SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS) MADURAI -2

DEPARTMENT OF MATHEMATICS

CBCS course structure for M.Sc. Mathematics
as directed by
Tamil Nadu State Council for Higher Education

From June 2022 Onwards
SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN(A)

MADURAI

DEPARTMENT OF MATHEMATICS

The Department of Mathematics is offering B.Sc. Mathematics since 1966 and M.Sc. Mathematics since 1980.

The department has an enterprising faculty team and provides an enriched academic ambience for the students. Six of the faculty members have a Ph.D. Two of them are recognized research guides of Madurai Kamaraj University. Four of the faculty members are currently pursuing Ph.D.

Five of the staff members have degree in pedagogy. Four faculty members have PGDCA qualification.

Vision

The Vision of our department is to empower the Women Students to attain academic excellence.

Mission

The Mission of Mathematics department is to provide a strong foundation in Mathematics which will enable our students to excel in pedagogy and research.

Program Outcomes

The successful completion of M.Sc. program will enable the students to:

PO1 Getting enriched by the existing knowledge in their respective disciplines and applying appropriate methodology for research and implementation

PO2 Develop technology compatible to new perceptions and evolve innovative pedagogy in their discipline

PO3 Design creative projects and translate it to the present day scenario

PO4 Evaluate the issues and challenges pertaining to their disciplines and synergize them with the growing needs in their arena

PO5 Explore the diverse value systems of our nation and contribute towards building an egalitarian society

Program Specific Outcomes

On successful completion of M.Sc. Mathematics program the students will be able to:

PSO1 Acquire mastery in the core subjects of Algebra, Analysis, Geometry and Differential equations and gain in depth knowledge in applications of mathematics such as Statistics, Operations Research, Design and Analysis of Algorithms.

PSO2 Master a wide range of mathematical skills.

PSO3 Develop the ability to model real life problems using the mathematical concepts .

PSO4 Identify the appropriate problem solving technique which can be applied to any given mathematical model.

PSO5 Tackle competitive examinations like CSIR JRF/NET, TRB recruitment etc with confidence.

MAPPING PATTERN

Mapping	**1-20%**	**21-40%**	**41-60%**	**61-80%**	**81-100%**
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

M.Sc. Mathematics (2022 onwards)

Semester	Subject Code	Title of the Paper	Hours	Credit
I	P22CM1	Abstract Algebra	7	5
	P22CM2	Real Analysis – I	6	5
	P22CM3	Ordinary Differential Equations	6	5
	P22CM4	Data Structure Using 'C'	6	4
	P22DSM1AP	Data Structure Using 'C' Lab	3	2
	P22DSM1BP	Data Structure Using 'C++' Lab		
	P22SEM1	Logic And Reasoning	2	2
		Total	**30**	**23**
II	P22CM5	Topology	6	4
	P22CM6	Complex Analysis	6	4
	P22CM7	Partial Differential Equations	6	4
	P22CM8	Mathematical Methods	5	4
	P22DSM2A	Mechanics	5	4
	P22DSM2B	Discrete Mathematics		
	P22SEM2	Mathematical Sciences	2	2
		Total	**30**	**22**
III	P22CM9	Real Analysis – II	6	5
	P22CM10	Graph Theory	6	5
	P22CM11	Differential Geometry	6	4
	P22CM12	Numerical Analysis	5	4
	P22DSM3A	Linear Algebra	5	4
	P22DSM3B	Number Theory And Cryptography		
	P22NMM1	Mathematical Logic And Reasoning	2	2
		Total	**30**	**24**
IV	P22CM13	Functional Analysis	5	4
	P22CM14	Mathematical Statistics	6	4
	P22CM15	Optimization Techniques	6	4
	P22CMPW	Project	8	5
	P22DSM4A	Fuzzy Sets And Their Applications	5	4
	P22DSM4B	Formal Languages and Automata Theory		
		Total	**30**	**21**

* DS - Discipline Specific Elective Course ** SE - Skill Enhancement Course
*** NM - Non Major Elective Course

M.Sc. Mathematics (2022 onwards)
CORE AND ELECTIVE

EVALUATION PATTERN

Internal	:	25
External	:	75
Total	:	100

Passing Minimum	:	50 Marks
No Internal Minimum		
External Minimum	:	45% (34 Marks)
Internal and External together	:	50%

Question Paper Pattern

Time: 3 hours Max Marks : 75

Section A :

5 questions. Each question with **internal choice** between two questions from the same unit. That is every question is of 'either – or ' type.

Marks = 25 Marks
(2 Questions from each unit)

Section B:

Every question is of Either – or type

Marks = 50 Marks
(2 Questions from each unit)

BLOOM'S TAXONOMY

REMEMBERING	**50%**
UNDERSTANDING	**30%**
APPLYING	**20%**

M.Sc. Mathematics (2022 onwards)
DISCIPLINE SPECIFIC ELECTIVE

EVALUATION PATTERN

Internal	:	25
External	:	75
Total	:	100

Passing Minimum : 50 Marks
No Internal Minimum
External Minimum : 45% (34 Marks)
Internal and External together : 50%

Question Paper Pattern

Time: 3 hours Max Marks : 75

Section A :

5 questions. Each question with **internal choice** between two questions from the same unit. That is every question is of 'either – or ' type.

Marks = 25 Marks
(2 Questions from each unit)

Section B:

Every question is of Either – or type

Marks = 50 Marks
(2 Questions from each unit)

BLOOM'S TAXONOMY

REMEMBERING	**50%**
UNDERSTANDING	**30%**
APPLYING	**20%**

M.Sc. Mathematics (2022 onwards)
SKILL ENHANCEMENT COURSE

EVALUATION PATTERN

Internal	:	25
External	:	75
Total	:	100

Passing Minimum : 50 Marks
No Internal Minimum
External Minimum : 45% (34 Marks)
Internal and External together : 50%

Question Paper Pattern

Time: 3 hours Max Marks : 75

Section A :

5 questions. Each question with **internal choice** between two questions from the same unit. That is every question is of 'either – or ' type.

Marks = 25 Marks
(2 Questions from each unit)

Section B:

Every question is of Either – or type

Marks = 50 Marks
(2 Questions from each unit)

BLOOM'S TAXONOMY

REMEMBERING	**50%**
UNDERSTANDING	**30%**
APPLYING	**20%**

NON MAJOR ELECTIVE

Mathematical Logic and Reasoning **(2022 onwards)**

EVALUATION PATTERN

Internal	:	25
External	:	75
Total	:	100

Passing Minimum	:	50 Marks
No Internal Minimum		
External Minimum	:	45% (34 Marks)
Internal and External together	:	50%

Question Paper Pattern

Time: 3 hours Maximum Marks : 75

Section A :

5 questions. Each question with **internal choice** between two questions from the same unit. That is every question is of 'either – or ' type.

Marks = 25 Marks
(2 Questions from each unit)

Section B:

Every question is of Either – or type

Marks = 50 Marks
(2 Questions from each unit)

Semester: I **Hours: 7/W 105hrs/Sem**
Course Code: P22CM1 **Credits: 5**
Title of the Paper: ABSTRACT ALGEBRA **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	7	4	1	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Deeply analyse the Sylow's Theorem	1	21
CO2. Acquire the knowledge of Polynomial Rings	2	21
CO3. Gain the knowledge of Extension fields, roots of polynomials	3	21
CO4. Identify the concept of fixal fields	4	21
CO5. Study the concept of Galois theory and solvability by radicals, Galois groups over the rationals	5	21

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	5	2	4	5	5	4	3	4	5	4
CO2	2	5	2	4	5	5	4	3	4	4	3.8
CO3	2	4	2	4	5	5	4	3	4	5	3.8
CO4	3	5	4	4	5	5	5	5	5	5	4.6
CO5	3	5	4	4	5	5	5	5	5	5	4.6

Overall Mean Score: 4.16

SEMESTER I

P22CM1 – ABSTRACT ALGEBRA

Lecture hours: 7 Credit: 5

UNIT I

Another Counting Principle – 1st, 2nd and 3rd parts of Sylow's Theorems – Double Coset – The Normalizer of a group.

UNIT II

External and Internal direct Products – Structure theorem for finite abelian groups – Non Iso-morphic abelian groups - Polynomial rings.

UNIT III

Polynomials over rational fields - Extension fields – Roots of polynomials – Splitting fields.

UNIT IV

More about roots – Simple extension – Separable extension – Fixed fields – Symmetric rational functions – Normal extension - Galois group – Fundamental theorem of Galois theory.

UNIT V

Solvable group – The commutator subgroup – Solvability by radicals – Finite fields- Wedderburn Theorem on Finite division ring.

TEXT BOOK

1. I.N. Herstein, Topics in Algebra, 2nd Edition, John Wiley and Sons, New York, 1975.

UNIT I : CHAPTER: 2 - SECTIONS: 2.11&2.12
UNIT II : CHAPTER: 2&3 - SECTIONS: 2.13, 2.14, 3.9
UNIT III : CHAPTER: 3&5 - SECTIONS: 3.10, 5.1, 5.3
UNIT IV : CHAPTER: 5 - SECTIONS: 5.5&5.6
UNIT V : CHAPTER: 5&7 - SECTIONS: 5.7, 7.1, 7.2

REFERENCE BOOKS

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

Semester: I **Hours: 6/W 90hrs/Sem**
Course Code: P22CM2 **Credits: 5**
Title of the Paper: REAL ANALYSIS - I **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	1	1	-

Course Outcomes On completing this course the student will be able to	Unit	Hrs/S
CO1. Recall the concepts metric spaces, compact sets and connected sets.	1	18
CO2. Demonstrate limits, Continuity and connectedness of functions.	2	18
CO3. Interpret derivative of a real function and apply L'Hospital's rule and Taylor's theorem	3	18
CO4. Analyse Sequences and Series of functions and apply the Stone-Weirestrass theorem..	4	18
CO5. Recall power series and analyse Fourier series.	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	4	4	4	4	4	3	3.6
CO2	3	4	3	3	4	4	4	3	3	3	3.4
CO3	3	4	3	3	4	4	3	4	3	3	3.4
CO4	3	4	3	3	4	4	4	3	4	4	3.6
CO5	3	3	3	3	3	3	3	4	4	3	3.2

Overall Mean Score: 3.44

SEMESTER I
P22CM2 – REAL ANALYSIS - I

Lecture hours : 6 Credit : 5

UNIT I

Metric spaces: Compact sets, Perfect sets, Connected sets.

UNIT II

Continuity: Limits of functions, Continuous functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic functions, Infinite limits and limits at infinity.

UNIT III

Differentiation: The derivative of a real function, Mean value theorem, The continuity of derivatives, L'Hospital's rule, Derivatives of higher order, Taylor's theorem, Differentiation of vector - valued functions

UNIT IV

Sequences and series of functions: Uniform convergence, Uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation, Equicontinuous families of functions, The Stone-Weierstrass theorem.

UNIT V

Some special functions: Power series, The exponential and Logarithmic functions, The trigonometric functions, The algebraic completeness and the complex field, Fourier series, The Gamma function

TEXT BOOK

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

UNIT I	:	Chapter 2
UNIT II	:	Chapter 4
UNIT III	:	Chapter 5
UNIT IV	:	Chapter 7
UNIT V	:	Chapter 8

REFERENCE BOOKS

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

Semester: I **Hours: 6/W 90hrs/Sem**
Course Code: P22CM3 **Credits:5**
Title of the Paper: ORDINARY DIFFERENTIAL EQUATIONS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	3	1	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Acquire Knowledge about Linear differential homogeneous equations .	1	18
CO2. Solve the homogeneous equations.	2	18
CO3. Solve the Non-homogeneous Equations and Legendre Equations	3	18
CO4. Know about Regular Singular Points and Bessel Equations.	4	18
CO5. Apply the method of successive approximations and Lipschitz condition.	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	3	3	3	4	4	3	4	4	3.6
CO2	4	4	3	3	3	4	3	3	4	4	3.5
CO3	4	4	3	2	2	3	4	3	4	4	3.3
CO4	3	4	3	3	2	4	4	2	4	3	3.2
CO5	3	4	3	2	2	3	3	2	3	3	2.8

Overall Mean Score: 3.3

SEMESTER – I

P22CM3 – ORDINARY DIFFERENTIAL EQUATIONS

Lecture hours: 6 Credit:5

UNIT I

Introduction - Second order Homogenous Equations – Initial Value Problem For Second order Equations - Linear Dependence and Independence - A Formula for Wronskian

UNITII

The Non- homogenous equations of order two-homogenous and Non -homogenous equations of order n - Initial value problems for n^{th} order equations- Annihilator method to solve non- Homogenous equation.

UNIT III

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

UNIT IV

Introduction-The Euler equations - Second order equations with regular singular points - Exceptional cases - The Bessel equation – The Bessel equation(contd).

UNIT V

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

TEXT BOOK

1. An introduction to Ordinary Differential Equations – Earl. A. Coddington, Prentice Hall of India, New Delhi, Sixteenth Indian Reprint, 2008.

UNIT I	:	Chapter 2	:	Sections 1 to 5.
UNIT II	:	Chapter 2	:	Sections 6 to 11
UNIT III	:	Chapter 3	:	Sections 1 to 8.
UNIT IV	:	Chapter 3	:	Sections 1 to 4, 6 to 8
UNIT V	:	Chapter 5	:	Sections 1 to 8.

REFERENCE BOOKS

1. Williams E. Boyce and Richard C. Diprima Elementary Differential Equations and Boundary Value Problems, 10th edition John Wiley and Sons, New York 2012
2. M.D. Raisinghania, Advanced Differential Equations, S. Chand & Company Ltd., New Delhi 2012

3. George F. Simmons, Differential Equations with Application And Historical Notes, Tata McGraw Hill, New Delhi 1974
4. B. Rai, D.P. Choudhury and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House Pvt. Ltd, New Delhi 2012.
5. Ravi P. Agarwal and Ramesh C. Gupta, Essentials of Ordinary Differential

Semester: I **Hours: 6/W 90hrs/Sem**
Course Code: P22CM4 **Credits: 4**
Title of the Paper: DATA STRUCTURES USING 'C' **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Learn about Abstract Data Types, Linked List concepts	1	18
CO2. Study about Implement stacks and queue	2	18
CO3. Acquire knowledge about Implementation of trees	3	18
CO4. Learn the algorithms of Insertion sort, Merge sort, Quick sort and its Analysis	4	18
CO5. Study about Dijikstras shortest path algorithm	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3.5	3.5	3.5	3	3.5	3.5	3	3	3.5	4	3.4
CO2	3.5	3.5	3	3.5	3.5	3	3.5	3.5	3.5	4	3.45
CO3	3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	3.5
CO4	3.5	3.5	3	3.5	3	3.5	3.5	3.5	3.5	4	3.45
CO5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	3.55

Overall Mean Score: 3.47

SEMESTER I

P22CM4 - DATA STRUCTURES USING C

Lecture hours: 6 Credit : 4

UNIT I

Lists -Abstract Data types(ADTs), The List ADT: Simple Array implementation of lists, Linked lists, Programming details, Common errors, Doubly linked lists, Circularly linked lists, Examples, Cursor implementation of linked lists.

UNIT II

Stacks, Queues - The stack abstract data types: stack model, Implementation of stacks, application. The Queue abstract data types, Queue model, Array implementation of queues, application of queues.

UNIT III

Trees - Preliminaries: Implementation of Trees, Trees traversals with an application, Binary trees, Implementation, Expression Trees. The Search Tree ADT, Binary Search Trees, Make empty, Find, FindMin and FindMax, Insert, Delete, Average Case Analysis.

UNIT IV

Sorting - Preliminaries: Insertion Sort-the Algorithm, Analysis of Insertion sort. Mergesort, Analysis of Mergesort. Quick sort -Picking the Pivot - Partitioning Strategy - Small Arrays - Actual Quicksort Routines - Analysis of Quicksort - A Linear Expected Time Algorithm for Selection.

UNIT V

Graph Algorithm - Shortest path Algorithm - Unweighted shortest paths -Dijkstra's Algorithm - Graphs with negative edge costs - Acyclic graphs - All Pairs Shortest Path.

TEXT BOOK

1. Data structures and algorithm analysis in C' - Mark Allen Weiss, Second Edition, Pearson Publications, 2014.

UNIT I : Chapter 3: Sections 3.1, 3.2
UNIT II : Chapter 3 : Sections 3.3, 3.4
UNIT III : Chapter 4 : Sections 4.1, 4.2, 4.3
UNIT IV : Chapter 7 : Sections 7.1, 7.2, 7.6, 7.7
UNIT V : Chapter 9 : Section 9.3

REFERENCE BOOKS

1. Fundamentals of Data Structures by Ellis Horrowitz, Sartaj Sahani – Galgotia Publishers, 1998.
2. C and Data Structures by P.RadhaGanessan, Scitech Publishers India Pvt Ltd, 2011.
3. Data Structures using ‘C’ by E.Balagurusamy, Tata McGraw-Hill Education, Reprint 2015

Semester: II **Hours: 6/W 90/Sem**
Course Code: P22CM5 **Credits: 4**
Title of the Paper: TOPOLOGY **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	-	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Have a sound knowledge of some of the elementary concepts associates with topological spaces viz, open and closed sets limit points and continuous functions etc.,	1	18
CO2. Master in Product topology, Metric topology and its relation.	2	18
CO3. Define and briefly study in compactness	3	18
CO4. Understand the concept of countability Axioms, Seperation axioms	4	18
CO5. Understanding the concept of Urysohn lemma and Urysohnmetrization Theorem	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	3	3	4	4	4	3	4	3	3.6
CO2	3	4	3	3	3	4	4	3	3	3	3.3
CO3	4	4	3	3	4	4	4	4	4	3	3.7
CO4	3	4	3	3	3	4	4	3	4	3	3.5
CO5	4	4	3	3	4	4	4	4	4	3	3.7

Overall Mean Score: 3.28

SEMESTER II

P22CM5 - TOPOLOGY

Lecture hours: 6 Credit: 4

UNIT I

Types of Topological Spaces and Examples - Basis for a Topology - The Order Topology The Product Topology on $X \times Y$ – The Subspace Topology - Closed Sets and Limit points – Continuous Functions.

UNIT II

The Product Topology - The Metric Topology - Sequence lemma - Uniform limit theorem - Connected Spaces - Connected Subspaces of the Real Line - Components and Local Connectedness.

UNIT III

Compact Spaces - Compact Subspaces of the Real Line - Uniform continuity theorem - Limit Point Compactness - Complete metric spaces - Compactness in metric spaces.

UNIT IV

First and Second countable spaces - Lindeloff and Separable spaces - Countability axioms - The Separation Axioms - Normal spaces - The Uryshon's lemma.

UNIT V

The Urysohn Metrization Theorem - Tietze Extension Theorem – The Tychonoff theorem - Stone Cechcompactifications.

TEXT BOOK

1. Topology by James R Munkers, Second Edition, Prentice Hall of India Private Ltd. New Delhi 2001.

UNIT I :	Chapter 2	: Sections	12 - 18
UNIT II :	Chapter 2	: Sections	19 - 20
	Chapter 3	: Sections	23 - 25
UNIT III :	Chapter 3	: Sections	26 - 28
UNIT IV :	Chapter 4	: Sections	30 - 33
UNIT V :	Chapter 4	: Sections	34 & 35
	Chapter 5	: Sections	37 & 38

REFERENCE BOOKS

1. G.F. Simmons, Introduction to Topology and Modern Analysis, Tata McGraw-Hill Edition, New Delhi (2004)
2. Fred H. Croom, Principles of Topology, Cengage India Pvt Ltd, New Delhi (2009)
3. Seymour Lipschutz, Theory and Problems of General Topology, McGraw-Hill Edition, New Delhi(2006)

Semester: II **Hours: 6/W 90hrs/Sem**
Course Code: P22CM6 **Credits: 4**
Title of the Paper: COMPLEX ANALYSIS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	5	1	-	-

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Have adequate knowledge of complex integration using Cauchy's theorem and integral formula	1	18
CO2. Have a strong knowledge of Harmonic Functions	2	18
CO3. Have a deep knowledge of Partial Fractions and Entire Functions	3	18
CO4. Familiar with Riemann Mapping Theorem	4	18
CO5. Have a strong knowledge of conformal mappings and elementary Riemann Surfaces	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	3	5	3	3	4	2	2.9
CO2	4	3	4	4	3	3	4	4	2	3	3.2
CO3	3	3	3	3	4	3	3	2	3	3	3
CO4	3	4	3	2	4	4	4	1	5	2	3.2
CO5	4	4	3	4	4	3	3	2	3	3	3.3

Overall Mean Score: 3.12

SEMESTER II
P22CM6 – COMPLEX ANALYSIS

Lecture hours: 6 Credit: 4

UNIT I

Fundamental Theorems: 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. Local Properties of analytical Functions: Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.

UNIT II

The General Form of Cauchy's Theorem: Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multiply connected regions. The Calculus of Residues: Residue Theorem - The argument principle - Evaluation of Definite Integrals. Harmonic Functions: Definition of Harmonic function and basic properties - Mean value property - Poisson formula.

UNIT III

Partial Fractions and Entire Functions: Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem. Riemann zeta Function and Normal Families: Product development – Extension of (s) to the whole plane – The zeros of zeta function – Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions – The Classical Definition.

UNIT IV

Riemann mapping Theorem: Statement and Proof – Boundary Behaviour – Use of the Reflection Principle. Conformal mappings of polygons: Behaviour at an angle – Schwarz-Christoffel formula – Mapping on a rectangle. Harmonic Functions: Functions with mean value property – Harnack's principle.

UNIT V

Simply Periodic Functions: Representation by Exponentials-The Fourier Development - Functions of Finite Order. Doubly Periodic Functions: The Period Module-Unimodular Transformations - The Caninical Basis-General Properties of Elliptic Functions. Weierstrass Theory: The Weierstrass-function – The functions (s) and (s) – The differential equation – The modular equation () – The Conformal mapping by ().

TEXT BOOK

1. Complex Analysis by Lars V. Ahlfors, Tata McGraw Hill International, Third Edition, 2013.

UNIT I : CHAPTER 4 : SECTIONS: 1.4, 1.5, 1, 2.1to2.3, 3.1to3.6
UNIT II : CHAPTER 4 : SECTIONS: 4.1to4.7, 5.1to5.3, 6.1to6.3
UNIT III : CHAPTER 5 : SECTIONS: 2.1to2.4, 3.1&3.2, 4.1, 4.2, 4.4, 5.1to5.5
UNIT IV : CHAPTER 6 : SECTIONS:1.1to1.3, 2.1to2.3, 3.1&3.2
UNIT V : CHAPTER 7 : SECTIONS:1.1to1.3, 2.1to2.4, 3.1to3.5

REFERENCE BOOKS

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford, 1990.
2. J.B. Corway, Functions of one complex variables, Springer - Verlag, International student Edition, Narosa Publishing Co.
3. E. Hille, Analytic function Thorey (2 vols.), Gonm& Co, 1959.
4. M.Heins, Complex function Theory, Academic Press, New York,1968.

Semester: II **Hours: 6/W 90hrs/Sem**
Course Code: P22CM7 **Credits: 4**
Title of the Paper: PARTIAL DIFFERENTIAL EQUATIONS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	-	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Grasp thoroughly the fundamentals of first order partial differential Equation	1	18
CO2. Solve quasi linear and non linear partial differential equation	2	18
CO3. Classify second order partial differential equation and solve the wave Equation	3	18
CO4. Apply Wave Equations	4	18
CO5. Solve the Diffusion Equations	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	5	4	3	4	4	4	3	4	3	3.8
CO2	4	5	5	4	4	4	4	4	5	3	3.8
CO3	4	5	3	4	4	4	4	3	4	3	3.8
CO4	4	5	5	4	4	4	4	4	4	3	3.7
CO5	3	4	5	4	4	3	4	4	5	3	3.9

Overall Mean Score: 3.8

SEMESTER II

P22CM7 - PARTIAL DIFFERENTIAL EQUATIONS

Lecture hours: 6 Credit: 4

UNIT I

Partial Differential Equations – Origins of First Order Differential Equations – Cauchy's Problem for first order equations – Linear Equations of the first order –Integral surfaces passing though a Given Curve-Surfaces Orthogonal to a Given System of surfaces- Nonlinear partial differential equations of the first order – Cauchy's method of characteristics – Compatible system of First order Equations –Charpits Method-Special type of First Order Equations-Solutions Satisfying Given Conditions Solutions satisfying Given Condition, Jacobi's method.

UNIT II

The Origin of Second Order Equations – Linear partial Differential Equations with constant coefficients – Equations with variable coefficients – Separation of variables – The method of Integral Transforms – Non – linear equations of the second order. Integral Surfaces through a given curve – Quasi - Linear Equations – Non-Linear First order P.D.E.

UNIT III

Elementary solutions of Laplace equation – Families of Equi-potential Surfaces – Boundary value problems – Separation of variables – Surface Boundary Value Problems – Separation of Variables – Problems With Axial Symmetry – The Theory of Green's Function for Laplace Equation.

UNIT IV

The Occurrence of the wave equation in Physics – Elementary Solutions of the One – dimensional Wave equations – Vibrating membrane, Application of the calculus of variations – Three dimensional problem – General solutions of the Wave equation.

UNIT V

Elementary Solutions of the Diffusion Equation – Separation of variables – The use of Integral Transforms – The use of Green's functions.

TEXT BOOK

1. Ian Sneddon – Elements of Partial Differential Equations – McGraw Hill International Book Company, New Delhi, 1983

UNIT I : Chapter 1 : Sections 1.1 to 1.8
UNIT II : Chapter 1 : Sections 1.9 to 1,11
UNIT III : Chapter 2 : Sections 2.1 to 2.3.5, except 2.3.4
UNIT IV : Chapter 2 : Sections 2.4 to 2.4.11
UNIT V : Chapter 2 :Sections 2.5 to 2.6.2

REFERENCE BOOKS

1. M.D. Raisinghania Advanced Differential Equations S. Chand and Company Ltd., New Delhi, 2001
2. K. Sankara Rao, Introduction to Partial Differential Equations,Second edition – Prentice – Hall of India, New Delhi 2006
3. J.N. Sharma & K. Singh Partial Differential Equations for Engineers & Scientists, Narosa Publishing House, 2001
4. R. Dennemeyer, Introduction to Partial Differential Equations and Boundary value Problems, McGraw Hill Book Company, New York, 1968.

Semester: II **Hours: 5/W 75hrs/Sem**
Course Code: P22CM8 **Credits: 4**
Title of the Paper: MATHEMATICAL METHODS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	-	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Grasp thoroughly the fundamentals of Calculus of variations	1	15
CO2 Solve Volterra and Fredhlom Integral Equations	2	15
CO3. Solve Fredhlom Integral Equations of the second Kind	3	15
CO4. Equip with the methods of finding Fourier Transforms	4	15
CO5. Get the knowledge about Hankel Transforms	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	3	4	4	4	3	4	3	3.7
CO2	4	4	4	4	4	4	4	4	4	3	3.9
CO3	4	4	3	4	4	4	4	3	4	3	3.7
CO4	4	4	4	4	4	4	4	4	4	3	3.9
CO5	3	4	4	4	4	3	4	4	4	3	3.7

Overall Mean Score: 3.78

SEMESTER II
P22CM8 – MATHEMATICAL METHODS

Lecture hours: 5 Credit: 4

UNIT I

Functionals - Strong and weak variations- The Variational notation & first Variation- Commutative character of operators and simplest Variational problem: Euler's Equation Commutative Character of the Variation and Integration- Other form of Euler's Equations- Solutions of Euler's Equation-Geodesic - Variational Problems involving several unknown functions- Functionals dependent on higher order derivatives. (Text Book 1)

UNIT II

Introduction- Relation between differential and integral equations- Relationship between final differential & Volterra integral equations- Alternative procedure to establish the relationship between differential equation and Volterra integral equation- The Green's function and its use in reducing boundary value problems to integral equations - Fredholm equations with separable kernels. (Text Book 1)

UNIT III

Fredholm equations with symmetric kernels: Hilbert Schmidt Theory-Hilbert Schmidt Method- Iterative methods for the solution of integral equations of the second kind- The Neumann Series-Orthogonal kernels(Text Book 1)

UNIT IV

Fourier Integral Formula- Fourier Sine Transforms-Fourier Cosine Transforms-Properties of Fourier Transforms- Multiple Fourier Transforms - Parseval's Identity for Fourier Transforms - Fourier Transforms of the derivatives of the function.

UNIT V

Definition-Inverse Formula-Some important results for Bessel function- Linearity Properity - Hankel Transform of the derivatives of the function - Hankel Transform of differential operators - Parseval's Theorem.

TEXT BOOKS

1. M. K. Venkataraman – Higher Mathematics for Engineering and Science, The National Publishing Company, Madras, Revised and enlarged fourth Edition (1992).(For Units 1 to 3)
2. A. R. Vasistha, R. K. Gupta - Integral Transforms – Krishna Prakashan Mandir Pvt. Ltd. India, 2002 (For Unit 4 &5)

UNIT 1:	Chapter 9	:	Section 1 to 12 (Text Book 1)
UNIT 2:	Chapter 10	:	Section 1 to 6 (Text Book 1)
UNIT 3:	Chapter 10	:	Section 7 to 11 (Text Book 1)
UNIT 4:	Chapter 6	:	6.1 to 6.21 (Text Book 2)
UNIT 5:	Chapter 9	:	9.1 to 9.7 (Text Book 2)

REFERENCE BOOKS

1. Francis B. Hildebrand- Methods of Applied Mathematics- Second Edition Prentice Hall of India Pvt. Ltd.-New Delhi (1968)-
2. The use of Integral Transforms by IAN N. Sneddon, McGraw- Hill Publishing Company, New York, 1972- (For Unit 5)
3. Linear Integral Equations Theory and Technique by R.P. Kanwal, Academic Press, New York, 1971.
4. Differential Equations and Calculus of Variations by L.Elsgolts, Mir Publishers, Moscow, 1970.
5. Integral Equations by Shanti Swarup, Krishna Prakashan Media Ltd, Meerut, 1982.

Semester: III **Hours: 6/W 90hrs/Sem**
Course Code: P22CM9 **Credits: 5**
Title of the Paper: REAL ANALYSIS -II **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	1	1	-

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Demonstrate functions of bounded variation.	1	18
CO2. Analyse and apply Riemann Stieltjes Integral.	2	18
CO3. Explain functions of several variables.	3	18
CO4. Define and Evaluate Lebesgue measure.	4	18
CO5. Evaluate the Lebesgue integral of a bounded function over a set of finite measure.	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	4	4	4	4	4	3	3.6
CO2	3	4	3	3	4	4	4	3	3	3	3.4
CO3	3	4	3	3	4	4	3	4	3	3	3.4
CO4	3	4	3	3	4	4	4	3	4	4	3.6
CO5	3	3	3	3	3	3	3	4	4	3	3.2

Overall Mean Score: 3.44

SEMESTER III

P22CM9 – REAL ANALYSIS - II

Lecture hours : 6 Credit : 5

UNIT I

Functions of bounded variation: Introduction- properties of monotonic functions - Functions of bounded variation- Total variation -Additive property of total variation - Total variation of la, x] as a function of × - function of bounded variation expressed as the difference of two increasing functions.

UNIT II

Riemann Stieltjes Integral: Definition and Existence - Properties- Integration and Differentiation - Integration of vector valued functions - Rectifiable curves.

UNIT III

Functions of several variables: Linear transformation - Differentiation - The inverse function theorem- The implicit functiontheorem - Determinants- Derivatives of higher order- Differentiation ofintegrals.

UNIT IV

Lebesgue measure: Outer measure - Measurable sets andLebesgue measure - Nonmeasurable sets- Measurable functions. Littlewood's three principles.

UNIT V

The Lebesgue integral: The Lebesgue integral of a boundedfunction over a set of finitemeasure - The integral of a nonnegativefunction- The general Lebesgue integral- Lebesgue's MonotoneConvergence Theorem and Dominated Convergence Theorem.

TEXT BOOKS

1. Walter Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill, New York, 1988.
2. G. de Barra, Measure Theory and Integration, Wiley Eastern Ltd.,New Delhi 1981.
3. Tom. M. Apostol, Mathematical Analysis, Narosa Publishing House,New Delhi, 1997.

UNIT I : TB3 – Chapter6- Sections :6.1 to 6.7
UNIT II : TB1 – Chapter6
UNIT III : TB1 – Chapter9
UNIT IV : TB2 – Chapter2 - Sections :2.1 to 2.4
UNIT V : TB2 – Chapter3

REFERENCE BOOKS

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

Semester: III **Hours: 6/W 90hrs/Sem**
Course Code: P22CM10 **Credits: 5**
Title of the Paper: GRAPH THEORY **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	1	½	½

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Understand network applications and apply short route algorithms, PERT & CPM	1	18
CO2. Demonstrate Parametric Linear Programming	2	18
CO3. Understand state EOQ Models, Classic EOQ Model Dynamic EOQ, Model and solve EOQ problems	3	18
CO4. Understand unconstrained problems & apply Newton Raphson Method, Solve constrained problems	4	18
CO5. Demonstrate unconstrained nonlinear algorithms and apply constrained algorithms, separate programming & quadratic programming	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	4	4	4	4	4	3	4	4	3.8
CO2	3	4	4	4	4	4	4	4	4	4	3.9
CO3	3	4	4	4	4	4	4	3	4	4	3.8
CO4	3	4	4	4	4	4	4	4	4	4	3.9
CO5	4	4	4	4	4	4	4	3	4	4	3.9

Overall Mean Score: 3.86

SEMESTER – III

P22CM10 - GRAPH THEORY

Lecture hours: 6 Credit: 5

UNIT I

An Introduction to graphs: Basic concepts – Isomorphism and Automorphism –The pigeonhole principle and Turan's theorem – Distance, Radius, Diameter and Girth – Subgraphs and Isometric subgraphs –Operations on Graphs - The Adjacency, Incidence and Path matrices – Introduction to Algorithms – Breadth-first search Algorithm – Dijkstra's Algorithm – Ford's Algorithm.

Bipartite Graphs: Characterisations of bipartite graphs – Trees – cut edges and cut vertices – Spanning trees and isometric trees – Cayley's Formula – Binary trees– Spanning tree Algorithm – Kruskal's Algorithm – Prim's Algorithm.

UNIT II

Connectivity: Connectivity and edge connectivity – 2-Connected graphs – Menger's Theorem – Separable graphs, 1-Isomorphism and 2-Isomorphism.

Graphic Sequences: Degree sequences – Graphic sequences – Wang and Kleitman's Theorem –Haval & Hakimi Algorithm – Generalisation of Haval & Hakimi Algorithm .

UNIT III

Eulerian and Hamiltonian Graphs: Charecterisations of Eulerian Graphs –- Randomly Eulerian Graphs – Application – Algorithm – Fleury's Algorithm –Hamiltonian Graphs – Hamilton Cycle in Power Graphs and Line Graphs – Hamiltonian Sequences – Application –Two Optimal Algorithm – The Closest Insertion Algorithm – Albertson's Algorithm.

Matchings: Matching – System of Distinct Representatives and Marriage Problem – Covering – Konig-Egervary Theorem - 1-Factor- Tutte's Theorem – Stable Matchings – Application –The Hungarian Algorithm – Algorithm for Maximum Matching.

UNIT IV

Independence: Independent Sets – Edge colourings – Application – Vizing's Theorem – Vertex Colouring – Uniquely Colourable Graphs – Brook's Bound and Improvements – Hajos Conjecture – Tamilnadu State Council for Higher Education Mycielski's Construction – Line-distinguishing Colourings – Chromatic Polynomials –Sequential Colouring Algorithm.

UNIT V

Planar Graphs: Planar Embedding – Euler's Formula – Maximum Planar Graphs – Geometric dual – Characterisations of Planar Graphs – DMP Planarity Algorithm – Colouring in Planar Graphs – Face Colouring.

TEXT BOOK

1. M. Murugan by Graph Theory and Algorithms, Second Edition, Muthali Publishing House, Annanagar, Chennai, 2018.

UNIT I : Chapter 1: Sections 1.1 – 1.12
Chapter 2 : Sections 2.1 – 2.7
UNIT II : Chapter 3: Sections 3.1 – 3.4
Chapter 4: Sections 4.1 – 4.4
UNIT III : Chapter 5: Sections 5.1 – 5.11
Chapter 6: Sections 6.1 – 6.7
UNIT IV : Chapter 7: Sections 7.1 – 7.13
UNIT V : Chapter 8: Sections8.1 – 8.8

REFERENCE BOOKS

1. Harary F , Graph Theory, Addison –Wesley , Reading Mass, 1969.
2. J.A. Bondy and U.S.R. Murthy, Graph Theory with applications, Macmillan Co., London, 1976.
3. R. Balakrishnan and K. Ranganathan, Text Book of Graph Theory, Springer,2000.

Semester: III **Hours: 6/W 90hrs/Sem**
Course Code: P22CM11 **Credits: 4**
Title of the Paper: DIFFERENTIAL GEOMETRY **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	2	2	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Basic definitions of space curve	1	18
CO2. Understand intrinsic equation, Fundamental existence theorem for space curve and Helics	2	18
CO3. Gain the knowledge of metric, local intrinsic properties of a surface and Geodesics	3	18
CO4. Present the knowledge of Geodesic parallels, Geodesic curvature and Gauss Bonnet theorem	4	18
CO5. Get the knowledge of local non-intrinsic properties of a surface.	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	2	3	4	3	4	3	2	4	3.2
CO2	4	4	2	3	3	3	4	4	2	4	3.3
CO3	3	4	2	3	4	3	4	3	2	4	3.2
CO4	3	4	2	3	4	3	4	4	2	4	3.3
CO5	3	4	2	3	3	4	4	3	2	4	3.3

Overall Mean Score: 3.13

SEMESTER – III

P22CM11 –DIFFERENTIAL GEOMETRY

Lecture hours: 6 Credit: 4

UNIT I

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

Intrinsic properties of a surface - Definition of a surface – Curves on a surface – Surface of revolution – Helicoids – Metric – Direction coefficients – Families of curves – Isometric correspondence – Intrinsic properties.

UNIT III

Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence theorems – Geodesic parallels – Geodesics curvature- GaussBonnet Theorem – Gaussian curvature – Surface of constant curvature.

UNIT IV

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 V

The second fundamental form – Principal curvatures – Lines of Curvature – Developables associated with space curves– Developables associated with curves on surfaces - minimal surfaces – ruled surfaces.

TEXT BOOK

1. An Introduction to Differential Geometry by T.J. Willmore published by Oxford University Press, New Delhi 2009

UNIT I	:	Chapter 1 :	Sections 1 – 9
UNIT II	:	Chapter 2 :	Sections 1 – 9
UNIT III	:	Chapter 2 :	Sections 10 – 18
UNIT IV	:	Chapter 3:	Sections 1 – 8
UNIT V	:	Chapter 4 :	Sections 1 – 8.

REFERENCE BOOKS

1. D.T. Struik, "Lectures on Classical Differential Geometry", Addition –Wesley, Mass, 1950.
2. S. Kobayashi and K. Nomizu, "Foundations of Differential Geometry", Interscience Publishers, 1963.
3. W. Klingenberg, "A Course in Differential Geometry", Graduate Texts in Mathematics, Springer – Verlag 1979.
4. C.E.Weatherburn, "Differential Geometry of Three Dimensions", University Press, Cambridge, 1930.

Semester: III **Hours: 5/W 75/Sem**
Course Code: P22CM12 **Credits: 4**
Title of the Paper: NUMERICAL ANALYSIS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	4	-	1	-

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1: Understand the Number Systems and compute its error	1	15
CO2: Compute interpolating polynomial and estimate its error	2	15
CO3. Solve Non linear equations	3	15
CO4: Solve Systems of Linear Equations	4	15
CO5. Gather knowledge about numerical integration and differentiation	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	4	3	3	3	3	3	3
CO2	2	3	3	3	4	3	3	3	3	3	3
CO3	2	3	3	3	4	3	3	3	3	3	3
CO4	2	3	3	3	4	3	3	3	3	3	3
CO5	2	3	3	3	4	3	3	3	3	3	3

Overall Mean Score: 3

SEMESTER- III
P22CM12 - NUMERICAL ANALYSIS

Lecture hours : 5 Credit : 4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOK

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

UNIT I : Chapter 1 Sections : 1.1 – 1.7
UNIT II : Chapter 2 Sections : 2.1 – 2.3, 2.5 and 2.6
UNIT III : Chapter 3 Sections : 3.1, 3.3, 3.6 and 3.7
UNIT IV : Chapter 4 Sections : 4.2 – 4.4
UNIT V : Chapter 7 Sections : 7.1,7.2 and 7.4

REFERENCE BOOKS

1. Azmysackleh et al, Classical and modern Numerical Analysis, CRC Press
2. Applied Numerical Analysis (5^{th} Edition) by Curtis and Whealtey, Patrick.O .
3. Numerical Methods – P. Kandasamy, K.Thilagavathy, K.Gunavathy, Reprint 2001, S.Chand& Co. Ltd, New Delhi.
4. Elementary Numerical Analysis – An Algorithmic Approach by Samuel D Conte & Carl de Boor, Third Edition, Mc Graw Hill International editions.

Semester: IV **Hours: 5/W 75hrs/Sem**
Course Code: P22CM13 **Credits: 4**
Title of the Paper: FUNCTIONAL ANALYSIS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Acquire basics of Banach spaces, linear transformations and Hahn Banach Theorems	1	15
CO2. Master operators and imbeddings of N and its double conjugate	2	15
CO3. Have a strong knowledge of Hilbert spaces and ortho normal bases	3	15
CO4. Have a good knowledge of operators	4	15
CO5. Have a sound knowledge of spectral theory and theorem and determinants	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	3	4	4	4	3	3	3.2
CO2	3	4	4	4	3	4	4	4	3	4	3.7
CO3	4	4	4	4	3	2	3	3	2	4	3.3
CO4	4	4	2	2	4	3	3	3	3	3	3.1
CO5	2	1	3	3	4	1	4	2	3	4	2.7

Overall Mean Score: 3.2

SEMESTER IV
P22CM13 - FUNCTIONAL ANALYSIS

Lecture hours: 5 Credit: 4

UNIT 1

Banach spaces : The Definition and some examples - Continuous linear transformations - The Hahn-Banach theorem.

UNIT II

The natural Imbedding of N in N^{**} - The Open Mapping theorem - The Conjugate of an operator.

UNIT III

Hilbert space: Definition and properties - Orthogonal complements - Orthonormal sets- The Conjugate space H^*.

UNIT IV

Adjoint of an operator - Self-adjoint operator - Normal and Unitary operators.

UNIT V

Projections - Finite Dimensional Spectral theory - Determinants and the spectrum of an operator - The Spectral theorem

TEXT BOOK

1. Introduction to Topology and Modern Analysis by G.F.Simmons - McGraw-Hill Book Company, International Student Edition, 20th Reprint 2013.

UNIT I : Sections 46 to 48
UNIT II : Sections 49 to 51
UNIT III : Sections 52 to 55
UNIT IV : Sections 56 to 58
UNIT V : Sections 59, 61 & 62.

REFERENCE BOOKS

1. Functional Analysis by B. V. Limaye, Published by Mohinder Singh Sejwal for Wiley Eastern Ltd, New Delhi.
2. Foundations of Functional Analysis by S.Ponnusamy, Narosa Publishing House, New Delhi, 2011.
3. A Course in Functional Analysis by J.B. Conway, 2nd edition, Springer, Berlin, 1990.
4. A First course in Functional Analysis by C.Goffman and G. Pedrick, Perentice Hall of India 1974.
5. Introduction to Functional Analysis with Applications by E.Kreyzig, John Wiley & Sons, New York, 1978.

Semester: IV **Hours: 6/W 90hrs/Sem**
Course Code: P22CM14 **Credits: 4**
Title of the Paper: MATHEMATICAL STATISTICS **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	4	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Recall discrete and continuous types of random variables.	1	18
CO2. Describe two dimensional random variables.	2	18
CO3. Interpret Binomial, Poisson, Normal, Gamma and Chi-square distributions.	3	18
CO4. Construct probability density function of given functions of the random variables.	4	18
CO5. State and demonstrate Central Limit Theorem.	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	3	3	4	3	3	3	3
CO2	3	3	4	4	4	4	4	4	4	3	3.7
CO3	4	3	4	4	4	4	3	3	4	3	3.6
CO4	3	3	4	3	3	3	3	4	3	3	3.2
CO5	3	3	3	4	4	3	4	3	3	3	3.3

Overall Mean Score: 3.36

SEMESTER IV
P22CM14 - MATHEMATICAL STATISTICS

Lecture hours : 6 Credits : 4

UNIT I

The Probability set function – Conditional probability and independence –Random variables of the discrete type – Random variables of the continuous type – Properties of the distribution function – Expectation of a random variable – Some special expectations – Chebyshev's Inequality.

UNIT II

Distribution of two random variables – Conditional Distributions and expectations – The correlation coefficient – Independent random variables – Extension to several random variables.

UNIT III

The Binomial and related distributions – The Poisson distribution – The Gamma and Chi-Square distributions – The Normal distribution – The Bivariate normal distribution.

UNIT IV

Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type - The Beta, t and F distributions – Extensions of the change of the variable technique – Distributions of order statistics – The Moment Generating function Technique – The distributions of and nS^2/σ^2 – Expectations of functions of random variables.

UNIT V

Convergence in distribution – Convergence in probability – Limiting Moment Generating functions – The Central Limit theorem – Some theorems on limiting distributions.

TEXT BOOK

1. Robert V.Hogg and Allen T.Craig-Introduction to Mathematical Statistics Fifth Edition, Pearson Education (Singapore) Pvt.Ltd, Third Reprint 2004.

UNIT I : Chapter 1 (Sections 1.3 to 1.10)
UNIT II : Chapter 2
UNIT III : Chapter 3
UNIT IV : Chapter 4 (Sections 4.1 to 4.9)
UNIT V : Chapter 5

REFERENCE BOOKS

1. M. Fisz, Probability theory and Mathematical statistics, John Wiley & sons, New York, 1963.
2. E. J. Dudewiczn and S. N. Mishra, Modern Mathematical Statistics, John Wiley & sons, New York, 1988.
3. V. N. Rohatgi, An introduction to Probability theory and Mathematical statistics, Wiley Eastern Limited, New Delhi, 1988.
4. Fundamentals of Mathematical Statistics by S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons Educational Publishers, New Delhi, 1997.
5. Mathematical Statistics with Applications by I. Miller and M.Miller; Seventh Edition, Pearson Education, 2004.
6. Mathematical Statistics by Jun Shao, Second Edition, Springer, 2003.
7. An introduction to probability and Statistics by Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, Second edition, Wiley, 2008.

Semester: IV **Hours: 6/W 90hrs/Sem**
Course Code: P22CM15 **Credits: 4**
Title of the Paper: OPTIMIZATION TECHNIQUES **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	3	1	1	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. solve the Integer programming problem	1	18
CO2. study about Dynamic integer programming Algorithm	2	18
CO3. understand EOQ Models and solve Inventory Deterministic problems	3	18
CO4. understand the Queuing Models and solve the related problems	4	18
CO5. apply Kuhn-Tucker conditions with Non-Negative Constraints in Non linear programming	5	18

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5	
CO1	3	4	4	4	4	4	4	3	4	4	3.8
CO2	3	4	4	4	4	4	4	4	4	4	3.9
CO3	4	4	4	4	4	4	4	3	4	4	3.9
CO4	4	4	4	4	4	4	4	4	4	4	4
CO5	4	4	4	4	4	4	4	4	4	4	4

Overall Mean Score: 3.92

SEMESTER IV

P22CM15 - OPTIMIZATION TECHNIQUES

Lecture Hours : 6 Credit: 4

UNIT I

Integer programming : Introduction - Integer programming Formulations - The cutting - Plane Algorithm - Branch and Bound Technique - Zero –one Implicit Enumeration Algorithm.

UNIT II

Dynamic programming : Introductions – Applications of Dynamic Programming: Capital Budgeting Problem - Reliability Improvement Problem - Stage-coach Problem - Cargo Loading Problem - Minimizing Total Tardiness in Single Machine Scheduling Problem -- Optimal Subdividing Problem - Solution of Linear Programming Problem through Dynamic Programming.

UNIT III

Inventory Control : Introduction – Types of Inventories – Inventory Decisions - Cost Associated with Inventories -- Factors Affecting Inventory Control - Economic Order Quantity - Deterministic Inventory Problems with No Shortages - deterministic inventory Models with shortages - EOQ with price Breaks - Multi Item Deterministic problems - Inventory Problems with Uncertain Demand .

UNIT IV

Queuing Theory: Introduction – Queuing System - Elements of Queuing System - Operating Characteristics of Queuing System - Classification of Queuing Models - Model –I (M/M/1):(/FIFO), Model –II(M/M/1):(N/FIFO), Model – III(M/M/C):(/FIFO), Model – IV(M/M/C):(N/FIFO). Problems in above four models.

UNIT V

Non Linear Programming: Introduction – Lagrangian Method – Kuhn-Tucker Method - Quadratic Programming - Separable Programming - Chance-constrained Programming or Stochastic Programming.

TEXT BOOKS

1. Kanti Swarup , P.K. Gupta, Man Mohan, Operations research, Sultan Chand & Sons, Educational Publishers, New Delhi.
2. Panneerselvam. R, Operation Research, 2nd Edition, PHI Learning Private Limited, Delhi, 2015

UNIT I :	Chapter : 6 TB 2
UNIT II :	Chapter : 8 TB 2
UNIT III :	Chapter : 19 TB 1
	Chapter : (20.2) only TB 1
UNIT IV :	Chapter: 21 TB 1
UNIT V :	Chapter: 17 TB 2

REFERENCE BOOKS

1. Hamdy A. Taha, Operations Research, Sixth Edition, Prentice-Hall of India private Limited, New Delhi, 1997.
2. Hiller.F.S & Lieberman. J Introduction to Operation Research, 7th Edition, Tata-McGraw Hill Publishing Company, New Delhi, 2001.
3. Prem Kumar Gupta. Er, Hira.D.S. Operations Research, 7th Edition, S. Chand & Company Pvt. Ltd. 2014.

Semester: IV **Hours: 5/W 90hrs/Sem**
Course Code: P22CMPW **Credits: 4**
Title of the Paper: PROJECT **CORE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	-	-	4	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Acquire knowledge about the topic	1	15
CO2. Understand the topic	2	15
CO3. Demonstrate the topic	3	15
CO4. Develop the topic	4	15
CO5. Analyse and apply the topic	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	5	3	4	5	4	4	4	5	3	4.1
CO2	4	5	3	4	5	4	4	4	5	3	4.1
CO3	4	5	3	4	5	4	4	4	5	3	4.1
CO4	4	5	3	4	5	4	4	4	5	3	4.1
CO5	4	5	3	4	5	4	4	4	5	3	4.1

Overall Mean Score: 4.1

Semester: I **Hours: 3/W 90/Sem**
Course Code: P22DSM1AP **Credits: 2**
Title of the Paper: DATA STRUCTURES USING C (LAB) **DS ELECTIVE**

1. Create a Stack and do the following operations using arrays and linked lists :
   (i) Push (ii) Pop (iii) Top
2. Create a Queue and do the following operations using arrays and linked lists:
   (i) Add (ii) Remove
3. Implement the operations on singly linked list.
4. Sort the given list of numbers using following sorting techniques:
   (i) Insertion sort (ii) Merge sort
5. Find the shortest path in a given graph using Dijkstra's algorithm.

TEXT BOOK

Data structures and algorithm analysis in C' by Mark Allen Weiss, Second Edition Pearson Publications, 2014.

REFERENCE BOOKS

1. Fundamentals of Data Structures by Ellis Horrowitz, Sartaj Sahani – Galgotia Publishers, 1998.
2. C and Data Structures by P.RadhaGanessan, Scitech Publishers India Pvt Ltd, 2011.
3. Data Structures using ‘C’ by E.Balagurusamy, Tata McGraw-Hill Education, Reprint 2015.

Semester: I **Hours: 3/W 90/Sem**
Course Code: P22DSM1BP **Credits: 2**
Title of the Paper: DATA STRUCTURES USING C++ (LAB) **DS ELECTIVE**

1. Create a Stack and do the following operations using arrays and linked lists :
   (i) Push (ii) Pop (iii) Top
2. Create a Queue and do the following operations using arrays and linked lists:
   (i) Add (ii) Remove
3. Implement the operations on singly linked list.
4. Sort the given list of numbers using following sorting techniques:
   (i) Insertion sort (ii) Merge sort
5. Find the shortest path in a given graph using Dijkstra's algorithm.

TEXT BOOK

1. Sartaj Sahni, Data Structures, Algorithm and Applications in C++, 2nd Edition, University Press, Hyderabad, 2005.

REFERENCE BOOKS

1. Vinu V Das, Principles of Data Structures Using C and C++, New Age International Publishers, New Delhi, 2006
2. Hemant Jain, Problem solving in Data Structures and Algorithms using C++, 1st Edition, 2016

Semester: II **Hours: 5/W 75/Sem**
Course Code: P22DSM2A **Credits: 4**
Title of the Paper: MECHANICS **DS ELECTIVE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Recall the elementary principles of mechanics.	1	15
CO2. Demonstrate Lagrange's equations.	2	15
CO3. Analyse Hamilton's principle.	3	15
CO4. Demonstrate and apply Hamilton-Jacobi Theory.	4	15
CO5. Define and solve problems on canonical transformations.	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	4	4	3	3	3	4	3	3.4
CO2	3	4	4	4	4	3	3	3	4	3	3.5
CO3	3	4	3	4	4	3	3	3	4	3	3.4
CO4	3	4	3	4	4	3	3	3	4	3	3.4
CO5	3	4	3	4	4	3	3	3	4	3	3.4

Overall Mean Score: 3.42

DISCIPLINE SPECIFIC ELECTIVE
P22DSM2A - MECHANICS

Lecture Hours: 5 Credit:4

UNIT I

Introductory concepts: Mechanical system – Generalized coordinates – Constraints – Virtual work – d'Alembert's Principle - Energy and Momentum – Equilibrium and Stability – Kinetic Energy – Angular Momentum.

UNIT II

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

UNIT III

Hamilton's Equations: Stationary values - Hamilton's Principle under different conditions – Hamilton's Equations – The Legendre transformation – Modified Hamilton's Principle – Principle of least action.

UNIT IV

Hamilton - Jacobi theory: Hamilton's Principle function – Canonical Integral – Pfaffian differential form – Hamilton-Jacobi equation – Jacobi's Theorem – Modified Hamilton-Jacobi Equation – Separability – Liouville's System Stackel's Theorem.

UNIT V

Canonical Transformations: Differential forms and Generating functions – Some simple, point and momentum transformations - Lagrange and Poisson brackets.

TEXT BOOK

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

UNIT I : Chapter 1
UNIT II : Chapter 2 – Sections 2.1,2.2,2.3
UNIT III : Chapter 4 – Sections 4.1,4.2,4.3
UNIT IV : Chapter 5 – Sections 5.1,5.2,5.3
UNIT V : Chapter 6 – Sections 6.1,6.2,6.3

REFERENCE BOOKS

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

Semester: II **Hours: 5/W 75hrs/Sem**
Course Code: P22DSM2B **Credits: 4**
Title of the Paper: DISCRETE MATHEMATICS **DS ELECTIVE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	1	-	1

Course Outcomes	Unit	Hrs/S
On completing this course the students will be able to		
CO1. Study about the Foundations of Logic and Proofs.	1	15
CO2. Learn about Counting and Advanced Counting Techniques.	2	15
CO3. Acquire a good foundation in Boolean Algebra and Modelling Computations.	3	15
CO4. Acquire a Knowledge about Coding Theory	4	15
CO5. Study about Applications of Algebra and Automata Semi groups	5	15

Course Outcome	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	5	4	4	4	4	4	4	4.5	4	4	4.15
CO2	4	4.5	4.5	4.5	4	4	4.5	4.5	4	4	4.2
CO3	4	4.5	4.5	4	4	4.5	4	4	4	4.5	4.2
CO4	4	4	4	4	4	4	4	4	4	4	4
CO5	4	4	4	4	4	4	4	4	4	4	4

Overall Mean Score : 4.11

DISCIPLINE SPECIFIC ELECTIVE

P22DSM2B - DISCRETE MATHEMATICS

Lecture hours : 5 Credit : 4

UNIT I

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

UNIT II

Counting & Advanced Counting Techniques: The Basics of Counting - The Pigeonhole Principle - Permutations and Combinations - Generalized Permutations and Combinations - Generating Permutations and Combinations - Applications of Recurrence Relations - Solving Linear Recurrence Relations - Generating Functions

UNIT III

Boolean Algebra & Modeling Computations: Boolean Functions - Representing Boolean Functions - Logic Gates - Minimization of Circuits - Finite- State machines with Output - Finite - State machines with No Output - Turing Machines.

UNIT IV

Coding Theory: Introduction to Coding - Linear Codes- Cyclic codes - Special Cyclic codes.

UNIT V

Further Applications of Algebra: Semi group - Semigroup and Automata - Semigroup and formal Languages- Linear Recurring sequences.

TEXT BOOK

TB1. Kenneth H. Rosen, Discrete Mathematics and it's Applications, 7th Edition/ McGraw Hill Education, New York, 2012. (Units I, II, III).

TB2. Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra 2nd Edition Springer, 1997 (Units IV & V).

UNIT I : TB1 : Chapter 1 : 1.1 to 1.5 and Chapter 3 : 3.1, 3.2
UNIT II : TB1 : Chapter 6 and Chapter 8: 8.1, 8.2, 8.4
UNIT III : TB1 : Chapter 12 and Chapter 13 : 13.2, 13.3, 13.5
UNIT IV : TB2 :Chapter 4 : Sec 16 to 19
UNIT V : TB2 :Chapter 7 : Sec 28 to 30 and 33

REFERENCE BOOKS

1. J.P. Tremblay & R. Manohar, A First Course in Discrete Structures with Applications to Computer Science, McGraw Hill, 1987.

2. T. Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hills Publishing Company Limited, 7th Reprint, 2008
3. Liu C.L, Elements of Discrete Mathematics, McGraw Hill, New York, 1978
4. Grimaldi R.P and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, 2004

Semester: III **Hours: 5/W 75 hrs/Sem**
Course Code : P22DSM3A **Credits:4**
Title of the Paper: LINEAR ALGEBRA **DS ELECTIVE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	4	-	1	-

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1: Define Linear Transformation, find the representation of linear transformation by matrices	1	15
CO2: Understand the Algebra of polynomials, find the prime factorisation of a Polynomial	2	15
CO3: Derive the Inverse of an invertible matrix using determinants	3	15
CO4 : Explain about Diagonalization	4	15
CO5 : Find the minimal polynomials, Jordan forms and the rational forms of real matrices.	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5	
CO1	3	3	4	3	3	4	4	4	4	3	3.5
CO2	3	4	4	3	4	3	3	3	4	4	3.5
CO3	3	3	4	3	4	4	3	4	4	4	3.6
CO4	3	4	3	3	4	4	3	3	3	4	3.4
CO5	3	3	4	3	4	4	4	3	3	3	3.4

Over all Mean Score : 3.48

DISCIPLINE SPECIFIC ELECTIVE
P22DSM3A - LINEAR ALGEBRA

Lecture hours:5 Credit:4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOK

1. Kenneth M Hoffman and Ray Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India Pvt. Ltd, New Delhi, 2013.

UNIT I : Chapter 3 Sections 3.1 – 3.5
UNIT II : Chapters 4 & 5 Sections 4.1, 4.2, 4.4, 4.5 and 5.1, 5.2
UNIT III : Chapters 5 & 6 Sections 5.3, 5.4 and 6.1 to 6.3
UNIT IV : Chapter 6 Sections 6.4 – 6.8
UNIT V : Chapter 7 Sections 7.1 – 7.3

REFERENCE BOOKS

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

Semester: III **Hours: 5/W 75hrs/Sem**

Course Code: P22DSM3B **Credits: 4**

Title of the Paper: NUMBER THEORY AND CRYPTOGRAPHY **DS ELECTIVE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Demonstrate and apply Chinese Remainder Theorem.	1	15
CO2. Define and illustrate Quadratic residues.	2	15
CO3. Analyse and apply Mobius inversion formula.	3	15
CO4. Discuss and solve Diophantine equation.	4	15
CO5. Analyse Public Key Cryptography and apply Modular Arithmetic.	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	4	3	3	3	2	3	2	2.8
CO2	3	3	3	3	2	3	4	3	4	2	3
CO3	3	4	4	3	3	3	3	3	2	3	3.1
CO4	3	3	4	4	3	2	3	4	3	3	3.2
CO5	2	3	3	3	3	3	3	3	3	3	2.9

Overall Mean Score: 3

DISCIPLINE SPECIFIC ELECTIVE

P22DSM3B - NUMBER THEORY AND CRYPTOGRAPHY

Lecture hours : 5 Credit : 4

UNIT I

Divisibility and Euclidean algorithm - Congruences, Euler's Theorem, Wilson's Theorem, Chinese Remainder Theorem, Primitive roots.

UNIT II

Quadratic residues.- Quadratic reciprocity – The Jacobi symbol

UNIT III

Arithmetic functions – The Moebius Inversion formula – Multiplication of arithmetic functions.

UNIT IV

Linear Diophantine equations – Sum of Four and Five Squares – Sum of Fourth Powers - Sum of Two Squares.

UNIT V

Public key Cryptography – Concepts of public key Cryptography – Modular arithmetic – RSA – Discrete logarithm – Elliptic curve Cryptography

TEXT BOOKS

1. An Introduction to Theory of Numbers by Ivan Nivan and Herberts Zucherman, Third Edition, 1972, Wiley Eastern Limited, New Delhi
2. Cryptograpy and Network Security Principles and Practice by William Stallings, Pearson, Sixth Edition.

UNIT I : Text Book 1 - Chapter1 – Sections 1.2
Chapter2 – Sections 2.1, 2.3, 2.9
UNIT II : Text Book 1 - Chapter3 – Sections 3.1,3.2,3.3
UNIT III : Text Book 1 - Chapter4 – Sections 4.2, 4.3, 4.4
UNIT IV : Text Book 1 - Chapter5 – Sections 5.1, 5.7, 5.9, 5.10
UNIT V **:** Text Book 2 - Chapter 8,9,10.

REFERENCE BOOKS

1. Cryptograpy and Network Security Principles and Practice by William Stallings, Prentice Hall, Fifth Edition, New Delhi, 2011.
2. Tom Apostol, Introduction to Analytic Number theory, Narosa Publications, New Delhi
3. David M.Burton, Elementary Number Theory, Wm.C.Brown Publishers, Dubuque, Iowa, 1989.
4. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York,1987.

Semester: IV **Hours: 5/W 75hrs/Sem**
Course Code: P22DSM4A **Credits: 4**
Title of the Paper: FUZZY SETS AND THEIR APPLICATIONS DS ELECTIVE

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Remember basic concept of fuzzy sets and extension principle.	1	15
CO2. Understand the knowledge of operation on fuzzy sets.	2	15
CO3. Explain fuzzy relations, its operations properties, tolerance and equivalence relation.	3	15
CO4. Analyze decision making in fuzzy environment, fuzzy ranking methods and fuzzy linear programming.	4	15
CO5. Apply fuzzy concept in medicine, economics, interpersonal communication and also other applications.	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	3	3	3	4	3	4	3	2	3.3
CO2	4	3	4	4	4	3	4	3	4	2	3.5
CO3	4	4	4	3	3	4	4	3	3	2	3.4
CO4	4	4	4	3	3	4	4	3	3	2	3.4
CO5	4	4	4	3	3	4	4	3	3	2	3.4

Overall Mean Score : 3.4

DISCIPLINE SPECIFIC ELECTIVE
P22DSM4A - FUZZY SETS AND THEIR APPLICATIONS

Lecture Hours: 5 Credit :4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Decision making in Fuzzy Environments: General Discussion – Individual Decision making – Multi person decision making – Multi criteria decision making – Multi stage decision making – Fuzzy ranking methods – Fuzzy linear programming.

UNIT V

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

TEXT BOOK

1. George J.Klir and Bo Yuan , Fuzzy sets and Fuzzy Logic Theory and Applications, PHI Learning Private Limited, New Delhi (2009).

UNIT I : Chapters 1 & 2
UNIT II : Chapter 3
UNIT III : Chapter 5: Sections 5.1 to 5.5
UNIT IV : Chapter 15
UNIT V : Chapter 17

REFERENCE BOOKS

1. H.J.Zimmermann, Fuzzy set theory and its applications, Springer, 2012.
2. K.Pundir and R.Pundir, Fuzzy sets and their application, Published by A Pragati Edition, 2012
3. A. K. Bhargava, Fuzzy Set Theory, Fuzzy Logic and their Applications, published by S. Chand Pvt. Limited, 2013.

Semester: IV **Hours: 5/W 75hrs/Sem**
Course Code: P22DSM4B **Credits: 4**
Title of the Paper: FORMAL LANGUAGES AND AUTOMATA THEORY DS ELECTIVE

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	5	3	1	-	1

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Master in deterministic and non-deterministic Finite Automata	1	15
CO2. Master regular expressions and criteria to test not to be a regular language.	2	15
CO3. Have a sound knowledge on context free grammars and closure properties.	3	15
CO4. Acquire mastery in parse trees and push down automata.	4	15
CO5. Master in PDA & CFG's and its equivalence.	5	15

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	2	3	5	3	4	2	3	5	3.4
CO2	3	4	3	3	2	3	4	4	3	3	3.2
CO3	4	2	3	3	3	3	4	4	3	3	3.2
CO4	3	1	4	4	3	4	3	5	4	3	3.4
CO5	3	5	2	2	4	4	3	1	2	4	3

Overall Mean Score: 3.24

DISCIPLINE SPECIFIC ELECTIVE

P22DSM4B - FORMAL LANGUAGES AND AUTOMATA THEORY

Lecture hours : 5 Credit : 4

UNIT I

Deterministic Finite Automata, Non deterministic Finite Automata, Finite Automata with Epsilon, Transitions.

UNIT II

Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be regular.

UNIT III

Closure properties of Regular languages, Context Free Grammars.

UNIT IV

Parse Trees, Ambiguity in Grammars and Languages, Definition of the Push down Automaton.

UNIT V

The languages of a PDA, Equivalence of PDA's and CFG's, Definition of a Deterministic PDA.

TEXT BOOK

1. Introduction to Automata Theory, Languages and Computation by John E. Hopcroft, Rajeev &Jefferey D. Ullman, 3rd Edition, Copy right 2008, Pearson Education.

UNIT I : Chapter 2 : Sections 2.2, 2.3, 2.5
UNIT II : Chapter 3 : Sections 3.1,3.2
Chapter 4 : Sections 4.1
UNIT III : Chapter 4 : Sections 4.2
Chapter 5 : Section 5.1
UNIT IV : Chapter 5 : Sections 5.2, 5.4
Chapter 6 : Section 6.1
UNIT V : Chapter 6 : Sections 6.2, 6.3, 6.4 to 6.4.2

REFERENCE BOOKS

1. Formal Languages and Automata Theory by D.GoswamyandK.V.Krishna, 2010
2. Introduction to Automata Theory by Shyamlendu Kandan, imprintPearson Education, Copyright 2013.
3. Introduction to Automata theory by J.E.Hopcroft, R.Motwani and J.D. Ullman; Cambridge University press, 2007.
4. A text book on Automata theory by P.K. Srimani and S.F.B. Nasir; Cambridge University press, 2007.
5. Discrete Mathematical Structures with Applications to Computer Science by J.P. Tremblay and R. Manohar McGraw Hill Education (India) Pvt Ltd,2017.

Semester: I **Hours: 2/W 30hrs/Sem**
Course Code: P22SEM1 **Credits: 2**
Title of the Paper: LOGIC AND REASONING **SE COURSE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	2	2	-	-	-

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Gain the Knowledge of Mathematical Operators & Mathematical Problems	1	6
CO2. Develop increase their cognitive capabilities	2	6
CO3. Acquire knowledge to complete a series	3	6
CO4. Understand the Direction Sense Test – Numbers Test and Time Sequence Test	4	6
CO5. Learn about Blood relation	5	6

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3.5	4	3.5	2.5	4	3	3	4	4	4.5	3.6
CO2	3	4	3	2.5	4	3	3	4	4	4.5	3.5
CO3	3	4	3	2.5	4	3	3	4	4	4.5	3.5
CO4	3	4	3	2.5	4	3	3	4	4	4.5	3.5
CO5	4	4	3	2.5	4	3	3	4	4	4.5	3.6

Overall Mean score: 3.54

SKILL ENHANCEMENT COURSE

P22SEM1 - LOGIC AND REASONING

Lecture Hours : 2 Credit : 2

UNIT – I

Mathematical Operators – Mathematical Problem

UNIT – II

Puzzle Test - Analogy Test

UNIT – III

Arranging in Order – Series Completion Test

UNIT – IV

Direction Sense Test – Numbers Test and Time Sequence Test

UNIT – V

Deductive Logic – Blood Relation Test

TEXT BOOK

1. Alok Kumar – CSIR-UGC NET/JRF/SET Mathematical Sciences, Latest Revised Edition, Upkar Prakashan, AGRA – 2.

UNIT I : Page Number 3-15
UNIT II : Page Number 16 – 33 & 39 - 43
UNIT III : Page Number 44 - 54
UNIT IV : Page Number 55 - 64
UNIT V : Page Number 65 – 83

Semester: II **Hours: 2/W 30hrs/Sem**
Course Code: P22SEM2 **Credits: 2**
Title of the Paper: MATHEMATICAL SCIENCES **SE COURSE**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	2	2	-	-	-

Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1. Gain the Knowledge of Mathematical Operators & Mathematical Problems	1	6
CO2. Develop increase their cognitive capabilities	2	6
CO3. Acquire knowledge to complete a series	3	6
CO4. Understand the Direction Sense Test – Numbers Test and Time Sequence Test	4	6
CO5. Learn about Blood relation	5	6

Course Outcomes	Programme Outcomes					Programme Specific Outcomes					Mean Score
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	3	3	4	3	3	4	4	4	3.6
CO2	4	4	3	3	4	3	3	4	3	4	3.5
CO3	4	4	3	3	4	3	3	4	4	3	3.5
CO4	3	4	3	4	4	3	3	4	4	3	3.5
CO5	4	4	4	4	4	3	3	4	4	4	3.8

Overall Mean score: 3.58

SKILL ENHANCEMENT COURSE

P22SEM2 - MATHEMATICAL SCIENCES

Lecture Hour : 2 Credits : 2

UNIT I

Algebra

UNIT II

Linear Algebra

UNIT III

Complex Analysis

UNIT IV

Ordinary Differential Equations and Partial Differential Equations

UNIT V

Numerical Analysis.

TEXT BOOK

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UNIT I : Chapter 4
UNIT II : Chapter 2
UNIT III : Chapter 3
UNIT IV : Chapter 5
UNIT V : Chapter 6