DHANALAKSHMI SRINIVASAN

COLLEGE OF ARTS AND SCIENCE FOR WOMEN (AUTONOMOUS)

Affiliated to Bharathidasan University, Tiruchirappalli

(Nationally Re-Accredited with A++ Grade by NAAC)

Perambalur – 621212.

M.Sc., MATHEMATICS

Choice Based Credit System-Learning Outcomes Based Curriculum Framework

(CBCS-LOCF)

(Applicable to the candidates admitted from the academic year 2024-25 onwards)

Programme Pattern

Sem	Course	Course Title	Course Code	Ins.Hrs	Credit	Exam Hours	Marks	Total	
							Internal	External	
I	Core Course-I	Abstract Algebra	24PMM1C1	6	5	3	25	75	100
	Core Course-II	Real Analysis	24PMM1C2	6	5	3	25	75	100
	Core Course-III	Ordinary Differential Equations	24PMM1C3	5	4	3	25	75	100
	Core Course-IV	Graph Theory	24PMM1C4	5	4	3	25	75	100
	Core Elective-I	A) Discrete Mathematics	24PMM1E1A	5	4	3	25	75	100
		B) Combinatorics	24PMM1E1B						
	Value Added Course-1	LaTex	24PMM1VAC	3	2	3	25	75	100
				30	**24**		-	-	**600**
II	Core Course- V	Linear Algebra	24PMM2C5	6	5	3	25	75	100
	Core Course-VI	Complex Analysis	24PMM2C6	6	5	3	25	75	100

	Core Course-VII	Partial Diffential Equations	24PMM2C7	6	5	3	25	75	100
	Core Course-VIII	Fluid Dynamics	24PMM2C8	6	4	3	25	75	100
	Industrial Based Course	Mathematics of Finance	24PMM2I1	3	3	3	25	75	100
	Non Major Elective - I	A) Quantitative Aptitude-I	24PMM2N1A	3	2	3	25	75	100
		B) Numerical methods and Statistics	24PMM2N1B						
	Self paced learning - I (Online Course)	Self paced learning-Mooc		-	2*				
				30	**24**		**-**	**-**	**600**
III	Core Course-IX	Topology	24PMM3C9	6	5	3	25	75	100
	Core Course-X	Measure Theory andIntegration	24PMM3C10	6	5	3	25	75	100
	Core Course-XI	Classical Dynamics	24PMM3C11	5	4	3	25	75	100
	Core Course-XII	Calculus of Variations and Integral equations	24PMM3C12	5	4	3	25	75	100
	Core Elective-II	A) Fuzzy Mathematics	24PMM3E2A	5	4	3	25	75	100
		B) Python Programming	24PMM3E2B						
	Non Major Elective - II	A) Quantitative Aptitude-II	24PMM3N2A	3	2	3	25	75	100
		B) R Programming	24PMM3N2B						
	Internship/Field Study/ Industrial		24P3IV		1				100*

	Visit								
	Self paced learning - II (Online Course)				2*				
				30	**25**		**-**	**-**	**600**
IV	Core Course-XIII	Functional Analysis	24PMM4C13	6	5	3	25	75	100
	Core Course-XIV	Differential Geometry	24PMM4C14	6	5	3	25	75	100
	Core Elective-III	Numerical Analysis	24PMM4E3A	5	4	3	25	75	100
		Automata Theory	24PMM4E3B						
	Project Work	Project Work	24PMM4PW	13	3	3	40	60	100
				30	**17**		**-**	**-**	**400**
Total				**120**	**90**				**2200**
Extra Credit Course					**90(4*)**				**2200**

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1C1	CC-I: ABSTRACT ALGEBRA	6	5

Objectives: To give foundation in Algebraic Structures like Groups & Rings

UNIT I (18 Periods)

Group Theory - A counting principle - Normal Subgroups and Quotient groups - Homomorphism - Cayley's theorem - Permutation groups - Another counting principle - Sylow's theorems

UNIT II (18 Periods)

Ring Theory: Homeomorphisms - Ideals and quotient rings - More ideals and quotient rings -Euclidean Rings - A particular Euclidean Ring.

UNIT III (18 Periods)

Polynomial rings - Polynomials over the rational field - polynomials over commutative Rings -Inner Product spaces.

UNIT IV (18 Periods)

Fields: Extension fields - Roots of Polynomials - More about roots.

UNIT V (18 Periods)

The elements of Galois Theory - Finite fields

UNIT VI (Advanced topics only for discussion)

Current contours:

Module Theory.

TEXT BOOK(S)

1. I.N. Herstein, Topics in Algebra, Second Edition, Wiley Eastern Limited, 2004

   UNIT I - Chapter 2 Section 2.5, 2.6, 2.7, 2.9, 2.10, 2.11, 2.12

   UNIT II - Chapter 3 Section 3.3, 3.4, 3.5, 3.7, 3.8

   UNIT III - Chapter 3 & 4 Section 3.9, 3.10, 3.11, 4.4

   UNIT IV - Chapter 5 Section 5.1, 5.3, 5.5

   UNIT V - Chapter 5 & 7 Section 5.6, 7.1

REFERENCE BOOK(S)

1. David S. Dummit and Richard M. Foote, Abstract Algebra, Third Edition, Wiley Student Edition,2015.
2. Vijay, K. Khanna, and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 2008 (Third Edition)
3. John, B.Fraleigh, A first course in Abstract Algebra, Addison-Wesley Publishing company.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand the concepts of homomorphism, permutation groups and their properties	K1
CO 2	Relate ring theory and more ideals and quotient rings	K2
CO 3	Learn properties of polynomial ring and determine inner product spaces	K3
CO 4	Realize importance of Galois theory and its more about roots	K3
CO 5	Remembering the concepts of ring , fields and extension fields	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I	24PMM1C1		CC-I: ABSTRACT ALGEBRA							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1C2	CC-II: REAL ANALYSIS	6	5

Objectives: To give the students a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced learning in Pure Mathematics.

UNIT I (18 Periods)

Basic Topology: Finite, Countable and Uncountable Sets – Metric spaces – Compact sets – Perfect sets – Connected sets. Numerical Sequences and Series: Sequences – Convergence – Subsequences – Cauchy Sequences – Upper and Lower Limits - Some Special Sequences – Tests of convergence – Power series – Absolute convergence – Addition and multiplication of series –Rearrangements.

UNIT II (18 Periods)

Continuity: Limits of functions – Continuous functions – continuity and Compactness– Continuity and connectedness – Discontinuities – Monotonic functions – Infinite limits and limits at infinity. Differentiation: Derivative of a real function – Mean value Theorems - Intermediate value theorem for derivatives – L'Hospital's Rule – Taylor's Theorem – Differentiation of vector valued functions.

UNIT III (18 Periods)

Riemann – Stieltjes Integral: Definition and Existence – Properties – Integration and Differentiation – Integration of vector valued functions.

UNIT IV (18 Periods)

Sequences and series of functions: Uniform Convergence and Continuity – Uniform Convergence and Differentiation – Equi continuous families of functions – The Stone – Weierstrass Theorem.

UNIT V (18Periods)

Functions of several variables: Linear Transformations - Differentiation – The Contraction Principle – The Inverse Function Theorem - The Implicit Function Theorem.

UNIT VI (Advanced topics only for discussion)

Current contours: Calculus on manifolds.

TEXT BOOK(S)

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, Mc Graw Hill, 1976.
   - UNIT I Chapters 2 and 3
   - UNIT II Chapters 4 and 5
   - UNIT III Chapter 6
   - UNIT IV Chapter 7

UNIT V Chapter 9 Section 9.1 to 9.29

REFERENCE BOOK(S)

1. Tom P. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969
3. Kenneth A. Ross, Elementary Analysis: The Theory of Calculus, Springer NewYork, 2004.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand basic properties of R, Such as its characterization as a complete and ordered field.	K1
CO 2	Classify and explain upper and lower limits, test of convergence, power series.	K2
CO 3	Recognize the difference between continuous and discontinuous	K3
CO 4	Determine the integration and differentiation and weierstras theorem and the implicit function theorem	K3
CO 5	Remembering the upper and lower integrals and the Riemann conditions	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I	24PMM1C2		CC-II: REAL ANALYSIS							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1C3	CC-III: ORDINARY DIFFERENTIAL EQUATIONS	5	4

Objectives: To give an in-depth knowledge of differential equations and their applications and study the existence, uniqueness, stability behavior of the solutions of the ODE

UNIT I (15 Periods)

The general solution of the homogeneous equation– the use of one known solution to find another – The method of variation of parameters – Power Series solutions. A review of power series– Series solutions of first order equations – Second order linear equations; Ordinary points.

UNIT II (15 Periods)

Regular Singular Points – Gauss's hyper geometric equation – The Point at infinity - Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions.

UNIT III (15 Periods)

Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial Value Problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.

UNIT IV (15 Periods)

Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions– Sturm Comparison Theorems – Eigen values, Eigen functions and the Vibrating String.

UNIT V (15 Periods)

Nonlinear equations - Autonomous Systems; the phase plane and its phenomena – Types of critical points; Stability – critical points and stability for linear systems –Stability by Liapunov's direct method – Simple critical points of nonlinear systems.

UNIT VI (Advanced topics only for discussion)

Current contours:

system of ODE and using canonical forms to solve.

TEXT BOOK(S)

1. G.F. Simmons, Differential Equations with Applications and Historical Notes, TMH, New Delhi, 2003.

   UNIT I - Chapter 3: Sections 15, 16, 19 and Chapter 5: Sections 26 to 28

   UNIT II - Chapter 5: Sections 28 to 31 and Chapter 6: Sections 32 to 35

   UNIT III - Chapter 7: Sections 37, 38 and Chapter 11: Sections 55, 56

   UNIT IV - Chapter 4: Sections 22 to 24

   UNIT V - Chapter 8: Sections 42 to 44

REFERENCE BOOK(S)

1. W.T. Reid, Ordinary Differential Equations, John Wiley & Sons, New York, 1971
2. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, McGraw Hill Publishing Company, New York, 1955.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Approximate gauss's hyper geometric equation	K1
CO 2	Understand properties of Legendre polynomials and Bessel function	K2
CO 3	Cary out the oscillation and boundary value problems	K3
CO 4	Solve the types of critical points stability, stability by liopunov's direct method	K3
CO 5	Understand the concepts of fundamental matrix and successive approximation for finding solution	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course					Hours		Credits
I	24PMM1C3		CC-III: ORDINARY DIFFERENTIAL EQUATIONS					5		4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1C4	CC-IV: GRAPH THEORY	5	4

Objectives: To give a rigorous study of the basic concepts of Graph Theory and applications of Graph Theory in other disciplines

UNIT I: BASIC RESULTS (15 Periods)

Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness- Operations on Graphs - Directed Graphs: Basic Concepts - Tournaments.

UNIT II: CONNECTIVITY (15 Periods)

Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees: Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.

UNIT III: INDEPENDENT SETS AND MATCHINGS (15 Periods)

Vertex Independent Sets and Vertex Coverings - Edge Independent Sets –Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

UNIT IV: GRAPH COLOURINGS (15 Periods)

Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials

UNIT V: PLANARITY (15 Periods)

Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.

UNIT VI (Advanced topics only for discussion)

Current contours:

Graphical theory in a number of heterogeneous areas.

TEXT BOOK(S)

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008

UNIT I - Chapter 1 & 2 Section 1.1 to 1.5, 1.8, 2.2 2.3
UNIT II - Chapter 3 & 4 Section 3.2, 3.3, 4.1, 4.2 , 4.4,4.5
UNIT III - Chapter 5 & 6 Section 5.1 to 5.4, 6.1, 6.2,6.3
UNIT IV - Chapter 7 Section 7.1 to 7.3, 7.5,7.6,7.9
UNIT V - Chapter 8 Section 8.1 to 8.7

REFERENCE BOOK(S)

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.

2. Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraph, CRC press,2010

3. F.Harary, Graph Theory, Addison - Wesley, Reading, Mass., 1969.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand the basic concepts of graphs, directed graphs	K1
CO 2	Understand the properties of trees, counting the number of spanning trees	K2
CO 3	Understand eulerian graph and Hamiltonian graphs	K3
CO 4	Apply the knowledge of graphs to solve the real life problem	K3
CO 5	Define vertex coloring and prove theorems on vertex coloring	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course					Hours		Credits
I	24PMM1C4		CC-IV: GRAPH THEORY					5		4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1E1A	CEC-I:DISCRETE MATHEMATICS	5	4

Objectives: To study the concepts like Boolean Algebra, Coding theory and obtain the knowledge in Grammar and Languages

UNIT I (15 Periods)

Relations and Functions: Binary relations, equivalence relations and partitions, partial order relations, inclusion and exclusion principle, Hasse diagram, Pigeon hole principle. Functions, inverse functions, compositions of functions, recursive functions

UNIT II (15 Periods)

Mathematical Logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and quantifiers.

UNIT III (15 Periods)

Lattices: Lattices as Partially Ordered Sets. Their Properties, Lattices as algebraic Systems, Sub lattices, Direct Product and homomorphism. Some Special Lattices - Complete, Complemented and Distributive Lattices, Isomorphic Lattices.

UNIT IV (15 Periods)

Boolean Algebra: Various Boolean identities, the switching Algebra Example, Sub Algebras, Direct Production and Homomorphism. Boolean Forms and their Equivalence, Midterm Boolean forms, Sum of Products, Canonical Forms. Minimization of Boolean Functions: Design Examples Using Boolean Algebra, Finite-state Machine

UNIT V (15 Periods)

Computability and Languages: Russell's Paradox and Non computability, Ordered Sets, Languages, Phrase structure grammars, Types of Grammars and Languages, Remarks and Reference.

UNIT VI (Advanced topics only for discussion)

Current contours:

Perron- Frobenius theorem and Google's page rank

TEXT BOOK(S)

1. Trembly. J.P & Manohar.P., "Discrete Mathematical Structures with Applications to Computer Science" McGraw- Hill, 2003.
2. Liu, C.L., "Elements of Discrete Mathematics", McGraw-Hill Book co, 1985.

UNIT I - Chapter 2 of [1], Chapter 4 of [2], Chapter 2 of [3]

UNIT II- Chapter 1 of [1]

UNIT III - Chapter 4 of [1]

UNIT IV - Chapter 4 of [1]

UNIT V - Chapter 2 of [2]

REFERENCE BOOK(S)

1. Kolman, Busy & Ross, "Discrete Mathematical Structures", PHI, 1996.
2. K.D Joshi,"Foundations of Discrete Mathematics", Wiley Eastern Limited,2003
3. Seymour Lipschutz, M.Lipson:"Discrete Mathematics",McGraw-HillEdition.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Construct mathematical arguments using logical connectives and quantifiers	K1
CO 2	Validate and correctness of an argument using statement and predicate calculus	K2
CO 3	Understand how lattices and Boolean algebra are used as tools and mathematical models in the study of networks	K3
CO 4	Learn how to work with some of the discrete structures which include sets, relations, function, graphs and recurrence relation	K3
CO 5	Discuss the theory of inference, quantifiers, predicate calculus	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I	24PMM1E1A		CEC-1A: DISCRETE MATHEMATICS							5	4
Couse outcomes	Programme outcomes(Pos)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1E1B	CEC-I: COMBINATORICS	5	4

Objectives:

To introduce the notion of different types of distributions of objects and generating functions and study the Polya's enumeration theorems

UNIT I (15 Periods)

Permutations and combinations - distributions of distinct objects - distributions of non distinct objects - Stirlings formula

UNIT II (15 Periods)

Generating functions - generating function for combinations - enumerators for permutations - distributions of distinct objects into non-distinct cells -partitions of integers – the Ferrer's graphs - elementary relations

UNIT III (15 Periods)

Recurrence relation - linear recurrence relations with constant coefficients solutions by the technique of generating functions - a special class of nonlinear difference equations - recurrence relations with two indice

UNIT IV (15 Periods)

The Principle of inclusion and exclusion - general formula - permutations with restriction on relative positions - derangements - the rook polynomials - permutations with forbidden positions

UNIT V (15 Periods)

Polya's theory of counting - equivalence classes under a permutation group Burnside theorem - equivalence classes of functions - weights and inventories of functions - Polya' s fundamental theorem – generation of Polya's theorem.

TEXT BOOK(S)

1. Introduction of Combinatorial Mathematics, C.L. Liu, McGraw Hill, 1968

UNIT I - Chapter 1

UNIT II - Chapter 2

UNIT III - Chapter 3

UNIT IV - Chapter 4

UNIT V - Chapter 5

BOOKS FOR REFERENCE

1. Combinatorial Theory, Marshall Hall Jr.,John Wiley & Sons, second edition.
2. Combinatorial Mathematics, H.J. Rayser, Carus Mathematical Monograph, No.14.

Semester	Course code	Title of the course	Hours	Credits
I	24PMM1VAC	LATEX	3	2

Objectives: To make the students learn the art of typing mathematics text on their own. To include professional training required to become a scholar in mathematics.

UNIT I (9 Periods)

Basic structure of Latex 2e- Input file structure – Layout- Editors- Forward search- Inverse search- Compling - Conversion to various formats.

UNIT II (9 Periods)

Typesetting simple documents- sectioning- Titles- Page layout- listing- enumerating- quote- letter formula.

UNIT III (9 Periods)

Using package amsmath typing equations labeling and refreing.

UNIT IV (9 Periods)

Figure inclusion- Table inclusion.

UNIT V (9 Periods)

Bibliaography- Index typing – Beamer presentation styles.

UNIT VI (Advanced topics only for discussion)

Current contours:

Type a mathematical article using various journal style files.

TEXT BOOK(S)

1. Leslie Lamport. Latex: A document preparation system, Addison-wesley, Reading, Massachusetts, second edition, 1994.

REFERENCE BOOK(S)

1. Tobias Oetiker, Hubert partl, Irene Hyna and Elisabeth Schlegl., The (Not so) short introduction to LATEX2e, samurai media limited (or available online at http.//mirrors.ctan.org/info/Ishort/English/short. pdf).
2. Latex tutorials- A primer, indian Tex users group, available online at http.//www.tug.org/twg/mactex/tutorials/txtprimer-1.0.pdf.
3. Amsmath and geometry package available in Ctan org.

Course outcomes:

- Students can type their own mathematical article/ notes/ book/ journal paper/ project work.
- Will motivate them to meticulously prepare their own mathematical notes.
- Able to understand basic structure of Latex 2e and conversions of them to various formats.
- Use various style files and in particular amsmath, amsfont, ansthm.
- Understand how to align math equations, matrices etc.
- Utilize bibtex feature of including bibliographies and indexes

Semester	Course code	Title of the course	Hours	Credits
II	24PMM2C5	CC-V: LINEAR ALGEBRA	6	5

Objectives: To give the students a thorough knowledge of the various aspects of Linear Algebra and train the students in problem-solving as a preparatory for Competitive Exams

UNIT I (18 Periods)

Matrices: Systems of linear Equations - Matrices and Elementary Row operations - Row-reduced Echelon Matrices - Matrix Multiplication - Invertible Matrices -Bases and Dimension (Only revision of Vector spaces and subspaces)

UNIT II (18 Periods)

Linear Transformations: The algebra of linear transformations - Isomorphism of Vector Spaces -Representations of Linear Transformations by Matrices - Linear Functional– The Double Dual - The Transpose of a Linear Transformation.

UNIT III (18 Periods)

Algebra Of Polynomials: The algebra of polynomials - Lagrange Interpolation - Polynomial Ideals -The prime factorization of a polynomial - Commutative rings – Determinant functions.

UNIT IV (18 Periods)

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 V (18 Periods)

Diagonalization: Invariant subspaces - Simultaneous triangulation and simultaneous Diagonalization Direct - sum Decompositions - Invariant Direct sums – Primary Decomposition theorem.

UNIT VI (Advanced topics only for discussion)

Current contours:

Introduction to module theory

TEXTBOOK(S)

1. Kenneth Hoffman and Ray Alden Kunze, Linear Algebra, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2005.

UNIT I - Chapter 1 & 2 Section 1.2-1.6 and 2.3
UNIT II - Chapter 3
UNIT III - Chapter 4 & 5 Section 4.2 - 4.5 and 5.1 - 5.2
UNIT IV - Chapter 5 & 6 Section 5.3, 5.4 and 6.1 - 6.3
UNIT V - Chapter 6 Section 6.4 - 6.8

REFERENCE BOOK(S)

1. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice-Hall of India Ltd, 2004.
2. A.R. Rao, P. Bhimashankaram, Linear Algebra, Second Edition, Tata McGraw Hill, 2000.
3. V.Krishnamurthy,V.P.Mainra,J L.Arora,Introduction toLinear Algebra,East West Press Ltd, 1985.

Course Outcomes

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand the concept of linear equations matrices and elementary row operations	K1
CO 2	Relate the linear transformations by matrices	K2
CO 3	Learn Lagrange interpolation, commutative ring	K3
CO 4	Realize important of diagonalization and sum decompositions	K3
CO 5	Understand inner product spaces and their properties	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
II	24PMM2C5		CC-V: LINEAR ALGEBRA							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24PMM2C6	CC-VI: COMPLEX ANALYSIS	6	5

Objectives: To learn the various intrinsic concepts and the theory of Complex Analysis and study the concept of Analyticity, Complex Integration and Infinite Products in depth

UNIT I (18 Periods)

Elementary Point Set Topology: Sets and Elements – Metric Spaces – Connectedness –Compactness – Continuous Functions – Topological Spaces; Conformality: Arcs and Closed Curves – Analytic Functions in Regions – Conformal Mapping – Length and Area; Linear Transformations: The Linear Group – The Cross Ratio – Symmetry

UNIT II (18 Periods)

Fundamental theorems in complex integration: Line Integrals – Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk; Cauchy's Integral Formula: The Index of a Point with Respect to a Closed Curve – The Integral Formula – Higher Derivatives.

UNIT III (18 Periods)

Local Properties of Analytic Functions - Removable Singularities - Taylor's Theorem – Integral representation of the nth term - Zeros and Poles – Algebraic order of f(z) – Essential Singularity - The Local Mapping – The Open Mapping Theorem – The Maximum Principle.

UNIT IV (18 Periods)

The General Form of Cauchy's Theorem: Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions; The Calculus of Residues: The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals

UNIT V (18 Periods)

Harmonic Functions: Definition and Basic Properties – The Mean-value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle; Power series expansions-Weierstrass's Theorem – The Taylor Series – The Laurent Series;

UNIT VI (Advanced topics only for discussion)

Current contours:

Analytic continuation.

TEXT BOOK(S)

1. Lars V. Ahlfors, Complex Analysis, Third Ed. McGraw-Hill Book Company, Tokyo, 2013.

UNIT – I -Chapter 3 Section 1.1 to 1.6, 2.1 to 2.4, 3.1-3.3
UNIT – II -Chapter 4 Section 1.1 to 1.5, 2.1 to 2.3
UNIT – III -Chapter 4 Section 3.1, 3.2, 3.3, 3.4
UNIT – IV -Chapter 4 Section 4.1 to 4.7, 5.1 to 5.3
UNIT – V -Chapter 4 Section 6.1 to 6.5, and Chapter5 Section 1.1to 1.3

REFERENCE BOOK(S)

1. Serge Lang, Complex Analysis, Addison Wesley, 1977.
2. Karunakaran, Complex Analysis, Alpha Science international Ltd, Second Edition,2005.
3. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, NewDelhi, 1997.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Define and analyze limits and continuity for functions of complex variables	K1
CO 2	Evaluate complex cauchy's theorem for a rectangle	K2
CO 3	Understand the reflection principle	K3
CO 4	Evaluate chains and cycles and the calculus of residues	K3
CO 5	Explaining the concepts of local mapping theorem, caushy residue theorem and its application	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I	24PMM2C6		CC-II: COMPLEX ANALYSIS							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24PMM2C7	CC-VII: PARTIAL DIFFERENTIAL EQUATIONS	6	5

Objectives: To give an in-depth knowledge of solving partial differential equations and apply them in Scientific and Engineering problems and study the other aspects of PDE

UNIT I (18 Periods)

Partial differential equations- origins of first order Partial differential equations- Cauchy's problem for first order equations- Linear equations of the first order- Integral surfaces Passing through a Given curve- surfaces Orthogonal to a given system of surfaces - Nonlinear Partial differential equations of the first order.

UNIT II (18 Periods)

Cauchy's method of characteristics- compatible systems of first order equations - Charpits method- Special types of first order equations- Solutions satisfying given conditions- Jacobi's method

UNIT III (18 Periods)

Partial differential equations of the second order: The origin of second order equations–second order equations in Physics – Higher order equations in Physics - Linear partial differential equations with constant co-efficient- Equations with variable coefficients- Characteristic curves of second order equations

UNIT IV (18 Periods)

Characteristics of equations in three variables - The solution of Linear Hyperbolic equations -Separation of variables. The method of Integral Transforms – Non-Linear equations of the second order

UNIT V (18 Periods)

Laplace equation - Elementary solutions of Laplace's Equations-Families of equipotential Surfaces- Boundary value problems-Separation of variables –Problems with Axial Symmetry

UNIT VI (Advanced topics only for discussion)

Current contours:

Green's function-theory of distributions.

TEXT BOOK(S)

1. Ian N. Sneddon, Elements of Partial differential equations**,** Dover Publication –INC, New York, 2006.

UNIT I - Chapter 2 Sections 1 to 7
UNIT II - Chapter 2 Sections 8 to 13
UNIT III - Chapter 3 Sections 1 to 6
UNIT IV - Chapter 3 Sections 7 to 11
UNIT V - Chapter 4 Sections 2 to 6

REFERENCE BOOK(S)

1. M.D. Raisinghania, Advanced Differential Equations, S. Chand and company Ltd., New Delhi,2001
2. E.T. Copson**,** Partial Differential Equations, Cambridge University Press.
3. I.C.Evans,Partial differential equations, Graduate studies in mathematics vol.19 AMS, 1998

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Know the basics of origins of first order partial differential equations	K1
CO 2	Analyze the special types of first order equation	K2
CO 3	Solve the method of integral transforms	K3
CO 4	Represent the Laplace equation and boundary value problems	K3
CO 5	Finding the solutions of the heat equation, wave equation and the Laplace equation subject to boundary condition	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course						Hours	Credits
II	24PMM2C7		CC-VII: PARTIAL DIFFERENTIAL EQUATIONS						6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24PMM2C8	CC-VIII: FLUID DYNAMICS	6	4

Objectives: To give the students an introduction to the behavior of fluids in motion and the students a feel of the applications of Complex Analysis in the analysis of the flow of liquids.

UNIT I (18 Periods)

Real Fluids and Ideal Fluids - Velocity of a Fluid at a point – Streamlines and Path lines: Steady and Unsteady Flows – The Velocity potential – The Velocity vector – Local and Particle Rates of Change – The Equation of continuity – Worked examples – Acceleration of a Fluid – Conditions at a rigid boundary – General analysis of fluid motion – 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 equation of motion – Bernoulli's equation – Worked example.

UNIT II (18 Periods)

Discussions of a case of steady motion under conservative body forces – Some potential theorems – 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; Stokes stream function.

UNIT III (18 Periods)

Some Two- Dimensional Flows: Meaning of a Two- Dimensional Flow – Use of cylindrical polar co-ordinates – 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 (18 Periods)

The use of conformal Transformation and Hydro dynamical Aspects – Vortex rows. Viscous flow Stress components in a real fluid - relations between cartesian components of stress - Translational Motion of Fluid element – The Rate of Strain Quadraic and Principle Stresses – Some further properties of the rate of strain quardric - 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 (18 Periods)

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.

UNIT VI(Advanced topics only for discussion)

Current contours: Gas dynamics and magneto hydro dynamics.

TEXT BOOK(S)

1. Text Book of Fluid Dynamics by F.Chorlton , CBS Publishers & Distributors, New Delhi ,1985.

   UNIT I - Chapter 2 and Chapter 3 Section 3.1 to 3.6

   UNIT II - Chapter 3 Section 3.7to3.11 and chapter 4 Section 4.1, 4.2, 4.3, 4.5

   UNIT II - Chapter 5 Section 5.1 to 5.9 except 5.7

   UNIT IV - Chapter 5 Section 5.10, 5.12 and Chapter 8 Section 8.1 to 8.9

   UNIT V - Chapter 8 Section 8.10 to 8.16.

REFERENCE BOOK(S)

1. Computational Fluid Dynamics: An Introduction, J.F. Wendt J.D. Anderson, G. Degrez and E. Dick, Springer – Verlag, 1996.
2. Computational Fluid Dynamics, The Basics with Applicatios, J. D. Anderson, McGraw Hill,1995.
3. Mathematical Introduction to Fluid Dynamics, A.J. Chorin and A.Marsden Springer- Verlag, New York, 1993.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Differentiate the real fluids and ideal fluids	K1
CO 2	Discussion of some flows involving axial symmetry	K2
CO 3	Understanding the concept of stream function and some worked example	K3
CO 4	Obtain some solvable problems in viscous flow	K3
CO 5	Describe the principles of motion for fluids	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code	Title of the Course								Hours	Credits
II	24PMM2C8	CC-VIII: FLUID DYNAMICS								6	4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24PMM2I1	IBC: MATHEMATICS OF FINANCE	3	3

Objectives: To study the mathematical models through ODE and Difference equations and train the students to develop mathematical models in real life problems

UNIT I (9 Periods)

Mathematical Modeling through Ordinary Differential Equationsof First order**:** Linear Growth and Decay Models – Non-Linear Growth and Decay Models –Compartment Models – Dynamics problems – Geometrical problems.

UNIT II (9 Periods)

Mathematical Modeling through Systems of OrdinaryDifferential Equations of First Order: Population Dynamics – Epidemics – Compartment Models – Economics –Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III (9 Periods)

Mathematical Modeling through Ordinary Differential Equationsof Second Order: Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modeling through Linear Differential Equations of Second Order –Miscellaneous Mathematical Models.

UNIT IV (9 Periods)

Mathematical Modeling through Difference Equations: Simple Models – Basic Theory of Linear Difference Equations with ConstantCoefficients – Economics and Finance – Population Dynamics and Genetics –Probability Theory

UNIT V (9 Periods)

Mathematical Modeling through Graphs: Solutions that can be Modeled through Graphs – Mathematical Modeling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

TEXT BOOK(S)

1. J.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Delhi, 1988.

UNIT I - Chapter 2 Sections 2.1 to 2.6

UNIT II - Chapter 3 Sections 3.1 to 3.6

UNIT III - Chapter 4 Sections 4.1 to 4.4

UNIT IV - Chapter 5 Sections 5.1 to 5.5

UNIT V - Chapter 7 Sections 7.1 to 7.5

BOOK FOR REFERENCE

1. J. N. Kapur, Mathematical Models in Biology and Medicine, EWP New Delhi, 1985.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Analyze the mathematical modeling through ordinary differential equation	K1
CO 2	Compare the difference of planetary motion and circular motion	K2
CO 3	Determine the linear difference equations with constant coefficients	K3
CO 4	Illustrate mathematical modeling through graphs	K3
CO 5	Take an analytical approach to problem in their future endeavors	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
II	24PMM2I1		IBC: MATHEMATICAL FINANCE							3	3
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24PPH2N1A	**NME-I PHYSICS IN EVERYDAY LIFE**	3	2

Objective: To understand the concepts connection in day today life as physics aspects.

UNIT I: (6 Periods)

Physics in Earth's Atmosphere: Sun, Earth's atmosphere as an ideal gas; Pressure, temperature and density, Pascal's Law and Archimedes' Principle, Coriolis acceleration and weather systems, Rayleigh scattering, Red sunset. Reflection, refraction and dispersion of light, Total internal reflection, Rainbow.

UNIT II: (6 Periods)

Physics in Human Body: The eyes as an optical instrument. Vision defects, Rayleigh criterion and resolving power, Sound waves and hearing. Sound intensity, Decibel scale, and temperature control.

UNIT III: (6 Periods)

Physics in Sports: The sweet spot, Dynamics of rotating objects, Running, Jumping and pole vaulting. Motion of a spinning ball, Continuity and Bernoulli equations, Banana shot: Magnus force, Turbulence and drag.

UNIT IV: (6 Periods)

Physics in Technology: Microwave ovens, Lorentz force, Global Positioning System, CCDs. Lasers, Displays, Optical recording, CD, DVD Player, Tape records, Electric motors, Hybrid car, Telescope, Microscope, Projector etc.

UNIT V: (6 Periods)

Physics in Digital Access Devices: Digital computer Internet access - Online ticket reservation Functions and networks - Barcode Scanner and decoder - Electronic Fund Transfer -Automated Teller Machines (ATMs) - Set- Top boxes - Digital cable TV - Video on demand.

UNIT VI: Green Energy

Electricity as energy-Electromagnetic Induction-thermal power generation-Heat engine-nuclear power-solar power-wind power-biofuels

TEXT BOOK(S)

1. University Physics by F. W. Sears, M. Zemansky. R. A. Freedman, and H. D. Young, Pearson Education
2. Fundamentals of Physics by D. Halliday, R. Resnick, J. Walker, John Wiley & Sons

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3C9	CC-IX: TOPOLOGY	6	5

Objectives: To study the concepts concerned with properties that are preserved under continuous deformations of objects and train the students to develop analytical thinking and the study of continuity and connectivity.

UNIT I (18 Periods)

Topological Spaces: Topological spaces - Basis for a topology - The order topology - The product topology on X &Y - The subspace topology - Closed sets and limit points.

UNIT II (18 Periods)

Continuous Functions: Continuous functions - the product topology - The metric topology.

UNIT III (18 Periods)

Connectedness: Connected spaces- connected subspaces of the Real line - Components and local connectedness.

UNIT IV (18 Periods)

Compactness: Compact spaces - compact subspaces of the Real line - Limit Point Compactness –Local Compactness.

UNIT V (18 Periods)

Countability And Separation Axioms: The countability Axioms - The separation Axioms - Normal spaces - The Urysohn Lemma - The Urysohn metrization Theorem - The Tietz extension theorem.

UNIT VI(Advanced topics only for discussion)

Current contours: Elementary concepts from algebraic topology.

TEXT BOOK(S)

1. James R. Munkres, Topology (2nd Edition) Pearson Education Pvt. Ltd., New Delhi-2002 (Third Indian Reprint).

UNIT I - Chapter 2 Sections 12 to 17

UNIT II - Chapter 2 Sections 18 to 21 (Omit Section 22)

UNIT III - Chapter 3 Sections 23 to 25.

UNIT IV - Chapter 3 Sections 26 to 29.

UNIT V - Chapter 4 Sections 30 to 35.

REFERENCE BOOK(S)

1 .J. Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.

2 .L. Steen and J. Seeback, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.

3. J. L. Kelly, "General topology", Van Nostrand Reinhold Co., New York.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand basic properties of R, Such as its characterization as a complete and ordered field.	K1
CO 2	Classify and explain upper and lower limits, test of convergence, power series.	K2
CO 3	Recognize the difference between continuous and discontinuous	K3
CO 4	Determine the integration and differentiation and weierstras theorem and the implicit function theorem	K3
CO 5	Remembering the upper and lower integrals and the Riemann conditions	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
III	24PMM3C9		CC-IX: TOPOLOGY							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3C10	CC-X: MEASURE THEORY AND INTEGRATION	6	5

Objectives: To generalize the concept of integration using measures and develops the concept of analysis in abstract situations

UNIT I (18 Periods)

Measure on Real line - Lebesgue outer measure - Measurable sets - Regularity - Measurable function - Borel and Lebesgue measurability

UNIT II (18 Periods)

Integration of non-negative functions - The General integral - Integration of series - Riemann and Lebesgue integrals.

UNIT III (18 Periods)

Abstract Measure spaces - Measures and outer measures - Completion of a measure - Measure spaces - Integration with respect to a measure

UNIT IV (18 Periods)

Convergence in Measure- Almost uniform convergence - Signed Measures and Halin Decomposition - The Jordan Decomposition

UNIT V (18 Periods)

Measurability in a Product space – The product Measure and Fubini's Theorem

UNIT VI(Advanced topics only for discussion)

Current contours:

Riesz- Markov Kakutani theorem.

TEXT BOOK(S)

1. G. De Barra, Measure Theory and Integration, New age international (p) Limited.

   UNIT I - Chapter 2 Sections 2.1 to 2.5

   UNIT II - Chapter 3 Sections 3.1 to 3.4

   UNIT III - Chapter 5 Sections 5.1 to 5.6

   UNIT IV - Chapter 7 Sections 7.1and7.2,Chapter 8Sections 8.1 and 8.2

   UNIT V - Chapter 10 Sections 10.1 and 10.2

REFERENCE BOOK(S)

1. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited Publishers, New Delhi, 1986, Reprint 2000.
2. Richard L. Wheeden and AntoniZygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
3. Inder,K.Rana,AnIntroduction to Measure and Integration,Narosa publishing House, New Delhi, 1997.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand the lebesgue out measure	K1
CO 2	Evaluate the abstract measure spaces	K2
CO 3	Define signed measures and halin decomposition	K3
CO 4	Analysis the product measure and fubini's theorem	K3
CO 5	Understanding basic concepts of measure and integration	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course					Hours		Credits
III	24PMM3C10		CC-X: MEASURE THEORY AND INTEGRATION					6		5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3C11	CC-XI: CLASSICAL DYNAMICS	5	4

Objectives: To give a detailed knowledge of the mechanical system of particles and study the applications of Lagrange's and Hamilton's equations

UNIT I (15 Periods)

Introductory concepts: The mechanical system - Generalized Coordinates - constraints - virtual work - Energy and momentum.

UNIT II (15 Periods)

Lagrange's equation: Derivation and examples - Integrals of the Motion – Small oscillations.

UNIT III (15 Periods)

Special Applications of Lagrange's Equations: Rayleigh's dissipation function - impulsive motion - Gyroscopic systems - velocity dependent potentials.

UNIT IV (15 Periods)

Hamilton's equations: Hamilton's principle - Hamilton's equations – Other variational principles - phase space

UNIT V (15 Periods)

Hamilton - Jacobi Theory: Hamilton's Principal Function – The Hamilton - Jacobi equation - Separability.

UNIT VI(Advanced topics only for discussion)

Current contours:

Introduction to relativity.

TEXT BOOK(S)

1. Donald T. Greenwood, Classical Dynamics, PHI Pvt. Ltd., New Delhi-1985

UNIT I - Chapter 1 Sections 1.1 to 1.5

UNIT II - Chapter 2 Sections 2.1 to 2.4

UNIT III - Chapter 3 Sections 3.1 to 3.4

UNIT IV - Chapter 4 Sections 4.1 to 4.4

UNIT V - Chapter 5 Sections 5.1 to 5.3

REFERENCE BOOK(S)

1. H. Goldstein, Classical Mechanics, (2nd Edition), Narosa Publishing House, New Delhi
2. Narayan Chandra Rana & Promod Sharad Chandra Joag, Classical Mechanics, Tata Mc Graw Hill, 1991.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Realize the mechanical system and applications of lagrange's	K1
CO 2	Solve the derivation and examples of lagrange's equation	K2
CO 3	Understanding the concept of hamilton's equations	K3
CO 4	Understand the dynamical system based on the laws governing oscillations	K3
CO 5	Understand the motion of a mechanical system using langrange Hamilton formalism.	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
III	24PMM3C11		CC-XI: CLASSICAL DYNAMICS							5	4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3C12	CC-XII: CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	5	4

Objectives: To introduce the concept of calculus of variations and integral equations and their applications and study the different types of transforms and their properties.

UNIT I (15 Periods)

Calculus of variations – Maxima and Minima – the simplest case – Natural boundary and transition conditions - variational notation – more general case – constraints and Lagrange's multipliers – variable end points – Sturm - Liouville problems.

UNIT II (15 Periods)

Fourier transform - Fourier sine and cosine transforms - Properties Convolution - Solving integral equations - Finite Fourier transform - Finite Fourier sine and cosine transforms - Fourier integral theorem - Parseval's identity.

UNIT III (15 Periods)

Hankel Transform -Definition – Inverse formula – Some important results for Bessel function – Linearity property – Hankel Transform of the derivatives of the function – Hankel Transform of differential operators – Parseval's Theorem

UNIT IV (15 Periods)

Linear Integral Equations - Definition, Regularity conditions – special kind of kernels – eigen values and eigen functions – convolution Integral – the inner and scalar product of two functions – Notation – reduction to a system of Algebraic equations – examples – Fredholm alternative - examples – an approximate method.

UNIT V (15 Periods)

Method of successive approximations: Iterative scheme – examples – Volterra Integral equation – examples – some results about the resolvent kernel. Classical Fredholm Theory: the method of solution of Fredholm – Fredholm's first theorem – second theorem – third theorem.

UNIT VI (Advanced topics only for discussion)

Current contours:

Variational problems in fluid flow and heat transfer.

TEXT BOOK(S)

1. Ram.P.Kanwal – Linear Integral Equations Theory and Practise, Academic Press1971.
2. F.B. Hildebrand, Methods of Applied Mathematics II ed. PHI, ND 1972
3. A.R. Vasishtha, R.K. Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2002.

UNIT I - Chapter 2 Sections 2.1 to 2.9 of [2]

UNIT II - Chapter 7 of [3]

UNIT III - Chapter 9 of [3]

UNIT IV - Chapters 1 and 2 of [1]

UNIT V - Chapters 3 and 4 of [1]

REFERENCE BOOK(S)

1. S.J. Mikhlin, Linear Integral Equations (translated from Russian), Hindustan Book Agency, 1960.
2. I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966.
3. L.Elsgolts,differential equation and the calculus of variation ,university press of the pacific ,2003.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Realize the importance of calculus of variations and some general case	K1
CO 2	Compare Fourier sine and cosine transforms and finite Fourier transforms	K2
CO 3	Calculate the Henkel transforms of the derivatives of the function	K3
CO 4	Solve the method of successive approximations by using iterative scheme	K3
CO 5	Solve boundary values problem through integral equation using green's function	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code	Title of the Course					Hours	Credits			
I	24PMM3C12	CC-II: CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS					5	4			
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3E2A	CEC-II: FUZZY MATHEMATICS	5	4

Objectives: To introduce the notion of Fuzzy numbers and Fuzzy relation.

UNIT I (15 Periods)

Fuzzy sets – Basic types – Basic concept – α-cuts – Additional properties of α-cuts – Extension principle for Fuzzy sets

UNIT II (15 Periods)

Operations on Fuzzy sets – Types of operations – Fuzzy complements – t-Norms– Fuzzy Unions – Combinations of operations.

UNIT III (15 Periods)

Fuzzy Arithmetic – Fuzzy numbers – Arithmetic operations on intervals –Arithmetic operations on Fuzzy numbers.

UNIT IV (15 Periods)

Fuzzy relations – Binary fuzzy relations – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy ordering relations – fuzzy morphisms

UNIT V (15 Periods)

Fuzzy Relation Equations – General discussion – Problem partitioning – Solution method – Fuzzy Relation Equations based on Sup-i Compositions – Fuzzy Relation Equations based on inf-ωi Compositions.

UNIT VI(Advanced topic only for discussion)

Current contours: Discuss about fuzzy logic and fuzzy set theory.

TEXT BOOK(S)

1. George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 2004.

UNIT I - Chapter 1 Sections 1.4; Chapter 2 Sections 2.1 & 2.3

UNIT II - Chapter 3 Sections 3.1 to 3.5

UNIT III - Chapter 4 Sections 4.1 to 4.4

UNIT IV - Chapter 5 Sections 5.3 to 5.8

UNIT V - Chapter 6 Sections 6.1 to 6.5

REFERENCE BOOK(S)

1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited, New Delhi, 1991.

2. G.J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 1995

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understanding the concept of fuzzy sets and extension principle of fuzzy set	K1
CO 2	Appreciate the operation on fuzzy sets	K2
CO 3	Solve fuzzy relation and fuzzy Morphism	K3
CO 4	Solve fuzzy relation equation based on sup-i compositions	K3
CO 5	Find crisp and fuzzy set and discuss the types of fuzzy sets	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
IV	24PMM3E2A		CEC-2A: FUZZY MATHEMATICS							5	4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3E2B	CEC-III: PYTHON PROGRAMMING	5	4

Objective: To acquire Object Oriented Skills in Python.

UNIT I (15Periods)

Introduction, what is Python, Origin, Comparison, Comments, Operators, Variables and Assignment, Numbers, Strings, Lists and Tuples, Dictionaries, if Statement, while Loop, for Loop, and the range () Built-in Function, Variable Assignment, Identifiers, Basic Style Guidelines, Memory Management, Python Application Examples.

UNIT II: (15Periods)

Python Objects, Standard Types, Other Built-in Types, Numbers and Strings. Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions. Sequences: Strings, Lists, and Tuples, Sequences, Strings, Strings and Operators, String-only Operators, Built-in Functions, String Built-in Methods, Special Features of String.

UNIT III (15Periods)

Interpolation: Lagrange Polynomial interpolation – Newton's polynomial interpolation – Root Finding: Bijection method – Newton Rapson Method.

UNIT IV (15Periods)

Ordinary Differential Equations: Initial value Problems – Boundary value Problems Fourier Transforms: Fourier series.

UNIT V (15Periods)

Regression: Least square Regression - Eigenvalue and Eigenvectors

UNIT VI (Advanced topics only for discussion)

Current contours:

Discuss about topic in algebra, calculus and matrix analysis.

TEXT BOOK:

1. Mark Lutz, Learning Python, O'Reilly Media Inc, Fourth Edition, 2000

REFERENCE BOOK(S)

1. Qingkai Kong, Timmy Siauw, Alexandre Bayen, Python Programming and Numerical Methods, Edition 1, 2020.
2. Joakim Sundnes, Introduction to Scientific Programming with Python, Simula Springer Briefs on Computing, Volume 6, 2020
3. Jeeva Jose and P.Sojan Lal, "Introduction to computing and Problem Solving with PYTHON" Khanna Book Publishing Co,2016.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Construct mathematical arguments using logical connectives and quantifiers	K1
CO 2	Validate and correctness of an argument using statement and predicate calculus	K2
CO 3	Understand how lattices and Boolean algebra are used as tools and mathematical models in the study of networks	K3
CO 4	Learn how to work with some of the discrete structures which include sets, relations, function, graphs and recurrence relation	K3
CO 5	Discuss the theory of inference, quantifiers, predicate calculus	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code	Title of the Course								Hours	Credits
IV	24PMM3E2B	CEC-II: PYTHON PROGRAMMING								5	4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24PMM3N2B	**NME-II** SOLAR ENERGY AND ITS UTILIZATION	3	2

Unit-I: (9 Periods)

Solar Energy Fundamentals Introduction conduction convection radiation structure of sun- solar constant electromagnetic energy spectrum-terms and definitions - solar radiation at earth's surface- solar radiation geometry - solar radiation measuring instruments-solar data-solar angles - day length-angle of incidence on tilted surface.

Unit-II: (9 Periods)

Solar Energy conversion system: Solar energy applications essential subsystems in solar energy conversion system - solar energy chain sun path diagram shadow determination - extraterrestrial characteristics - analysis of Indian solar radiation data.

Unit-III: (9 Periods)

Solar collectors: Concentrating collectors - Flat plate collector and evacuated tube collector - characteristic features of collector - selective surfaces- ideal coating characteristics-collector efficiency - types of energy storage system.

Unit - IV: (9 Periods)

Solar Heating and cooling systems: Liquid based solar heating system- natural, forced and gravity flow, mathematical, modelling - solar desiccant cooling solar thermal storage sensible storage- latent heat storage thermo- chemical storage solar still solar cooker - solar pond - solar passive heating and cooling systems - Green house technology - Fundamentals - design - modelling and applications.

Unit-V: (9 Periods)

Solar PV technology: Solar cell physics - P-N junction: homo and hetero junctions, Metal-semiconductor interface - dark and illumination characteristics- figure of merits of solar cell - efficiency limits variation of efficiency with band gap and temperature efficiency measurements high efficiency cells - Tandem structure.

Unit - VI: Solar PV applications:

SPV applications- centralized and decentralized SPV systems - stand alone - hybrid - grid connected system - system installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems - Government schemes and policies.

References:

1. Solar Energy Utilization-G.D. Rai-Khanna Publications
2. Solar Energy-SP Sukathme, Tata Mc Graw Hill, 2008
3. Solar Energy: Fundamentals & Applications - Garg HP & Prakash J- Tata Mc Graw Hill, New Delhi
4. Solar Thermal Engineering System - Tiwari GN, Narosa Publishing House
5. Solar Cells and their applications - Lary D Partin- John Wiley and Sons, New York 1995

Course outcome:

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understood the Solar Energy Fundamentals	K2
CO 2	To know about Solar Heating and cooling systems	K3
CO 3	Understood the solar collector concept	K3
CO 4	Studied the types of energy storage system	K4
CO 5	Understood the applications	K4

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	M	S
CO 2	S	S	S	S	S
CO 3	M	S	M	S	S
CO 4	S	M	S	S	M
CO 5	M	S	S	M	S

S- Strong, M- Medium, L- Low

Semester	Course code	Title of the course	Hours	Credits
IV	24PMM4C13	CC-XIII: FUNCTIONAL ANALYSIS	6	5

Objectives: To study the three structure theorems of Functional Analysis viz., Hahn-Banach theorem, Open mapping theorem and Uniform boundedness principle and introduce Hilbert spaces and operator theory leading to the spectral theory of operators on a Hilbert space.

UNIT I (18 Periods)

Algebraic Systems: Groups – Rings – The structure of rings – Linear spaces – The dimension of a linear space – Linear transformations – Algebras – Banach Spaces : The definition and some examples – Continuous linear transformations – The Hahn- Banach theorem – The natural imbedding of N in N** - The open mapping theorem –The conjugate of an operator

UNIT II (18 Periods)

Hilbert Spaces: The definition and some simple properties – Orthogonal complements – Orthonormal sets - The conjugate space H* - The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections

UNIT III (18 Periods)

Finite-Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator – The spectral theorem – A survey of the situation

UNIT IV (18 Periods)

General Preliminaries on Banach Algebras: The definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius – The radical and semi-simplicity

UNIT V (18 Periods)

The Structure of Commutative BanachAlgebras: The Gelfand mapping – Applications of the formula $r(x) = \lim \| x^n \|1/n$ - Involutions in Banach Algebras – The Gelfand- Neumark theorem.

UNIT VI(Advanced topics only for discussion)

Current contours:

Discussion on compact operators.

TEXT BOOK(S)

1. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill International Ed. 1963.

   UNIT I - Chapters 8 and 9

   UNIT II - Chapter 10

   UNIT III - Chapter 11

   UNIT IV - Chapter 12

   UNIT V - Chapter 13

REFERENCE BOOK(S)

1 Walter Rudin, Functional Analysis, TMH Edition, 1974.

2 B.V. Limaye, Functional Analysis, Wiley Eastern Limited, Bombay, Second Print, 1985.

3 M. Thamban Nair, Functional Analysis - A First Course, Prentice Hall of India, 2010.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understand basic properties of R, Such as its characterization as a complete and ordered field.	K1
CO 2	Classify and explain upper and lower limits, test of convergence, power series.	K2
CO 3	Recognize the difference between continuous and discontinuous	K3
CO 4	Determine the integration and differentiation and weierstras theorem and the implicit function theorem	K3
CO 5	Remembering the upper and lower integrals and the Riemann conditions	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
IV	24PMM4C13		CC-XIII: FUNCTIONAL ANALYSIS							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
IV	24PMM4C14	CC- XIV: DIFFERENTIAL GEOMETRY	6	5

Objectives: To introduce the notion of surfaces and their properties and study geodesics and differential geometry of surfaces

UNIT I (15 Periods)

Space Curves: Definition of a space curve - Arc length - tangent - normal and binormal– curvature and torsion - contact between curves and surfaces- tangent surface- involutes and evolutes- Intrinsic equations - Fundamental Existence Theorem for space curves - Helics

UNIT II (15 Periods)

Intrinsic Properties of a Surface: Definition of a surface - curves on a surface - Surface of revolution -

UNIT III (15 Periods)

Helicoids -Metric- Direction coefficients - families of curves- Isometric correspondence- Intrinsic properties

UNIT IV (15 Periods)

Geodesics: Geodesics - Canonical geodesic equations - Normal property of geodesics- Existence Theorems - Geodesic parallels - Geodesics curvature- Gauss- Bonnet Theorem - Gaussian curvature- surface of constant curvature.

UNIT V (15 Periods)

Non-Intrinsic Properties of a Surface: The second fundamental form- Principal curvature - Lines of curvature - Developable –Developable associated with space curves and with curves on surface – Minimal surfaces - Ruled surfaces.

UNIT VI (Advanced topics only for discussion)

Current contours: The Gauss Bonet theorems.

TEXT BOOK(S)

1. T.J. Willmore, An Introduction to Differential Geometry, Oxford University Press, (17thImpression) New Delhi 2002. (Indian Print).

UNIT I - Chapter 1 Sections 1 to 9

UNIT II - Chapter 2 Sections 1 to 3

UNIT III - Chapter 2 Sections 4 to 9

UNIT IV - Chapter 2 Sections 10 to 18

UNIT V - Chapter 3 Sections 1 to 8

REFERENCE BOOK(S)

1. Wihelm Klingenberg: A course in Differential Geometry, Graduate Texts in Mathematics, Springer Verlag, 1978.
2. J.A. Thorpe Elementary topics in Differential Geometry, Under - graduate Texts in Mathematics, Springer - Verlag 1979.
3. Struik, D.T. Lectures on Classical Differential Geometry, Addison - Wesley,Mass. 1950.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	Understanding the concept of space curves and contact between curves and surfaces	K1
CO 2	Represent the intrinsic properties of a surface	K2
CO 3	Know the geodesics and canonical geodesic equations	K3
CO 4	Plan and deliver the non intrinsic properties of a surface	K3
CO 5	Understand the physical system involved in partial differential equation	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I	24PMM4C14		CEC-1B: DIFFERENTIAL GEOMETRY							6	5
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
IV	24PMM4E3A	CEC III : NUMERICAL ANALYSIS	5	4

Objectives: To know the theory behind various numerical methods and to apply these methods to solve mathematical problems

UNIT I (18 Periods)

Transcendental and polynomial equations: Rate of convergence – Secant Method, Regula Falsi Method, Newton Raphson Method, Muller Method and Chebyshev Method. Iterative Methods: Birge-Vieta method, Bairstow's method -Direct Method: Graeffe's root squaring method.

UNIT II (18 Periods)

System of Linear Algebraic equations: Error Analysis of Direct methods – Operational count of Gauss elimination, Vector norm, Matrix norm, Error Estimate. Iteration methods - Jacobi iteration method, Gauss Seidel Iteration method, Successive Over Relaxation method - Convergence analysis of iterative methods, Optimal Relaxation parameter for the SOR method.

UNIT III (18 Periods)

Interpolation and Approximation: Hermite Interpolations, Piecewise and Spline Interpolation –piecewise linear interpolation, piecewise quadratic interpolation, piecewise cubic interpolation, spline interpolation-cubic Spline interpolation. Bivariate Interpolation - Lagrange Bivariate interpolation. Least square approximation

UNIT IV (18 Periods)

Differentiation and Integration: Numerical Differentiation – Optimum choice of Step length – Extrapolation methods – Partial Differentiation. Numerical Integration: Methods based on undetermined coefficients - Gauss Legendre Integration method and Lobatto Integration Methods only.

UNIT V (18 Periods)

Ordinary differential equations – Single step Methods: Local truncation error or Discretization Error, Order of a method, Taylor Series method, Runge-Kutta methods: Explicit Runge–Kutta methods– Minimization of Local Truncation Error, System of Equations, Implicit Runge-Kutta methods. Stability analysis of single step methods (RK methods only)

UNIT VI (Advanced topics only for discussion)

Current contours: Method for partial differential equations.

TEXT BOOK(S)

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International (p) Limited Publishers, New Delhi, Third Edition 2012
   UNIT I - Chapter 2 Section 2.5 & 2.8
   UNIT II - Chapter 3 Section 3.3, 3.4
   UNIT III - Chapter 4 Section 4.4 - 4.7 & 4.9
   UNIT IV - Chapter 5 Section 5.2 - 5.6 & 5.8
   UNIT V - Chapter 6 Section 6.3 & 6.6

REFERENCE BOOK(S)

1. Kendall E. Atkinson, An Introduction to Numerical Analysis, II Edn., John Wiley & Sons, 1988.
2. M.K. Jain, Numerical Solution of Differential Equations, II Edn., New Age International Pvt Ltd., 1983.
3. Samuel. D. Conte, Carl. De Boor, Elementary Numerical Analysis, Mc Graw-Hill International Edn., 1983.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO 1	To calculate the transcendental and polynomial equation	K1
CO 2	Determine the system of linear algebraic equation	K2
CO 3	Classify numerical differentiation and numerical integration	K3
CO 4	Solve the ordinary differential equations using singsletep method	K3
CO 5	Research numerical solution of differential equation system	K4

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
IV	24PMM4E3A		CC-XIV: NUMERICAL ANALYSIS							5	4
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	1	2	2	2	2	3	2	2	3	2	2.3
CO-5	2	2	2	1	3	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
IV	24PMM4E3B	**CEC III : AUTOMATA THEORY**	5	4

Objectives:

To make the students to understand the nuances of Automata and Grammar and make them to understand the applications of these techniques in computer science

UNIT I (15 Periods)

Finite Automata and Regular expressions: Definitions and examples - Deterministic and Nondeterministic finite Automata - Finite Automata with -moves.

UNIT II (15 Periods)

Context free grammar: Regular expressions and their relationship with automation - Grammar - Ambiguous and unambiguous grammars - Derivation trees – Chomsky Normal form.

UNIT III (15 Periods)

Pushdown Automaton: Pushdown Automaton - Definition and examples - Relation with Context free languages.

UNIT IV (15 Periods)

Finite Automata and lexical analysis: Role of a lexical analyzer - Minimizing the number of states of a DFA - Implementation of a lexical analyzer.

UNIT V (15 Periods)

Basic parsing techniques: Parsers - Bottom up Parsers - Shift reduce - operator precedence - Top down Parsers - Recursive descent - Predictive parsers.

TEXT BOOK(S)

1. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata theory, Languages and Computations, Narosa Publishing House, Chennai, 2000.
2. A.V. Aho and Jeffrey D. Ullman, Compiler Design, Narosa Publishing House, Chennai, 2002

UNIT I - Chapter 2 Sections 2.1 - 2.4 [1]

UNIT II - Chapter 2 Section 2.5, Chapter 4 Sections 4.1 - 4.3, 4.5, 4.6 [1]

UNIT III - Chapter 5 Section 5.2, 5.3 [1]

UNIT IV - Chapter 3 Section 3.1 - 3.8 [2]

UNIT V - Chapter 5 Section 5.1 - 5.5 [2]

BOOKS FOR REFERENCE

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Second
Edition, Prentice Hall, 1997

2. A.V. Aho, Monica S. Lam, R. Sethi, J.D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Addison-Wesley, 2007