KUNTHAVAI NAACCHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN

An Autonomous College Affiliated to Bharathidasan UniversityRe-Accredited by NAAC with 'B' Grade

Thanjavur - 613 007, Tamil Nadu, India.

CBCS & OBE
Scheme of Instruction and Syllabus for

M.Sc., Mathematics

(Semester : I to IV)

Effective from 2022 - 2023 and onwards

PG & RESEARCH

DEPARTMENT OF MATHEMATICS

KUNTHAVAI NAACHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS)

PG DEPARTMENT OF MATHEMATICS

I . VISION

- To be a goal centers of excellent in mathematics for the growth of science.

II . MISSION

- To provide quality education and research in mathematics through updated curriculum and effective teaching learning process .
- To create stakeholders with both basic and applied mathematical knowledge.
- To create post graduate with strong skill and knowledge of mathematics.

III. PROGRAM OUTCOME(PO)

After completing the M.Sc Programme the students will be able to:

PO 1: Mastery of fundamental concepts of Algebra, Analysis , Geometry, measure, graph and probability theory.

PO2: Introduction to various courses like Fourier analysis, Fluid Dynamics, Mathematical Modelling and Probability Theory.

PO 3 : Communicate mathematical concepts effectively.

PO 4 : Analyze and model in real world problems based on mathematical principles.

PO 5 : Students will be able to strong in logical thinking and reasoning to solve any problems.

PO 6 : To use ICT mathematics teaching in mathematical modeling and probability theory.

PO 7 : Evaluate hypothesis, theories, methods and evidence within their proper contexts.

PO 8 : Assist students in preparing for competitive exam, NET, GATE, etc.,

PO 9 : Ability to carry out extended investigation of mathematical work as various projects independently.

PO 10 : Completion of this programme will also enable learners to join teaching profession.

IV. PROGRAMME STRUCTURE

M.Sc Mathematics Course CBSC Structure with OBE for the candidates admitted 2022 – 2023

Semester	Course	Subject Code	Title of the Paper	Inst. Hrs.	Credit	Exam. Hrs.	Marks		Total
							Int.	Ext.	
I	CC 1	22KP1M01	Algebra	6	5	3	25	75	100
	CC 2	22KP1M02	Real Analysis	6	5	3	25	75	100
	CC 3	22KP1M03	Ordinary and Partial Differential Equations	6	4	3	25	75	100
	CC 4	22KP1M04	Graph Theory	6	5	3	25	75	100
	MBE 1	22KP1MELM1:1	Differential Geometry	6	4	3	25	75	100
		22KP1MELM1:2	Algebraic Number Theory						
				30	23		125	375	500
II	CC 5	22KP2M05	Complex Analysis	6	4	3	25	75	100
	CC 6	22KP2M06	Linear Algebra	6	5	3	25	75	100
	CC 7	22KP2M07	Topology	7	5	3	25	75	100
	CC 8	22KP2M08	Classical Dynamics	7	5	3	25	75	100
	NME 1	22KP2MEL01	Numerical Methods and Operations Research	4	3	3	25	75	100
	ECC1	22KP2ECCM1:1	CSIR - NET / SET Preparatory Course I		3*	3	-	100	100
		22KP2ECCM1:2	MOOC (Value Added)						
	ECC2	22KP2ECCM2	Introduction to LATEX (Add on Course)	-	4*	-	-	-	-
				30	22		125	475	500
III	CC 9	22KP3M09	Measure and Integration	7	5	3	25	75	100
	CC 10	22KP3M10	Stochastic Processes	6	5	3	25	75	100
	CC 11	22KP3M11	MATLAB Programming	6	5	3	25	75	100
	MBE 2	22KP3MELM2:1	Operations Research	7	4	3	25	75	100
		22KP3MELM2:2	Non Linear Differential Equations						
	NME 2	22KP3MEL02	Optimization Techniques	4	3	3	25	75	100
	ECC3	22KP3ECCM3:1	CSIR - NET / SET Preparatory Course II		3*	3	-	100	100
		22KP3ECCM3:2	MOOC (Value Added)						
				30	22		125	375	500
IV	CC 12	22KP4M12	Functional Analysis	6	5	3	25	75	100
	CC 13	22KP4M13	Integral Equations, Calculus of Variations and Transforms	6	5	3	25	75	100
	CC 14(P)	22KP4M14P	MATLAB Programming Practical	6	4	3	40	60	100
	MBE 3	22KP4MELM3:1	Fuzzy Sets and its Applications.	6	4	3	25	75	100
		22KP4MELM3:2	Fourier Analysis						
	Project Work	22KP4M15PW	Project Work	6	5		-	100	100
				30	23		115	385	500
				120	90		490	1510	2000

**ECC – Extra Credit Course 1,2,3 : Total credits 10.*

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V. ELECTIVES

M.Sc Mathematics – List of Elective Courses 2022 – 2023

Semester I	Major Based Elective I	Subject Code
MBE 1	Differential Geometry	22KP1MELM1:1
	Algebraic Number Theory	22KP1MELM1:2
Semester III	**Major Based Elective II**	**Subject Code**
MBE 2	Operations Research	22KP3MELM2:1
	Non-Linear Differential Equations	22KP3MELM2:2
Semester IV	**Major Based Elective III**	**Subject Code**
MBE 3	Fuzzy sets and its applications	22KP4MELM3:1
	Fourier Analysis	22KP4MELM3:2

Add on Course: Semester II : Introduction to LATEX .

M.Sc Mathematics – List of Non – Major Elective Courses 2022 – 2023

Semester I	Non -Major Based Elective I	Subject Code
NME 1	Numerical Methods and Operations Research	22KP2MEL01
Semester III	**Non- Major Based Elective II**	**Subject Code**
NME 2	Optimization Techniques	22KP3MEL02

VI. Details on the number of courses, Instruction Hours and Credits

Course	Course Title	No.of courses	Inst. Hours	Credits
Part III	Core Course 14(Theory) & 1(Project)	15	93	72
Part III	Major Based Elective	03	19	12
Part IV	NME	02	08	06
	Total	**20**	**120**	**90**
	ECC 1,2,3	**03**	**-**	**10**

VII. SEMESTER – WISE COURSE STRUCTURE

Semester	Course	Total Courses	Inst.Hours/week	Credits
I	CC, MBE	5	30	23
II	CC, NME,ECC	7	30	22
III	CC, MBE,NME,ECC	6	30	22
IV	CC, MBE	5	30	23

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2. S. Kirthi

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR -07.

SEM I	CC 1	ALGEBRA	22KP1M01	Inst Hour: 6	Credit: 5

Course Objectives : To facilitate a better understanding of Groups, Rings, Fields and describe the concept Sylow's theorem and Euclidean rings and to solve roots of polynomial, solvability of radicals.

CO	STATEMENT
1	Describe the concept of Group Theory and describe cayley's and sylow's theorem.
2	Express Ring theory , Ideals and Integral Domain.
3	Analyze the various types of polynomial rings and rational field.
4	Compute roots of various types of polynomials.
5	Analyze the fields and Galio's theory.

UNIT I : GROUP THEORY

A counting principle – Normal Subgroups and Quotient groups – Homomorphisms – Automorphisms. Cayley's theorem – Permutation groups – Another counting principle – Sylow's theorem.

Chapter 2: Sections 2.5, 2.6, 2.7, 2.8 ,2.9, 2.10, 2.11, 2.12

UNIT II : RING THEORY

Homomorphisms - Ideals and quotient rings – More ideals and quotient rings – The Field of Quotients of an Integral Domain - Euclidean Rings – A particular Euclidean Ring.

Chapter 3: Sections 3.3, 3.4, 3.5, 3.6,3.7, 3.8

UNIT III : POLYNOMIAL RINGS

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

Chapter 3: Sections 3.9, 3.10, 3.11

UNIT IV : FIELDS

Extension fields – Roots of Polynomials – More about roots.

Chapter 5 : Sections 5.1, 5.3, 5.5

UNIT V : FIELDS

The elements Galois theory – Solvability by Radicals – Finite Fields.

Chapter 5 : Sections 5.6,5.7; Chapter 7 : 7.1

UNIT VI : APPLICATIONS

Several techniques of linear algebra that are used for Physics, Computer science, Natural science, Computer animation and Social science. It is used is various applications Cryptography, Electrical circuits, Traffic flow, Genetics etc.,

Text Books

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

References

1. David S.Dummit and Richard M. Foote, Abstract Algebra, Third Edition, Wiley Student Edition, 2015.
2. John, B. Fraleigh, A First Course in Abstract Algebra, Addison – Wesley Publishing company.
3. Vijay, K. Khanna, and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 1993.
4. Joseph A.Gallian, Contemporary Abstract Algebra, Fourth Edition, Narosa Publishing House, 1999.

CO-PO Mapping with Programme Outcomes: **ALGEBRA** **Code : 22KP1M01**

CO / PO	1	2	3	4	5	6	7	8	9	10
1	3		3		2		1			
2				1	1				2	
3	1			1	2					
4			1	3					3	
5	1		1		2				2	

1-Low, 2- Moderate, 3 – High Correlation

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR -07.

SEM I	CC 2	REAL ANALYSIS	22KP1M02	Inst Hour: 6	Credit: 5

Course Objectives : The primary objective of this course is to understand the notion of basic topology and Numerical Sequences and Series, Differentiation, Riemann Stieltje's Integrals and functions of several variables.

CO	STATEMENT
1	Understand the basic concepts of topology such as finite, countable and uncountable sets, metric spaces, compact sets, perfect sets and connected sets.
2	Explain the concepts related to sequence, limits, series of non-negative terms, the number – e, power series, addition and multiplication of series.
3	Interpret the derivative of a real function, continuous functions and higher order derivatives and also explain L Hospital's rule and Taylor's Theorem.
4	Analyze the linear properties of Riemann stieltje's integral and the applications of the fundamental theorems of integration.
5	Express the concepts of functions of several variables, leads to the contraction principle, inverse function theorem, the rank theorem, derivatives of higher order.

UNIT I : BASIC TOPOLOGY

Finite, Countable and Uncountable sets – Metric spaces, Compact sets, Perfect sets, Connected sets.

Chapter 2 of Text Book 1

UNIT II : NUMERICAL SEQUENCES AND SERIES

Convergent Sequences – Subsequences – Cauchy Sequences – Upper and Lower Limits – Some Special sequences – Series: Series of Non-negative Terms – The Number e – The Root and Ratio Tests – Power Series – Summation by Parts – Absolute convergence – Addition and Multiplication of Series – Rearrangements.

Chapter 3 of Text Book 1

UNIT III : DIFFERENTIATION

The Derivative of a Real function – Mean Value Theorems – The Continuity of Derivatives – L Hospital's Rule – Derivatives of Higher Order – Taylor's Theorem – Differentiation of Vector valued functions.

Chapter 5 of Text Book 1

UNIT IV : RIEMANN STIELTJE'S INTEGRAL

Notation and Definition – Linear properties – Integration by Parts – Change of Variable – Reduction – Step functions as Integrators – Reduction to a finite sum – Euler's Summation Formula – Monotonically Increasing Integrators – Additive and Linearity properties of Upper and Lower Integrals – Riemann's condition – Comparison Theorem – Integrators of Bounded Variation – Sufficient and Necessary conditions for existence – Mean Value Theorem – Integral as a function of the interval – Second fundamental theorem of Integral Calculus – Change of

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variable – Second Mean Value Theorem – Riemann – Stieltje's Integrals depending on a parameter – Differentiation under the Integral sign – Interchanging the order of Integration – Lebesgue's criterion for existence – Complex-valued Riemann Stieltje's Integrals.
Chapter 7 of Text Book 2

UNIT V : FUNCTIONS OF SEVERAL VARIABLES
Linear Transformations – Differentiation – The Contraction Principle – The Inverse Function Theorem – The Implicit Function Theorem – The Rank Theorem – Determinants – Derivatives of Higher Order – Differentiation of Integrals.
Chapter 9 of Text Book 1

UNIT VI : APPLICATIONS
Tools from real analysis are useful in the study of many problems in theortical computer science. result in discrete analysis play an important role in hardness of approximation, computational learning, computational social choice and communication complexity.

Text Books

1. W.Rudin, Principles of mathematical Analysis, IIIEd.,2003, McGrawHillBookCo.
2. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 2nd Edition

Reference Books

1. A.J. White, Real Analysis: An Introduction, Addison Wesley Publishing Co., Inc 1968.
2. Tom.M.Apostal Mathematical Analysis – II, Edition Narosa Publishing House – 1974.
3. Rokert G.Bartle, Donal.R.Shelbert, Introduction to Real Analysis.
4. Ajith Kumar, S.Kumaresan, A Basic Course in Real Analysis.

CO-PO Mapping with Programme Outcomes: **REAL ANALYSIS** **Code : 22KP1M02**

CO / PO	1	2	3	4	5	6	7	8	9	10
1	3	3	3							
2	3	3	3							
3			1			3	3			
4	2	2	2							
5	2	2					1	2		

1-Low, 2- Moderate, 3 – High Correlation

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM I	CC 4	GRAPH THEORY	22KP1M04	Inst Hour: 6	Credit: 5

Course Objectives: This Course aims to teach Students with the fundamental concepts in Graph Theory while branching into various topics such as Matching's, Coverings, Partitions, Factorization and Digraphs.

CO	STATEMENT
1	Understand the basics of graph theory and their various properties.
2	Find the shortest path through a graph using Dijkstra's theorem.
3	The max flow min – cut theorem for finding a maximum (s,t) flow in network.
4	Reason from definitions to construct mathematical proofs with covering and factorization.
5	To apply theory based tools in solving practical problems.

UNIT I : INTRODUCTION TO GRAPH THEORY

Graphs and Simple Graphs – Graph Isomorphism – Incidence and Adjacency Matrices – Subgraphs – Vertex Degrees – Paths and Connections – Cycles – Shortest Path Problem – Spemer's Lemma. Trees – Cut Edges and Books – Cut Vertices - Cayley's Formula – Connector Problem.

Chapter 1 and 2 of Text Book 1.

UNIT II : OPTIMIZATION AND MATCHING

Shortest Path algorithms – Dijkstra's algorithm – Minimal Spanning Trees.

Chapter 4 : Section 4.1 to 4.3 of Text Book 2.

UNIT III : OPTIMIZATION AND MATCHING

Transport Networks – Max-Flow Min-Cut theorem – Matching Theory – Hall's Marriage Theorem.

Chapter 4 : Section 4.4 – 4.7 of Text Book 2.

UNIT IV : COVERINGS, PARTITIONS AND FACTORIZATION

Coverings – Independence – Vertex Covering – Edge Covering – Critical Points and Critical Lines – Line-Core and Point-Core – Partitions – 1-Factorization – 2-Factorization – Arboricity.

Chapter 7 : Section 7.1 – 7.10 of Text Book 2.

UNIT V : DIGRAPHS

Digraph – Types of Digraphs - Connected Digraphs – Euler Digraphs – Directed Walk – Directed Path – Directed Circuit – Tournaments - Matrix Representation of Digraphs.

Chapter 8 : Section 8.1 – 8.26 of Text Book 2.

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UNIT VI : APPLICATIONS

. Apply graph theory concepts to solve real world applications like routing, travelling salesman problem and traffic control problem.
. Model problems using graphs and to solve these problem algorithmically.
. Graph Theory is used in the field of computer science, physics, chemistry, and sociology.

Text Books

1. A.Bondy and U.S.R Murty, Graph Theory with Applications, Macmillan, 1976.
2. Vasudev, Graph Theory with Applications, New Age International Publishers.

Reference Books

1. S.A.Choudum, Afirst Course in Graph Theory, Mac Millan India Limited, 1987
2. R.J.Wilson &b J.J.WATKINS, Graphs: An Introduction Approach, John Wiley & Sons,1989.

CO-PO Mapping with Programme Outcomes: **GRAPH THEORY**

Code : 22KP1M04

CO / PO	1	2	3	4	5	6	7	8	9	10
1	2		3				2			
2			2	2			3			
3			3	3	2					
4			2		2		2			
5			3	2			3			

1-Low, 2- Moderate, 3 – High Correlation

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THANJAVUR –07.

SEM I	MBE 1	DIFFERENTIAL GEOMETRY	22KP1MELM1:1	Inst Hour: 6	Credit: 4

Course Objectives :The Primary Objective of this Course is to understand the notion of level sets, surfaces as solutions of equations, geometry of orientable surfaces, vector fields, Gauss map, geodesics, Weingarten maps, line integrals, parameterization of surfaces, areas, volumes and Gauss – Bonnet theorem.

CO	STATEMENT
1	Understand the basic concepts and results related to space curve, tangent surface, and involutes and evolutes with problems and theorems
2	Explain the intrinsic properties of a surface with problems and theorems
3	Describe the basic concepts of Geodesics, properties with problems.
4	Explain the properties of Geodesics and its applications with theorems and problems.
5	Analyzing the second fundamental forms and study the local non-intrinsic properties of surface with problems and theorems.

UNIT I : SPACE CURVES

Introduction - Representation, Unique Parametric representation of space curves – Arc length – tangent and osculating plane – Principal normal and binormal – curvature and torsion – contact between curves and surfaces – tangent surface – involutes and evolutes – Intrinsic equations – Fundamental Existence Theorem for space curves – Helices.

Chapter 1: Sections 1.1 to 1.7, 1.10, 1.13, 1.16, 1.17, 1.18

UNIT II : INTRINSIC PROPERTIES OF A SURFACE

Introduction - Definition of a surface – Nature of points on a surface – curves on surfaces – Tangent Plane – Surface normal – general surfaces of revolution – Helicoids – Metric on a surface – The first fundamental form - Direction coefficients on a surface – families of curves – Isometric correspondence – Intrinsic properties.

Chapter 2: Sections 2.1 to 2.11, 2.14 & 2.15.

UNIT III : GEODESICS

Introduction – Geodesics and their Differential equations – Canonical geodesic equations – geodesics on surface of revolution - Normal property of geodesics – Differential equations of geodesics using normal property - Existence Theorems.

Chapter 3: Sections 3.1 to 3.7

UNIT IV : GEODESICS

Geodesic parallels – Geodesics polar coordinates - Geodesics curvature – Gauss – Bonnet Theorem – Gaussian curvature – surfaces of constant curvature – Conformal mapping – Geodesic mapping.

Chapter 3: Sections 3.8 to 3.15

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SEM I	MBE 1	ALGEBRAIC NUMBER THEORY	22KP1MELM1:2	Inst Hour: 6	Credit: 4

UNIT – I

Introduction – Divisibility – Primes – The Binomial Theorem – Congruences – Euler's totient – Fermat's , Euler's and Wilson's Theorems – Solutions of congruences – The Chinese Remainder Theorem.

Chapter 1 and Chapter 2 : Sections 2.1 to 2.3

UNIT –II

Techniques of numerical calculations – Public key cryptography – Prime Power Moduli – Primitive roots and power residues – Congruences of degree two.

Chapter 2: Sections 2.4 to 2.9

UNIT –III

Number theory from an Algebraic Viewpoint – Groups, rings and fields – Quadratic Residues – The Legendre symbol (a/r) where r is an odd prime – Quadratic Reciprocity – The Jacobi Symbol (P/q) where q is an odd positive integer.

Chapter 2 : Sections 2.10, 2.11 and Chapter 3 : Sections 3.1 to 3.3

UNIT –IV

Binary Quadratic Forms – Equivalence and Reduction of Binary Quadratic Forms – Sums of three squares – Positive Definite Binary Quadratic Forms – Greatest integer Function – Arithmetic Functions – The Mobius Inversion Formula – Recurrence Functions – Combinatorial number theory.

Chapter 3: Sections 3.4 to 3.7 and Chapter 4

UNIT – V

Diophantine Equations – The equation ax+by = c Simultaneous Linear Diophantine Equations – Pythagorean Triangles – Assorted examples.

Chapter 5: Sections 5.1 to 5.4

Text Books

Ivan Niven, Herbert S, Zuckerman and Hugh L, Montgomery, An Introduction to the Theory of Numbers, Fifth edn., John Wiley & Sons Inc, 2004.

Reference Books

1. Elementary Number Theory, David M. Burton W.M.C. Brown Publishers, Dubuque, Lawa, 1989.
2. Number Theory, George Andrews, Courier Dover Publications, 1994.
3. Fundamentals of Number Theory, William J.Leveque Addison – Wesley Publishing Company, Phillipines, 1977.

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SEM II	CC 5	COMPLEX ANALYSIS	22KP2M05	Inst Hour: 6	Credit: 4

Course Objectives : The Primary objectives of this course is to understand the notion of an Analytical Function and Conformal Mapping and its fusion with maximum modulus theorem, Complex Integration and topics related with it, introduces Harmonic Function, leading to Dirichlet's Problem.

CO	STATEMENT
1	Understand the basis of analytical functions and conformal mapping that helps in extending fundamental theorems.
2	Articulate the richness of local properties of analytical functions, singularities, zeros and poles etc.,
3	Understand the basis of chains and cycles, connectivity which lead to the general form of Cauchy's theorem and how to evaluate the definite integrals.
4	Explain harmonic functions and how it helps in Weirstrass's theorem, Laurent's theorem and Taylor's theorem.
5	Evaluate how big the range of an entire function as well as Riemann zeta function.

UNIT I : CONFORMALITY

Arcs & closed curves – Analytic functions in regions – Conformal mapping – Length and area

Chapter 3 : Sections 2.1 to 2.4 .

FUNDAMENTAL THEOREMS:

Line integrals – Rectifiable arcs – Line integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a disk

Chapter 4 : Sections 1.1 to 1.5

CAUCHY'S INTEGRAL FORMULA:

Index of a point with respect to a closed curve - Integral Formula – Higher Derivatives

Chapter 4 : Sections 2.1 to 2.3

UNIT II : LOCAL PROPERTIES OF ANALYTICAL FUNCTIONS

Removable singularities – (Taylor's theorem) - Zeros and Poles – Meromorphic functions - essential singularities - Local mapping theorem – Maximum principle.

Chapter 4 : Sections 3.1 to 3.4

UNIT III : GENERAL FORM OF CAUCHY'S THEOREM

Chains and Cycles – Simple connectivity – Homology – General statement of Cauchy's theorem and it's proof – Locally exact differentials – Multiply connected regions.

Chapter 4 : Sections 4.1 to 4.7

CALCULUS OF RESIDUES:

Residue Theorem - Argument Principle - Evaluation of Definite integrals.

Chapter 4 : Sections 5.1 to 5.3

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UNIT IV : HARMONIC FUNCTIONS
Definition and Basic properties – The Mean Value Property – Poisson's Formula – Schwartz's Theorem –The Reflection Principle.
Chapter 4 : Sections 6.1 to 6.5

POWER SERIES EXPANSION :
Weirstrass's Theorem – Taylor series – Laurent series.
Chapter 5 : Sections 1.1 to 1.3

UNIT V : ENTIRE FUNCTIONS
Jensen's Formula- Hadamard's Theorem
Chapter 5 : Sections 3.1 to 3.2

RIEMANN ZETA FUNCTION:
Product Development – Extension of ς(s) to the Whole Plane- Functional Equation- Zeros of the Zeta Function.
Chapter 5 : Sections 4.1 to 4.4

UNIT VI : APPLICATIONS
Application of contour organization, signal processing, complex numbers are also utilized in calculations of current, voltage or resistance in a circuits. Used to quantum mechanics (it deals with the motions and interactions between subatomic particles).

Text Books

L. V.Ahlfors – Complex Analysis – Third Edition Mc Graw Hill Education (India) Edition 2013.

Reference Books

1. J.N. Sharma, Functions of Complex Variables.
2. SergeLang, Complex Analysis, Addison Wesley, 1977.
3. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1977.
4. Dr.V Karunakaran, Complex Analysis, Narosa Publishing House

CO-PO Mapping with Programme Outcomes: **COMPLEX ANALYSIS Code : 22KP2M05**

CO / PO	1	2	3	4	5	6	7	8	9	10
1	1	3					2			
2	2				2		2			
3	3				2		2			
4			3				3	1		
5					3	3		3		

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SEM II	CC 6	LINEAR ALGEBRA	22KP2M06	Inst Hour: 6	Credit: 5

Course Objectives : To facilitate a better understanding of vector space, to solve problems in Linear Algebra and to understand the concepts of Linear Transformation, Matrices and Inner Product Spaces.

CO	STATEMENT
1	Describe the concept of Linear equations and Matrices.
2	Express Linear transformation and Matrices and to solve differential equations with constant coefficients
3	Analyze the various types polynomials.
4	Explain determinants and various properties of determinants.
5	Analyze and distinguish the Elementary canonical forms of triangulation and Simultaneous diagonalisation.

UNIT I : LINEAR EQUATIONS AND VECTOR SPACES

System of linear equations – matrices and elementary row operations – Row reduced Echelon Matrices – Matrix multiplication – Invertible matrices – Vector spaces – Subspaces – Basis and dimension.

Chapter 1 : Sections 1.2. to 1.6
Chapter 2 –Section 2.1 to 2.3

UNIT II : LINEAR TRANSFORMATIONS

Linear transformations – The Algebra of linear transformation –Isomorphism – Representation of linear transformation by matrices – Linear functional – The double dual – The transpose of linear Transformation.

Chapter 3

UNIT III : POLYNOMIALS

Algebras – The Algebra of polynomials –Lagrange Interpolation – Polynomials Ideals – The prime factorization of a Polynomial.

Chapter 4

UNIT IV : DETERMINANTS

Determinants – Commutative rings – Determinant functions –Permutations and the uniqueness of determinants –Additional property of Determinants.

Chapter 5 Section 5.1-5.4

UNIT V : ELEMENTARY CANONICAL FORMS

Elementary canonical forms – Introduction – Characteristic values – Annihilating polynomials. Invariant subspaces – Simultaneous Triangulation and Simultaneous diagonalisation.

Chapter 6 : Section 6.1- 6.5

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UNIT VI : APPLICATIONS

Linear algebra is one of the most known mathematical disciplines because of its rich theoretical foundations and its many useful applications to science and engineering. Solving systems of linear equations and computing determinants are two examples of fundamental problems in linear algebra. Linear algebra also has interesting applications to image processing and computer graphics, networks, genetics, coupled linear oscillations, Markov chains, etc.

Text Books:

1. Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice – Hall of India Private Limited New Delhi:1975.

Refference Books:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited , New Delhi 1975.
2. I.S.Luther and I.B.S.Passi , Algebra, Vol I-Groups , Vol.II- Rings, Narosa Publishing House (Vol.I-1996,Vol.II-1999)
3. N.Jacobson, Basic Algebra, Vol.I& II.Freeman, 1980 Hindustan publishing company.

CO-PO Mapping with Programme Outcomes: **LINEAR ALGEBRA** **Code : 22KP2M06**

CO / PO	1	2	3	4	5	6	7	8	9	10
1	3		3		2		1			
2				1	1				2	
3	1			1	2					
4			1	3					3	
5	1		1		2				2	

1-Low, 2- Moderate, 3 – High Correlation

Verified 1. 2.

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HOD

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM II	CC 7	TOPOLOGY	22KP2M07	Inst Hour: 7	Credit: 5

Course Objectives : This course is an introduction to topological spaces. It deals with constructions like subspaces, product spaces and quotient spaces and properties like compactness and connectedness .

CO	STATEMENT
1	Knowledge about Topological spaces and know the types of topology
2	Distinguish between connectedness and compactness
3	Analyze the compact spaces and limit point of compact
4	Understand the types of axioms
5	Understand the Uryshon lemma and Tietze extension theorem and you can characterize metrizable spaces

UNIT I :TOPOLOGICAL SPACES AND CONTINUOUS FUNCTIONS

Topological Spaces – Basis for a Topology – The Order Topology – T he Product topology on XxY – The subspace Topology – Closed Sets and Limit points — Continuous Functions – The Product Topology – the Metric Topology.

Chapter 2: Sections 12 to 21.

UNIT II : CONNECTEDNESS AND COMPACTNESS

Connected Spaces – Connected Subspaces of the Real Line – Components and Local Connectedness.

Chapter 3: Sections 23, 24, 25.

UNIT III : CONNECTEDNESS AND COMPACTNESS

Compact Spaces – Compact Subspaces of the Real Line – Limit Point Compactness – Local Compactness.

Chapter 3: Sections 26, 27, 28, 29.

UNIT IV : COUNTABILITY AND SEPARATION AXIOMS

Countability Axioms – Separation Axioms – Normal Spaces

Chapter 4: Sections 30 to 32.

UNIT V : COUNTABILITY AND SEPARATION AXIOMS

Urysohn Lemma – Urysohn Metrization Theorem – Tietze Extension Theorem – Imbeddings of Manifolds.

Chapter 4: Sections 33 to 36.

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UNIT VI : APPLICATIONS

A subset of network topology and network mapping software, application topology mapping software tools are designed to map or diagram the layout of mission – critical applications in an enterprise, hoe different apps are connected to each other, how they can be accessed by various computers and networks. Topology can be used to describe the overall shape of the universe.

Text Books

James R.Munkres, Topology, PHI Learning Private Limited, Delhi, 2013, 2nd Edition.

Reference Books

1. A First course in Topology: James R.Munkres, Prentice Hall of India(p) Ltd., New Delhi, 1988.
2. George.F.Simmons, Introduction to Topology and Modern Analysis, Mc.Graw Hill Co., 1963.
3. J.L.Kelly, General Topology, Van Nostrand, Rein Hold Co., Newyork.

CO-PO Mapping with Programme Outcomes: **TOPOLOGY** **Code : 22KP2M07**

CO / PO	1	2	3	4	5	6	7	8	9	10
1	3		2					1		
2			3		2				1	
3			2	2			3	2		
4			2				3	2		
5			3		2			2	2	

1-Low, 2- Moderate, 3 – High Correlation

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HoD

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM II	CC 8	CLASSICAL DYNAMICS	22KP2M08	Inst Hour: 7	Credit: 5

Course Objectives : The course on Classical Dynamics is devised to introduce fundamental aspects of mechanical system behavior. Students will learn to develop steady state mechanical energy, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.

CO	STATEMENT
1	Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum and energy applied to fluid motions.
2	Determine Euler's equations of motion and deduce bernoulli's equation.
3	Explain the various types of three dimensional flows.
4	Describe and classify the some two – dimensional flows and solve problems based on two dimensional flows.
5	Establish some important theorems based on two dimensional image systems.

UNIT-I

Introductory concepts : The mechanical system – Generalised coordinates – constraints - virtual work – energy and momentum.

Chapter I : Sec 1.1 to 1.5

UNIT-II

Lagrange's equations: Derivation of Lagrange's equations – examples – Integrals of motion-small oscillations.

Chapter 2 : Sec 2.1 to2.4

UNIT-III

Special applications of Lagrange's Equations: Equation - Rayleigh's dissipation function – Impulsive motion – Gyroscopic systems – velocity – dependent potentials.

Chapter 3 : Sec 3.1 to 3.4

UNIT-IV

Hamilton's Equations: Hamilton's Principle – Hamilton's Equations.

Chapter 4 : 4.1 to 4.2

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UNIT-V

Other Variational principles – Phase space

Chaper 4 : 4.3, 4.4

UNIT VI : APPLICATIONS

The real life applications of Dynamics include Simulation examples of real engineering systems, Applications to vehicle dynamics, Three-dimensional motion of rigid bodies, with emphasis on gyroscopic effects, Transfer functions for linearized dynamic systems, Active control of dynamic systems.

Text Books:

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

Reference Books:

1. Classical Mechanics, Goldstein Poole & Safco, Pearson Education.

CO-PO Mapping with Programme Outcomes: **CLASSICAL DYNAMICS** **Code : 22KP2M08**

CO / PO	1	2	3	4	5	6	7	8	9	10
1		3	1				2			
2			1	1	3		2			
3			1	2	3					
4			2	1	3					
5				2	1		3			

1-Low, 2- Moderate, 3 – High Correlation

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HoD

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM II	NME 1	NUMERICAL METHODS AND OPERATIONS RESEARCH	22KP2MEL01	Inst Hour: 4	Credit: 3

Course Objectives: In this Course, Students will be enable to understand several concepts of Operations Research such as Interpolation , Transportation Problems, Assignment Problems and Network Scheduling PERT / CPM.

CO	STATEMENT
1	Understand and solving algebraic and transcendental equations.
2	Describe the various types of interpolation.
3	Learn about Transportation models and solve it.
4	Explain and solve Assignment problems.
5	Describe Network scheduling by PERT/CPM.

UNIT I : SOLUTION OF ALGEBRAIC AND TRANSCEDENTAL EQUATIONS

Solution of Algebraic and Transcedental Equations - Bisection Method – The Iteration Method - Method of False position – Newton Raphson Method.

Chapter 2: Sections : 2.1,2.2,2.3,2.4,2.5., of Text Book 1

UNIT II : INTERPOLATION

Interpolation – finite Differences – Forward Differences – Backward Differences - Central Differences.

Chapter 3: Sections : 3.3.1,3.3.2,3.3.3 of Text Book 1

UNIT III : TRANSPORTATION PROBLEMS

Transportation Model – Mathematical formulation –Solutions of Transportation Problems - North west Corner Rule – Least Cost Method – Unbalanced Transportation Problems.

Chapter 10: Sections 10.1 to 10.3, 10.6 to 10.8, 10.13 of Text Book 2

UNIT IV: ASSIGNMENT PROBLEMS

Introduction - Assignment Method – Special Cases in Assignment Problems – A typical Assignment Problems.

Chapter 11: Sections 11.1 to 11.5 of Text Book 2

UNIT V: NETWORK SCHEDULING BY PERT/CPM

Network and basic components – Rules of Network Construction - Numbering the events - Critical Path Analysis –Probability Considerations in PERT – Distinguish between PERT and CPM .

Chapter 21: Sections : 21.1 to 21.7 of Text Book 2.

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UNIT VI : APPLICATIONS

Linear programming is used in business and industry in production planning, transportation and routing and various types of scheduling. Transportation problem is a highly useful tool for managers and supply chain engineers for optimizing cost. Network methods are used to determine time – cost, trade – off resources allocation and help in updating activities time.

Text Books

1. An introductory methods for Numerical Analysis by S.S.Sastry, 4th Edition, Prentice Hall of India, Private Ltd., New Delhi -2005.

2. Operations research by Kanti Swarup , Gupta . P.K & Manmohan , Reprint 2002, Sultan Chand & Sons, Educational Publications, New Delhi.

Reference Books

1.Problems in Operations Research by Gupta P.K & Manmohan.

2. Resource Management Techniques by Prof. V.Sundaresan , K.S.Ganapathy Subramaniyam , K.Ganesan

CO-PO Mapping with Programme Outcomes: **NUMERICAL METHODS AND OPERATIONS RESEARCH**

Code : 22KP2MEL01:1

CO / PO	1	2	3	4	5	6	7	8	9	10
1		3	1				2			
2			1	1	3		2			
3			1	2	3					
4			2	1	3					
5				2	1		3			

1-Low, 2- Moderate, 3 – High Correlation

Verified

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HOD

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM II	ECC1	CSIR - NET / SET Preparatory Course I	22KP2ECCM1:1	Inst Hour:	Credit: 3

Course Objectives: In this paper, the learner is mostly self directed and is responsible for his or her own learning. In this method, the instructors facilitate the learning of participants and help them by offering opportunities to learn themselves and acquire new knowledge.

CO	STATEMENT
1	Understand the basic knowledge of algebra.
2	Describe the various theorem.
3	Learn about Cauchy theorem, Taylor series, etc.,
4	Explain the concept of real analysis
5	Describe numerical analysis and basic concepts of probability.

UNIT I: BASIC CONCEPTS OF LINEAR ALGEBRA

Space of n-vectors, Linear dependence , Basic, Linear Transformation, Algebra of Matrices, Rank of a Matrix, Determinants, Linear equations, Quadratic forms, Characteristic roots and vectors.

ALGEBRA: Permutations, combinations, pigeon - hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø - function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions, Galois Theory.

UNIT II : ANALYSIS

Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral. Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

UNIT III : COMPLEX ANALYSIS

Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem,

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Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

UNIT IV : REAL ANALYSIS

Riemann integrable functions; Improper integrals, their convergence and uniform convergence. Euclidean space R'',Bolzano - Weirstrass theorem, compact Subsets of R'', Heine – Borel theorem, Fourier series. Continuity of functions of R'', Differentiability of F:R''. Rm, Properties of differential, partial and directional derivatives, continuously differentiable functions. Taylor's series. Inverse function theorem, implicit function theorem. Integral functions, line and surface integrants, Green's theorem, Stoke's theorem.

UNIT V : NUMERICAL ANALYSIS

Finite differences , interpolation, Numerical solution of algebraic equation – Iteration – Newton Raphson Method – Solutions on linear system – Direct method – Gauss elimination Method – Matrix inversion – Eigen value Problems – Numerical differentiation and Picard's method – Euler's Method and Improved Euler's Method.

BASIC CONCEPTS OF PROBABILITY: Sample space - Discrete probability – Simple theorem on Probability – Independence of events – Bay's theorem – Discrete and Continuous random variables – Binomial – Poisson and Normal Distributions – Expectations and Moments, Independence of Random Variables – Chebyshev's inequality.

Reference Books

1.Kumaresan, Foundations in Mathematics.

CO-PO Mapping with Programme Outcomes: **CSIR - NET / SET Preparatory Course I**

Code : 22KP2ECCM1:1

CO / PO	1	2	3	4	5	6	7	8	9	10
1	2	3	1			3	3			
2	1		1	3			3			
3	1		1	2					2	
4	1	1	1	2					2	
5	1		3			1			1	

1-Low, 2- Moderate, 3 – High Correlation

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM II	ECC2	INTRODUCTION TO LATEX (Add on Course)	22KP2ECCM2	Inst Hour:	Credit: 4

Course Objectives : This course aims to provide the skill of using high-quality typesetting system, LATEX for publication of research papers, theses and book chapters. Write various types of formulae, equations, matrix etc. by using LATEX. Create Tables, Graphics and Pictures Lists, Arrays .

CO	STATEMENT
1	Identify the sample document and key concepts
2	Determine the equation environment and Theorems like environment
3	Explain the Symbols
4	Describe the Documents and Structures
5	Explain the errors

UNIT I :
Basic LATEX– Sample document and Key Concepts – Type style – Environments – Lists – Contering – Tables – Verbatim – Vertical and horizontal spacing.
Chapter 2: Sections 2.1. to 2.4.

UNIT II :
Typesetting Mathematics – Examples – Equation environments – Fonts, hats and underlining – Braces – Arrays and matrices – Customized commands – Theorems like environments.
Chapter 3: Sections 3.1. to 3.7.

UNIT III :
Math miscellaxy – Math Styles – Bold Math – Symbols for number sets – Binomial coefficient.
Chapter 3: Sections 3.8. to 2.4.

UNIT IV :
Further essential LATEX– Document classes and the overall structure – Titles for documents – Sectioning commands.
Chapter 4: Sections 4.1. to 4.3.

UNIT V:
Miscellaneous extras – Spacing – Accented characters – Dashes and hyphens – Quotation marks – Trouble shooting – Pinpointing the error – Common errors – Warning messages.
Chapter 4: Sections 4.4 to 4.5.

Text Books

1. David F Griffiths and Desmond J. Higham, Learning LaTex, SIAM (Society for Industrial and Applied Mathematics) Publishers, Phidel Phia, 1996.

Reference Books

1. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.
2. L. Lamport. LATEX: A Document Preparation System, User's Guide and ReferenceManual. AddisonWesley, New York, second edition, 1994.

CO-PO Mapping with Programme Outcomes: **INTRODUCTION TO LATEX**

Code : 22KP2ECCM2

CO / PO	1	2	3	4	5	6	7	8	9	10
1		1	1		2				2	
2	2	1	1				1			
3	1	1		2		2				
4	1	1	1				2			
5	1	3			1		2			

1-Low, 2- Moderate, 3 – High Correlation

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR -07.

SEM III	CC 9	MEASURE AND INTEGRATION	22KP3M09	Inst Hour: 7	Credit: 5

Course Objectives : The main objective is to familiarise with the Lebesgue Outer Measure, Measurable Set , Measurable Function, Decomposition of the Measure Space and the Measure, Extension of a Measure L^P Spaces, Product Measure uniqueness of Lebesgue Measure in Euclidean Space.

CO	STATEMENT
1	Understand whether a given subset of R or a real valued function in measurable.
2	Applying the concept of outer measure in an abstract space and integration with respect to a measure.
3	Learn and apply holder and Minkowski Inequalities in L^P –spaces and understand completeness of L^P – spaces and convergence in measure.
4	Analysing signed measure and complex measure, ability to use Hahn decomposition, Jordan decomposition, Redon - Niikodym Theorem and recognize singularity of measures.
5	Knowledge about the concepts of measurability in a product space and understand the concepts of the product measure.

UNIT I : MEASURE ON REAL LINE

Lebesgue outer measure – Measurable sets – Regularity – Measurable functions - Borel and Lebesgue measurability.

Chapter 2: Sections 2.1 to 2.5

UNIT II: ABSTRACT MEASURE SPACES

Measures and outer measures – Extension of a measure – Uniqueness of the extension – Completion of a measure – measure spaces - Integration with respect to a measure.

Chapter 5 : Sections 5.1 to 5.6

UNIT III: INEQUALITIES AND THE L^P SPACES

L^P Spaces – Convex functions – Jensen's inequality – Inequalities of Holder & Minkowski – Completeness of $L^P(\mu)$.

Chapter 6 : Sections 6.1 to 6.5

UNIT IV : SIGNED MEASURES AND THE DERIVATIVES

Signed Measures – Hahn Decomposition - Jordan Decomposition – Radon – Nikodym Theorem - Some application of Radon Nikodym theorem

Chapter 8 : Sections 8.1 to 8.4

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UNIT V: MEASURE AND INTEGRATION IN A PRODUCT SPACE
Measurability in a product space – The product measure and Fubini's Theorem – Lebesgue measures in Euclidien space
Chapter 10 : sections 10.1 to 10.3

UNIT VI : APPLICATIONS
The real life application of signed measures theorem and some applications Radon Nikodym theorem.

Text Books

1.Measure Theory and Integration – G.De Barra, Woodhead Publishing Limited, 2003.

Reference Books

1. Measure And Integration 2nd Editon By M.E.Manroe Addison – Wesley Publishing Company 1971.
2. Measure and Integration by Inder Rana.
3. Measure and Integration by H.L. Royden

CO-PO Mapping with Programme Outcomes: MEASURE AND INTEGRATION
Code : 22KP3M09

CO / PO	1	2	3	4	5	6	7	8	9	10
1	3						2		3	
2		3		2						3
3	3			2				3	3	
4		3		2				1	3	
5	2						2	3		

1-Low, 2- Moderate, 3 – High Correlation

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HOD

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS).
THANJAVUR –07.

SEM III	CC10	STOCHASTIC PROCESSES	22KP3M10	Inst Hour: 6	Credit: 5

Course Objectives : With this course, to expose the students to the basics of random process essential for their subsequent study of analog and digital communication. The objective of a queuing model is to find out the optimum service rate and the number of servers so that the average cost of being in queuing system and the cost of service are minimized.

CO	STATEMENT
1	Classify a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space and give examples of each type process.
2	Summarize the definition of a stochastic process and in particular a Markov process
3	Describe a Markov chain and it's transition matrix.
4	Describe the number of occurrences of some event in the specified period of time which is undoubtedly an integer.
5	Describe steady state behavior – transistent behavior of M/M/1 model and non Markovian models

UNIT I : STOCHASTIC PROCESSES

Some notaions: Introduction – Specification of Stochastic Processes – Stationary Processes Markov Chains: Definition and examples – Higher Transition probabilities – Generalization o independent Bernoulli Trails: Sequence of chain – Dependent trials.

Chapter 2: Sections 2.1 to 2.3, Chapter 3: Sections 3.1 to 3.3

UNIT II : MARKOV CHAINS

Classification of states and chains – Determination of Higher transition probabilities – Stability of Markov system – Markov Chain with Denumerable Number of States - Reducible chains – Marko chains with continuous state space.

Chapter 3: Sections 3.4 to 3.6, 3.8, 3.9 and 3.11

UNIT III : MARKOV PROCESSES WITH DISCRETE STATE SPACE

Poisson processes and their extensions- Poisson process and related distributions – Generalization of Poisson process – Birth and Death process – Markov processes with discrete state space Continuous time Markov Chains)

Chapter 4: Sections 4.1 to 4.5

UNIT IV : RENEWAL PROCESSES AND THEORY

Renewal process – Renewal processes in continuous time – Renewal equation- stopping time Wald's equation – Renewal theorems.

Chapter 6: Sections 6.1 to 6.5

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UNIT V : STOCHASTIC PROCESSES IN QUEUING AND RELIABILITY
Queuing Systems – General concepts

THE QUEUING MODEL M/M/1:
Steady State Behaviour – Transient Behaviour of M/M/1 Model – Non- Markovian Queuing models – the model GI/M/1.
Chapter 10: Sections 10.1 to 10.3, 10.7 and 10.8 (Omit sec 10.2.3 and 10.2.3.1)

UNIT VI : APPLICATIONS
Applications of queuing theory in traffic engineering & Markov process in communication engineering. Application to risk theory , insurance, actuarial science and system risk engineering.

Text Books
1.J.Medhi, Stochastic Processes, New age international publishers, New Delhi- Second Edition.

Reference Books
1. Samuel Karlin, Howard M.Taylor, A first course in stochastic processes, Academic press, Second Edition, 1975.
2. Narayan Bhat, Elements of Applied Stochastic Processes, John Wiley, 1972.
3. N.V.Prabhu, Stochastic Processes, Macmillan(NY).

CO-PO Mapping with Programme Outcomes: **STOCHASTIC PROCESSES**
Code : 22KP3M10

CO / PO	1	2	3	4	5	6	7	8	9	10
CO 1			3	1	3		1			
CO 2			3	1	2					
CO 3			3	1	2		3			
CO 4			2	1	3			2		
CO 5			2	1	3			2	3	

1-Low, 2- Moderate, 3 – High Correlation

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HOD

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM III	CC11	MATLAB PROGRAMMING	22KP3M11	Inst Hour: 6	Credit: 5

Course Objectives : Introduce common approaches, structures and conventions for creating and evaluating computer programs, primarily in a procedural paradigm, but with a brief introduction to object – oriented concepts and terminology. Introduce the MATLAB software environment.

CO	STATEMENT
1	Use MATLAB effectively to analyze and visualize data.
2	Apply numeric techniques and computer simulations to solve engineering-related problems.
3	Design and document computer programs and analyzes in a careful and complete manner so as to effectively communicated results.
4	To facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.
5	Demonstrate understanding and use of fundamental data structures.

UNIT I : STARTING WITH MATLAB

Starting MATLAB, MATLAB windows – working in the command window – arithmetic operations With scalars – display formats – elementary math built – in functions – defining scalars variables – Useful commands for managing variables – script files – examples of MATLAB applications.

CREATING ARRAYS:

Creating a one – dimensional array – creating a two – dimensional array – notes about variables in MATLA the transpose operator.

Chapter 1: Sections 1.1 to 1.9 (Pages : 1 -27)
Chapter 2: Sections 2.1 to 2.4 (Pages: 35 – 41)

UNIT II : MATHEMATICAL OPERATIONS WITH ARRAYS:

Array addressing – using a colon : in addressing array – adding elements to existing variables – deleting Elements – built in functions for handling arrays – strings and strings as variables – Mathematical operations With arrays : addition and subtraction – array multiplication – array division – element – by – elen operations –using arrays in MATLAB built – in math functions – built in functions for analyzing array generation of random numbers – examples of MATLAB applications.

Chapter 2: Sections 2.5 to 2.10 (Pages :42 -55)
Chapter 3: Sections 3.1 to 3.8 (Pages: 63 -86)

UNIT III : PROGRAMMING IN MATLAB:

Relational and logical operators – conditional statements – the switch – case statement – loops –nested Loops and nested conditional statements – the break and continue commands – examples of MATL applications.

Chapter 6: Sections 6.1 to 6.7 (Pages:173 – 209)

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UNIT IV : TWO – DIMENSIONAL PLOTS:
The plot command – the *fplotcommand* - plotting multiple graphs in the same plot – formatting a plot – plots with logarithmic axes – plots with error bars – plots with special graphics – histograms – polar plots- putting multiple plots on the same page – multiple figure windows – examples of MATLAB applications.
Chapter 5: Sections 5.1 to 5.12(Pages:133-163)

UNIT V : POLYNOMIALS AND CURVE FITTING:
Polynomials – curve fitting
APPLICATIONS IN NUMERICAL ANALYSIS:
Numerical Integration – ordinary differential equations – examples of MATLAB applications (upto sample problem 9-4)
Chapter 8: Sections 8.1 to 8.2 (Pages:261 -274)
Chapter 9: Sections 9.3 to 9.5 (Pages : 300 – 309)

UNIT VI : APPLICATIONS
MATLAB can be used as a tool for simulating various electrical network but the recent developments in MATLAB make it a very competitive tool for Artificial Intelligence, Robotics, Image Processing etc.,. It is a tool that enables computation, programming and graphically visualizing the results.

Text Books

1. "MATLAB – An Introduction with Application" by AMOS Gilat, John Wiley & Sons, Singapore, 2011.

Reference Books

2. Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers" by R.Pratap, Oxford University Press , New Delhi , 2006.
3. Introduction to Matlab 7 for Engineers" by **W.J.Palm,** McGraw – Hill Education, New York, 2005.
4. Introduction to MATLAB 7" by D.M.Etter, D.C. Kuncicky and H. Moore, Prentice Hall, New Jersy, 2004.

CO-PO Mapping with Programme Outcomes: **MATLAB PROGRAMMING**

Code : 22KP3M11

CO / PO	1	2	3	4	5	6	7	8	9	10
1				3		2		2		
2					2	3		2		
3				2	2	3			2	
4					2	2		3		2
5				2		2		3	2	2

1-Low, 2- Moderate, 3 – High Correlation

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM III	MBE 2	OPERATIONS RESEARCH	22KP3MELM2:1	Inst Hour: 7	Credit: 4

Course Objectives : In this Course, Students will be enable to understand several concepts of Operations Research such as Linear Programming, Integer Programming, Dynamic Programming, Inventory Model and Non Linear Programming.

CO	STATEMENT
1	To find Solutions to Integer Programming Problems using Gomary's Fractional Cut Algorithm and Branch and Bound Method.
2	Understand the various method for Solving a Dynamic Programming Problem.
3	Analyze the various Inventory Models such as Deterministic and Probabilistic Inventory Models.
4	To solve Linear Programming Problem using Revised Simplex Method and Bounded Variable Method. Simulate different real life Probabilistic situating using various Technique.
5	To determine solution for Non Linear Programming by using Quadratic Programming, Wolfe's Modified Simplex Method and Beale's Method.

UNIT I: INTEGER PROGRAMMING

Introduction – Pure and Mixed Integer Programming Problems – Gomary's All –IPP Method – Construction of Gomary's Constraints – Fractional Cut Method – Mixed Integer LPP – Branch and Bound Method – Applications of Integer Programming.

Chapter 7: Sections 7.1 to 7.8 of Text Book 2.

UNIT II : DYNAMIC PROGRAMMING

Introduction – Solution of Linear Programming Problem (DPP) by Dynamic Programming Problem – Solving a least cost Route problem by DPP.

Chapter 10: Sections 10.1 to 10.3 of Text Book 1.

UNIT III : INVENTORY MODELS

Introduction – Types of inventory – Costs involved in inventory Problems – Deterministic inventory Models – Probabilistic inventory models.

Chapter 12: Sections 12.1 to 12.10 of Text Book 1.

UNIT IV : ADVANCED TOPICS IN LPP:

Revised Simplex Method and Bounded Variable Method.

Chapter 4: Sections 4.1 and 4.2 of Text Book 1.

SIMULATION:

Introduction – Monte-Carlo Technique – Generation of Random Numbers – Steps in Simulation – Uses of Simulation – Simulation applied to Queueing Problems – Simulation applied to some

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other types of Problems.
Chapter 17: Sections 17.1 to 17.7 of Text Book 1.

UNIT V : NON-LINEAR PROGRAMMING METHODS
Introduction – Khun Tucker Conditions – Quadratic Programming – Wolfe's Modified Simplex Method – Beale's Method.
Section 28.1 to 28.6 of Text Book 2.

UNIT VI: APPLICATIONS
Integer Programming Problem is widely used to solve optimization problems in Economy, Management, Communication and Engineering. Dynamic Programming is used in the field of structural engineering and Water Resources engineering. Inventory Models are used by Food Manufacturing firms in Management of their Raw Materials.

Text Books
1.Prof.V.Sundaresan, Prof.K.S.Ganapathy Subramanian and Prof. K.Ganesan,Resource Management Techniques – AR Publications.
2. Kanti Swarup, P.K.Gupta Manmohan, Operations Research, Sultan Chand & Sons, 18th Edition.

Reference Books
1. Prem Kumar Gupta & D.S.Hira, Operations Research : An Introduction, S.Chand and Co., Ltd., New Delhi.
2. S.S.Rao, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi.

CO-PO Mapping with Programme Outcomes: **OPERATIONS RESEARCH**

Code : 22KP3MELM2:1

CO / PO	1	2	3	4	5	6	7	8	9	10
1			2	1	3		2			
2			3	3			2			
3			1	2						
4			3	2	2					
5				2	2			2		

1-Low, 2- Moderate, 3 – High Correlation

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SEM III	MBE 2	NON LINEAR DIFFERENTIAL EQUATIONS	22KP3MELM2:2	Inst Hour: 7	Credit: 4

UNIT I : FIRST ORDER SYSTEMS IN TWO VARIABLES AND LINEARIZATION
The general phase plane – Some population models – Linear approximation at equilibrium points – Linear systems in matrix form.

UNIT II : AVERAGING METHODS
An energy balance method for limit cycles – Amplitude and frequency estimates – Slowly varying amplitudes – Nearly periodic solutions – Periodic solutions: Harmony balance – Equivalent linear equation by harmonic balance – Accuracy of a period estimate.

UNIT III : PERTURBATION METHODS
Outline of the direct method – Forced Oscillations far from resonance – Forced Oscillations near resonance with weak excitation – Amplitude equation for undamped pendulum – Amplitude perturbation for the pendulum equation – Lindsted's Method – Forced Oscillation of a self – excited equation – The Perturbation method and Fourier Series.

UNIT IV : LINEAR SYSTEMS
Time Varying systems – Constant coefficient system – Periodic coefficients – Floquet Theory – Wronskian.

UNIT V : STABILITY
Poincare statbility – Solutions, Paths and Norms – Liapunov Stability of Linear systems – Comparison theorem for the zero solutions of nearly – Linear systems.

Text Books

1.Nonlinear Ordinary Differential equations, D.W.Jordan & P.Smith, Clarendon Press, Oxford, 1977.

Reference Books

1. Differential equations by G.F.Simmons, Tata McGraw Hill, New Delhi (1979).

2. Ordinary Differential equations and stability theory by D.A.Sanchez, Freeman(1968).

3. Notes on Nonlinear systems by J.K.Aggarwal, Van Nostrand, 1972.

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SEM III	NME 2	OPTIMIZATION TECHNIQUES	22KP3MEL02	Inst Hour: 4	Credit: 3

UNIT I : GOAL PROGRAMMING

Introduction- Categorization of Goal Programming – Formulation of Linear Goal Programming Problem- Graphical Goal Attainment Method- Simplex Method for Goal Programming Problem.

Chapter 8 : Sections 8.1 to 8.5 of Text Book 1

UNIT II : SEQUENCING PROBLEM

Introduction- Problem of Sequencing- Basic Terms Used in Sequencing- Processing n Jobs through Two Machines - Processing n Jobs through k Machines - Processing jobs 2 Jobs through k Machines- Maintenance Crew Scheduling- Problems of Complex Scheduling.

Chapter12 : Sections 12.1 to 12.8 of Text Book 1

UNIT III : REPLACEMENT PROBLEM AND SYSTEM RELIABILITY

Introduction- Replacement of Equipment / Asset that Deteriorates Gradually – Replacement of Equipment that Fails Suddenly- Recruitment and Promotion Problem- Equipment Renewal Problem- Reliability and System Failure Rates.

Chapter 18 : Sections 18.1 to 18.6 of Text Book 1

UNIT IV : SENSITIVITY

Introduction- Variations affecting feasibility – Changes Affecting Optimality.

Chapter 6 of Text Book 2

UNIT V : GAME THEORY

Introduction – Two person zero – Sum Games-The Maximum – Minimax Principle –Games without Saddle Points, Mixed Strategies – Matrix Oddment method for n X n games – Dominance Property – Graphical Method for 2 X n or m X 2 games-Linear Programming Method.

Chapter 16 : Sections 16.1 to 16.8 of Text Book 2

Text Books :

1. Operation Research- Kanti Swarup, P.K. Gupta, Man Mohan.(Sultan Chand & Sons) 19th Edition.
2. Resource Management Techniques – Pfor. V. Sundaresan, Prof K.S. Ganapathy Subramanian & Prof. K. Ganesan. (A.R. Publication. 10th Edition)

Reference Books:

1. Prem Kumar Gupta & D.S.Hira, Operations Research : An Introduction, S.Chand and Co., Ltd., New Delhi.
2.S.S.Rao, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi.

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CO-PO Mapping with Programme Outcomes: **OPTIMIZATION TECHNIQUES** **Code : 22KP3MEL02**

CO / PO	1	2	3	4	5	6	7	8	9	10
1			2	1	3		2			
2			3	3			2			
3			1	2						
4			3	2	2					
5				2	2			2		

1-Low, 2- Moderate, 3 – High Correlation

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SEM III	ECC3	CSIR- NET/SET PREPARATORY COURSE - II	22KP3ECCM3:1	Inst Hour:	Credit: 3

Course Objectives : In this paper, the learner is mostly self directed and is responsible for his or her own learning. In this method, the instructors facilitate the learning of participants and help them by offering opportunities to learn themselves and acquire new knowledge.

CO	STATEMENT
1	Understand the basic concepts of ordinary and partial differential equations
2	To solve the various numerical methods problems
3	Learn about the concepts of mechanics
4	Understand the basic concepts of probability
5	Describe the fundamental concepts of number theory, differential geometry and topology.

UNIT I : ORDINARY DIFFERENTIAL EQUATIONS (ODES)

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.General theory of homogenous and non-homogeneous linear ODEs, variation of parameters,Sturm-Liouville boundary value problem, Green's function.

PARTIAL DIFFERENTIAL EQUATIONS (PDES):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

UNIT II: NUMERICAL METHODS

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

UNIT III: MECHANICS

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.
Variational principles least action; Two dimensional motion of rigid bodies; Euler's dynamical equations for the motion of rigid body; Motion of a rigid body about an axis; Motion about revolving axes.

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UNIT IV: BASIC CONCEPTS OF PROBABILITY

Sample space, discrete probability,simple theorem on probability, independence of events, Bayes Theorem. Discrete and continuous random variables, Binomial,Poisson and Normal distributions; Expectation and moments, independence of random variables, Chebyshev's inequality.Probability - Axiomatic definition of probability. Random variables and distribution functions (univeriate and multivariate); expectation and moments; independent events and independent random variables; Bayes' theorem; marginal and conditional distribution in the multivariate case, coveriance matrix and correlation coefficients(product moment, partial and multiple), regression.Moment generating functions; characteristic functions; probability inequalities (Tchebyshef, Markov, Jenson). Convergence in probability and in distribution; weak law of large numbers and central limit theorem for independent identically distributed random variables with finite variance.

UNIT V: NUMBER THEORY DIVISIBILITY

Linear diophantine equations.Congruences. Quadratic residues; Sums of two squares, Arithmatic functions Mu, Tau, Phi and Sigma (and).

DIFFERENTIAL GEOMETRY: Space Curves – Their Curvature and torsion , Serret Frehat Formula; Fundamental theorem of Space curves; curves on surfaces – First and Second fundamental form – Gaussian curvatures – Principal directions and Principal Curvatures, geodesics, Fundamental equations of surface theory.

TOPOLOGY: Elements of Topological spaces – Continuity, Convergence, Homeomorphism, Compactness, Connectedness – Separation axioms – First and Second countability, Separately, Subspaces, Product space – Quotient spaces – Tychonoff's theorem – Urysohn's Metrization theorem – Homotopy and Fundamental Groups.

Reference Books

1.Kumaresan, Foundations in Mathematics.

CO-PO Mapping with Programme Outcomes: **CSIR - NET / SET Preparatory Course II**

Code : 22KP3ECCM3:1

CO / PO	1	2	3	4	5	6	7	8	9	10
1	2	3	1			3	3			
2	1		1	3			3			
3	1		1	2					2	
4	1	1	1	2					2	
5	1		3			1			1	

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM IV	CC 12	FUNCTIONAL ANALYSIS	22KP4M12	Inst Hour: 6	Credit: 5

Course Objectives: To Familiarize with the basic tools of Functional Analysis involving normed spaces, Banach spaces, and Hilbert spaces, their properties dependent on the dimension and the bounded linear operators from one space to another.

CO	STATEMENT
1	Describe the fundamental concepts of banach apaces and its role in Hahn Banach theorem.
2	Understand and apply fundamental theorems from the theory of open mapping theorem and the conjugate of an operator.
3	Explain the concepts of projection Hilbert space s and explores the concepts in finite dimensional spectral theory.
4	Learn about basic definition of banach algebra
5	Formulate the structure of commutative banach algebra and related theorems.

UNIT I : BANACH SPACES

Definition and examples- Continuous linear transformations – Hahn-Banach theorem - Natural imbedding of N in N** - Open mapping theorem – Conjugate of an operator.

Chapter 9: Sections 46 to 51

UNIT II : HILBERT SPACES

Definition - Simple properties – Orthogonal complements – Orthonormal sets – Conjugate space H* -Adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections.

Chapter 10: Sections 52 to 59

UNIT III : SPECTRAL THEORY

Finite – Dimensional Spectral Theory: Matrices – Determinants and the Spectrum of an operator – Spectral theorem.

Chapter 11: Sections 60 to 62

UNIT IV : GENERAL PRELIMINARIES ON BANACH ALGEBRAS

Definition and examples – Regular and singular elements – Topological divisors of zero - Spectrum – Formula for the spectral radius – The radical and semi – simplicity.

Chapter 12: Sections 64 to 69

UNIT V : THE STRUCTURE OF COMMUTATIVE BANACH ALGEBRAS

The Gelfand Mapping – Applications of the Formula $r(x) = \lim \| x^n \|^{1/n}$ - Involutions in Banach Algebras – The Gelfand – Neumark Theorem.

Chapter 13: Sections 70 to 73

UNIT VI : APPLICATIONS

Real life Applications of banach space and Hilbert space. It is applicable in Mechanics and theoretical Physics.

Text Books

G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Education (India) Private Limited, New Delhi, Edition 2004.

Reference Books

1. Walter Rudin, Functional Analysis, TMH Edition,1974.
2. B.V. Limaye, Functional Analysis , Wiley Eastern Limited, Bombay, Second print,1985.
3. K.Yosida, Functional Analysis, Springer – Verlag, 1974.
4. Laurent Schwarz, Functional Analysis, Courant Institute of Mathematical Sciences, New York University,1964.
5. D.Somasundaram, Functional Analysis, Narosa Publications, New Delhi.

CO-PO Mapping with Programme Outcomes: **FUNCTIONAL ANALYSIS Code : 22KP4M12**

CO / PO	1	2	3	4	5	6	7	8	9	10
1			3	1	3		1			
2			3	1	2					
3			3	1	2		3			
4			2	1	3			2		
5			2	1	3			2	3	

1-Low, 2- Moderate, 3 – High Correlation

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SEM IV	CC 13	INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS	22KP4M13	Inst Hour: 6	Credit: 5

Course Objectives: To Introduce the Concepts of Calculus of Variations and Integral Equations and their Applications. To Study different Types of Transforms and their Properties

CO	STATEMENT
1	Understand the different types of integral equations and its properties.
2	Explain Fredholm's first theorem, Fredholm's second theorem, Fredholm's third theorem.
3	Evaluate Boundary value problem, heat conduction equation, wave equation.
4	Identify the concept of Fourier integral theorem , Modulation theorem
5	Express Hankel transform of derivatives, Parsevals theorem.

UNIT I : APPLICATIONS OF LAPLACE TRANSFORMS

Initial Value Problem – Boundary Value Problem – Heat Conduction Equation – Wave Equation – Laplace Equation – Examples – Applications to Beams.

Chapter 5 of Text Book 2.

UNIT II : FOURIER TRANSFORM

Drichlet's conditions – Fourier Series – Fourier Integral Formula – Complex Fourier Transform – Inversion Formula for Sine, Cosine Transform – Linearity Property – Modulation Theorem – Parseval's Identity – Finite Fourier Transform – Finite Fourier Transform – Finite Fourier Sine and Cosine Transforms.

Chapter 7 and 8 of Text Book 2.

UNIT III : 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.

Chapter 9 of Text Book 2.

UNIT IV : LINEAR INTEGRAL EQUATIONS

Definition, Regularity conditions – Special kind of kernels – Eigen values and Eigen functions – Convolution Integral – Inner and scalar product of two functions – Notation – Reduction to a system of Algebraic equations – Examples – Fredholm alternative – Examples – Approximate method.

Chapter 1 and 2 of Text Book 1.

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UNIT V : METHOD OF SUCCESSIVE APPROXIMATIONS

Iterative scheme – Examples – Volterra Integral equation – Examples- Some results about the resolvent kernel. Classical Fredholm Theory: Method of solution of Fredholm – Fredholm's first theorem – Second theorem – Third theorem.

Chapters 3 and 4 of Text Book 1.

UNIT VI : APPLICATIONS

Application of Volterra integral equation is used in demography , the study of iso elastic materials and in actual science through the renewal equation - Integral equations used in Engineering field. -Fourier Transform used in field of signal processing.

Text Books

1. Ram.P.Kanwal- Linear Integral Equations Theory and Practise, Academic Press 1971.
2. A.R. Vasishtha, R.K. Gupta, Integral Transforms, Krishna Prakashan Media Pvt. Ltd, India, 2002.

Reference Books

1. S.J. Mikhlin, Linear Integral Equations(translated from Russian), Hindustan Book Agency, 1960.
2. .N.Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966.

CO-PO Mapping with Programme Outcomes: **INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS**

Code : 22KP4M13

CO / PO	1	2	3	4	5	6	7	8	9	10
CO 1	2		3		2					
CO 2		3	2				3	2		
CO 3	3			2	3					
CO 4		3	2				3		2	
CO 5	3		2	3			2			

1-Low, 2- Moderate, 3 – High Correlation

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR –07.

SEM IV	CC14(P)	MATLAB PROGRAMMING PRACTICAL	22KP4M14P	Inst Hour: 6	Credit: 4

Course Objectives : Introduce common approaches, structures and conventions for creating and evaluating computer programs, primarily in a procedural paradigm, but with a brief introduction to object – oriented concepts and terminology. Introduce the MATLAB software environment.

CO	STATEMENT
1	Use MATLAB effectively to analyze and visualize data.
2	Apply numeric techniques and computer simulations to solve engineering-related problems.
3	Design and document computer programs and analyzes in a careful and complete manner so as to effectively communicated results.
4	To facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.
5	Demonstrate understanding and use of fundamental data structures.

List of MATLAB Programmes:

1. Arithmetic operations
2. Logical operations
3. Control structure
4. Matrix operations
5. Fibonacci series
6. Draw lines joining the points in 2D plot
7. Multiple plots on the same axis
8. Logarithmic plot
9. Bisection method
10. Newton's method

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Reference Books:

1. MATLAB – An Introduction with Application" by Amos Gilat, John Wiley & Sons, Singapore, 2011.

2."Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers" by R.Pratap, Oxford University Press, New Delhi, 2006.

3."Introduction to MATLAB 7 for Engineers" by W.J.Palm, McGraw – Hill Education, NewYork, 2005.

4."Introduction to MATLAB 7" by D.M.Etter, D.C.Kuncicky and H.Moore, Prentice Hall, New Jersy, 2004.

CO-PO Mapping with Programme Outcomes: **MATLAB PROGRAMMING PRACTICAL**

Code : 22KP4M14P

CO / PO	1	2	3	4	5	6	7	8	9	10
1				3		2		2		
2					2	3		2		
3				2	2	3			2	
4					2	2		3		2
5				2		2		3	2	2

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SEM IV	MBE3	FUZZY SETS AND ITS APPLICATIONS	22KP4MELM3:1	Inst Hour: 6	Credit: 4

Course Objectives : In this Course, Students will be enable to understand the crisp and fuzzy set theory. Make applications on fuzzy logic membership function and fuzzy inference systems. Compare the statistical methods against fuzzy logic methods.

CO	STATEMENT
1	Understand basic knowledge of fuzzy sets, operations and their properties.
2	Knowledge about the fundamental concepts of fuzzy relations, possibility theory and fuzzy decision making.
3	Describe the Fuzzy relations from crisp versus sets.
4	Analyzing the Fuzzy measures and Discuss about the Possibility theory.
5	Distinguish the difference between the various types of Decision Making

UNIT I : CRISP SETS AND FUZZY SETS

Crisp Sets - Fuzzy Sets Basic Types and Basic Concept - Fuzzy Set Versus Crisp Sets – Additional Properties of α – Cuts – Representation of Fuzzy Sets, Extension Principle For Fuzzy Sets.

Chapter 1: Sections 1.2 to 1.4
Chapter 2 : Sections 2.1 to 2.3

UNIT II : OPERATION ON FUZZY SETS

Types of Operations – Fuzzy Complements – Fuzzy Intersection T – Norms Fuzzy Union T – Conforms – Combinations of Operations – Aggregation Operation.

Chapter 3: Sections 3.1 to 3.6

UNIT III : FUZZY RELATIONS

Crisp Versus Fuzzy Relations - Projections and Cylindrical Extension – Binary Fuzzy Relations – Binary Relations on a Single Set – Fuzzy Equivalence Relation – Fuzzy Compatability Relations – Fuzzy Ordering Relations.

Chapter 5: Sections 5.1 to 5.7

UNIT IV : FUZZY LOGIC

Classical Logic – Multivalued Logics – Fuzzy Propositions – Fuzzy Quantifiers – Linguistic Hedges – Inference from condition fuzzy propostions.

Chapter 8 : Sections 8.1 to 8.6

UNIT V : FUZZY DECISION MAKING

Individual decision making –Multi person Decision Making – Multicriteria Decision Making - Multistage decision Making- Fuzzy Ranking Methods - Fuzzy Linear Programming.

Chapter 15: Sections 15.2 to 15.7

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UNIT VI: APPLICATIONS

Fuzzy logic has been used in numerous applications such as facial recoganization, air conditioners, washing machines, vaccum cleaners, trasmision systems & knowledge based system for multi objective optimization of power systems.

Text Books

George J.Klir and Bo Yuan, Fuzzy sets and fuzzy logic theory and applications, Prentice- Hall of India , Pvt. Ltd, New Delhi, 2005.

Reference Books

1.George J.Klir, Tina. A Folger, Fuzzy sets, Uncertainty and information, Prentice Hall of India Pvt. Ltd. New Delhi, 2008.
2. H.J.Zimmermann," Fuzzy set theory and its applications" second edition, Springer New Delhi, 2006.

CO-PO Mapping with Programme Outcomes: **FUZZY SETS AND ITS APPLICATIONS**
Code : 22KP4MELM3:1

CO / PO	1	2	3	4	5	6	7	8	9	10
1		3				2	2			
2		1		2		3				
3		3		2		3		3		
4	2	2							2	1
5		3		2		3		3		

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3. 1-Low, 2- Moderate, 3 – High Correlation

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SEM IV	MBE 3	FOURIER ANALYSIS	22KP4MELM3:2	Inst Hour: 6	Credit: 4

Course Objectives : The learning objectives of the development of the discipline "Fourier analysis and its applications " are the formation of students basic knowledge in the field of modern fourier analysis and approximation theory. The formation of students basic knowledge in the field of modern fourier analysis and approximation theory as well as the skills and abilities of their application in various tasks of natural science content.

CO	STATEMENT
1	To remembering the basic concepts of Fourier Transforms and Fourier Series
2	Analyze the spectral characteristics of signals using Fourier analysis.
3	Classify system based on their properties and determine the response of LTI
4	Identify system properties based on impulse response and Fourier analysis
5	Apply transform techniques to analyze continuous- time and discrete –time

UNIT I: FOURIER SERIES ON $\mathbb{T}$

Fourier coefficients – Summability in norm and homogeneous Banach spaces on $\mathbb{T}$ - pointwise convergence of $\sigma_n(f)$ – The order of magnitude of fourier coefficients – Fourier series of square summable functions – Absolutely convergent Fourier series – Fourier coefficients of linear functional – Additional comments and applications.

Chapter 1: Sections 1 to 8

UNIT II : THE CONVERGENCE OF FOURIER SERIES

Convergence in norm – Convergence and divergence at a point – Sets of divergence .

THE CONJUGATE FUNCTION

The conjugate function – The maximal function of Hardy and little wood – The Hardy spaces.\

Chapter 2 and Chapter 3

UNIT III : INTERPOLATION OF LINEAR OPERATORS

Interpolation of norms and of linear operators – The theorem of Hausdorff Young .

LACUNARY SERIES AND QUASI ANALYTIC CLASSES

Lacunary series – Quasi analytic classes.

Chapter 4 and Chapter 5

UNIT IV : FOURIER ANALYSIS ON LOCALLY COMPACT ABELIAN GROUPS

Locally compact abelian groups – The Haar measure – Characters and the dual group – Fourier transforms – Almost periodic functions and the Bohr compactification.

COMMUTATIVE BANACH ALGEBRAS

Definitions, examples and elementary properties – Maximal ideals and multiplicative linear functional - The maximal ideal space and the Gelfand representation.

Chapter 7 and Chapter 8: Sections 1 to 3

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UNIT V : COMMUTATIVE BANACH ALGEBRAS

Homomorphisms of Banach algebras – Regular algebras – Wiener's general Tauberian theorem – spectral synthesis in regular algebras – Functions that operate in regular Banach algebras - Algebra M(T) and functions that operate on fourier – Stieltjes coefficients - Use of tensor products.

Chapter 8: Sections 4 to 10

UNIT VI: APPLICATIONS

There are many different applications of the Fourier analysis in the field of scinece such as qualization of audio recording, Image processing, X-ray ,Crystallography etc.

Text Books

Y. Katznelson, An Introduction to Harmonic Analysis, Third Edition, Cambridge University Press, 2004

CO-PO Mapping with Programme Outcomes: **FOURIER ANALYSIS** **Code : 22KP4MELM3:2**

CO / PO	1	2	3	4	5	6	7	8	9	10
1		1	1		3					
2			1	3			2			
3			2	3	2		2			
4			2	1	3					
5				2	1		3			

1-Low, 2- Moderate, 3 – High Correlation

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VIII. Continuous Internal Assessment System

	Maximum	Components			Passing Minimum
		Attendance	CIA	Seminar / Assignment	
Theory	25	05	15	05	10
Practical*	40	05	15	20 (Record)	16

** Department specific*

IX. Question Pattern

	Part A	Part B	Part C
Semester Exam: Theory (75)	20 x 1=20 (Answer All)	5 x 5= 25 (Internal choice)	3 x10 =30(Open choice)
Semester Exam: Practical (60)	5 x 10 = 50*	---	---
CIA Exam: Theory (50)	10 x 1=10 (Answer All)	4 x 5= 20 (Internal choice)	2 x 10 =20(Open choice)
Model Exam Theory (75)	20 x 1=20 (Answer All)	5 x 5= 25 (Internal choice)	3 x 10 =30(Open choice)
*Model Exam: Practical (50)	5 x10 = 50	---	---

** Department specific*

X. Question Allocation and Blooms Taxonomy for (Direct) Assessment

Unit	Section & Marks	Question Number	Blooms Level	Action Verbs
I	A (1 mark)	1-4	I / II	*Level I: Choose, Define, Find, How, Label, List, Match, Name, Select, Show Tell, What, When, Where, Which, Who, Why* *Level II: Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Show, Summarize, Translate* *Level III: Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize* *Level IV: Analyze, Assume, Categorize, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme* *Level V: Agree, Appraise, Assess, Award, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value* *Level VI: Adapt, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory*
	B (5 mark)	21 (a) and (b)	I / II	
	C (10 mark)	26	I / II	
II	A (1 mark)	5-8	I / II	
	B (5 mark)	22 (a) and (b)	I / II	
	C (10 mark)	27	I / II	
III	A (1 mark)	9-12	I / II	
	B (5 mark)	23 (a) and (b)	III / IV	
	C (10 mark)	28	III / IV	
IV	A (1 mark)	13-16	I / II	
	B (5 mark)	24 (a) and (b)	III / IV	
	C (10 mark)	29	V / VI	
V	A (1 mark)	17-20	I / II	
	B (5 mark)	25 (a) and (b)	V / VI	
	C (10 mark)	30	V / VI	

BL	No. Of Questions (Sections)			Total Marks	% of Marks
	A	B	C		
I. Remembering	12	4	2	12	50
II. Understanding	08			48	
III. Applying	-	4	2	20	33
IV. Analyzing	-			20	
V. Evaluating	-	2	1	10	17
VI. Creating	-			10	
Total Questions	20	10	5	120	100

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XI. Teaching Methodology Adopted: (department specific) + Department may adopted at least a 20 % of ICT enabled classes out of total hours of each course work and proper documents *(Date, Hour, Course and unit, name of the faculty and sign of the representative student)* to be maintained for the same

XII. Outline of Learning Outcomes - based Curriculum Frame work (LOCF)
(All the following categories of courses will be given with definition, procedure and system of implementation)

1. CC : Core Course : 13 Theory + 1 Practical + 1 Project **(15)**
2. MBE : Major Based Elective : 3 Theory
3. NME : Non Major Elective : 2 Theory
4. ECC - Extra Credit Course
   (A) SS-Self Study : 2
   (B) Add on Course : 1

* Add-on Certificate Courses with 10-30 contact Hrs conducting by Course Coordinator of the Department / College

Verified.

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QUESTION BLUE PRINT (75 Marks)

Q.No	*Unit*	*Blooms Level*
		Part A
1	I	Remembering I / Understanding II
2	I	Remembering I / Understanding II
3	I	Remembering I / Understanding II
4	I	Remembering I / Understanding II
5	II	Remembering I / Understanding II
6	II	Remembering I / Understanding II
7	II	Remembering I / Understanding II
8	II	Remembering I / Understanding II
9	III	Remembering I / Understanding II
10	III	Remembering I / Understanding II
11	III	Remembering I / Understanding II
12	III	Remembering I / Understanding II
13	IV	Remembering I / Understanding II
14	IV	Remembering I / Understanding II
15	IV	Remembering I / Understanding II
16	IV	Remembering I / Understanding II
17	V	Remembering I / Understanding II
18	V	Remembering I / Understanding II
19	V	Remembering I / Understanding II
20	V	Remembering I / Understanding II
		Part B
21 (a)	I	Remembering I / Understanding II
(b)	I	Remembering I / Understanding II
22 (a)	II	Remembering I / Understanding II
(b)	II	Remembering I / Understanding II
23 (a)	III	Applying III / Analyzing IV
(b)	III	Applying III / Analyzing IV
24 (a)	IV	Applying III / Analyzing IV
(b)	IV	Applying III / Analyzing IV
25 (a)	V	Creating V / Evaluating V I
(b)	V	Creating V / Evaluating V I
		Part C
26	I	Remembering I / Understanding II
27	II	Remembering I / Understanding II
28	III	Applying III / Analyzing IV
29	IV	Applying III / Analyzing IV
30	V	Creating V / Evaluating V I

verified

1. S.

2. S.

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