkarni, Introduction to Modelling and Analysis of Stochastic Systems, Second Edition, Springer (2011)

UNIT I : Chapter 4 (Sections 4.1 to 4.6))
UNIT II : Chapter 5 (Sections 5.1 to 5.5)
UNIT III: Chapter 6 (Sections 6.1 to 6.4)
UNIT IV : Chapter 6 (Sections 6.5 to 6.7)
UNIT V: Chapter7 (Sections 7.3 to 7.6)

REFERENCES:

1. J. Medhi, Stochastic Processes, NEW AGE (2009).
2. S. M. Ross, Stochastic Processes, Wiley Series in Probability and Statistics (1996).

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: To shape the students in the field of research/teaching
CLO2: To suffice the students to have an overall exposure to the different branches of statistics so as to gain a complete knowledge of statistics.
CLO3: To create analytical skills and to think practical level in the real life
CLO4: To create M/G/1 and G/M/1 Queues and Network of Queues.
CLO5: To suffice the students to have The Standard Brownian Motion, Brownian Motion

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓		✓		✓		✓	✓
CLO2	✓		✓		✓		✓		
CLO3	✓				✓			✓	
CLO4		✓	✓	✓			✓		✓
CLO5	✓		✓	✓		✓		✓	✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

EC – IV MECHANICS

Theory Hours : 5	**Course Code : P23MDE8**
Exam Hours : 3	**Credits : 3**
	Internal : 25
	External : 75

Objectives:

1. To create a foundation for understanding basic principles of mechanics and some classical problems
2. To learn Lagrangian and Hamiltonian formulations of classical mechanics
3. To learn the importanceandconsequences ofcanonical transformations

UNIT I:

Introductory concepts: mechanical system – generalized coordinates – constraints – virtual work – d'Alembert's principle - energy and momentum – equilibrium and stability – kinetic energy – angular momentum.

UNIT II:

Lagrange's equations: derivation of Lagrange's equations for different conditions – Lagrange equations for some simple systems - integrals of motion – Routhian procedure – natural system – Liouville's system – small oscillations.

UNIT III:

Hamilton's equations: stationary values - Hamilton's principle under different conditions – Hamilton's equations – the Legendre transformation – modified Hamilton's principle – principle of least action.

UNIT IV:

Hamilton-Jacobi theory: Hamilton's principle function – canonical integral – Pfaffian differential form – Hamilton-Jacobi equation

– Jacobi's theorem – modified Hamilton-Jacobi equation – separability – Liouville's system Stackel's theorem.

UNIT V:

Canonical transformations: differential forms and generating functions – some simple, point and momentum transformations - Lagrange and Poisson brackets.

TEXT BOOK :

[1] D.T. Greenwood, Classical Dynamics, Prentice Hall of India Pvt. Ltd, New Delhi, 1979.

UNIT I : Chapter 1 (Sections 1.1 to 1.5)
UNIT II : Chapter 2 (Sections 2.1 to 2.4)
UNIT III : Chapter 4 (Sections 4.1 to 4.3)
UNIT IV : Chapter 5 (Sections 5.1 to 5.3)
UNIT V : Chapter 6 (Sections 6.1 to 6.3)

REFERENCES:

1. H. Goldstein, C. Poole & J. Safko, Classical Mechanics, Pearson Education, New Delhi, 2002.
2. N.C.Rane and P.S.C.Joag, Classical Mechanics, Tata McGraw Hill, 1991.
3. J.L.Synge and B.A.Griffth, Principles of Mechanics (3rd Edition) McGraw Hill Book Co., New York, 1970.
4. L.N. Hand and J.D. Finch, Analytical Mechanics, Cambridge University Press, 1998.
5. S.L.Loney, An Elementary Treatise on Statics, Kalyani Publishers, New Delhi, 1979.
6. J.R.Taylor,ClassicalMechanics,University ScienceBooks, Sausalito 2005.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Derivation of Lagrange's equation using elementary calculus as an alternative to the more advanced variational calculus derivation.
CLO2: The use of Hamilton-Jacobi in identifying conserved quantities for a mechanical system, even when the mechanical problem itself cannot be solved completely.
CLO3: The use of analytical treatments in checking the numerical models.
CLO4: Derivation of Hamilton-Jacobi theory.
CLO5: Lagrange and Poisson brackets using Canonical transformations

Programme Outcomes and Programme Specific Outcomes

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	✓	✓		✓		✓		✓	
CLO2	✓		✓		✓		✓		✓
CLO3	✓		✓		✓			✓	
CLO4		✓	✓	✓	✓		✓		✓
CLO5	✓		✓	✓		✓		✓	✓

Question Paper Pattern

SECTION A1 10 × 1 = 10 (Each Unit Carries TWO Questions)
SECTION A2 5 x 2 = 10 (Each Unit Carries ONE Questions)
SECTION B 5 × 5 = 25 (Each Unit Carries TWO Questions (Either or Type))
SECTION C 3 × 10 = 30 (Each Unit Carries ONE Questions)

Total = 75

SEC – II PROGRAMMING IN SCI LAB – PRACTICAL

Theory Hours : 2	**Course Code : P23M2SE2**
Exam Hours : 2	**Credits : 2**
	Internal : 40
	External : 60

Objectives:

1. To make the students learn the art of typing mathematics text on their own.
2. To inculcate professional training required to become a scholar in mathematics.

UNIT I :

An Introduction to Scilab: Introduction – Getting Started- Using Scilab as a calculator - Basic Elements of Scilab as a Programming Language - Input and output of Mathematical values in Scilab - Suppressing the display of output - Dynamic nature of variable in Scilab - Functions to manage complex numbers – Booleans.

UNIT II:

Matrices: Vectors - Operations on Vectors – Element-wise product or dot product (.*) -, division of vectors, - power of vectors (.^) - - Two-dimensional matrices - Operations on matrices - Functions on matrices

UNIT III:

Scilab Programming: Branching statements - Looping statements - The whilestatement

UNIT 1V:

Plotting**:** The 2-dimensional plot - Contour plot - The 3-dimensional plot (Surface plot) - Titles, axis, legends and Style options.

UNIT V:

Polynomials in Scilab: Defining polynomials - Matrices of polynomials - Operations on polynomials or matrices of polynomials - Evaluation of polynomials .

TEXT BOOK:

1. Dr. AKHILESH KUMAR ROGRAMMING USING SCILAB,THEORY &PRACTICALS. Copyrights reserved with the author-2022

UNIT I : Chapter 1 (Sections 1.1 to 1.4)
UNIT II : Chapter 2 (Sections 2.1 to 2.2)
UNIT III : Chapter 3 (Sections 3.1 to 3.2)
UNIT IV : Chapter 5 (Sections 5.1 to 5.4)
UNIT V : Chapter 7 (Sections7.1 to 7.4)

Question Paper Pattern

ANSWER ALL THE QUESTIONS:

2×15 = 30 Marks

1× 20 = 20 Marks

Record = 5 Marks

Viva – voce = 5 Marks

Total = 60 Marks
