FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A" Grade by NAAC (3rd Cycle)
74th Rank in India Ranking 2020 (NIRF) by MHRD
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT: MATHEMATICS

NAME OF THE PROGRAMME : M.SC

PROGRAMME CODE : PSMA

ACADEMIC YEAR : 2020 - 21

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF MATHEMATICS

MAJOR CORE – 70 CREDITS

PROGRAMME CODE: PSMA

S. No	SEM.	COURSE CODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	TOT. MKs
1.	**I**	19PG1M1	Algebra	6	4	40	60	100
2.		19PG1M2	Real Analysis	6	4	40	60	100
3.		19PG1M3	Number Theory	6	4	40	60	100
4.		19PG1M4	Classical Mechanics	6	4	40	60	100
5.			Library	3	-			
6.	**II**	19PG2M5	Advanced Algebra	6	4	40	60	100
7.		19PG2M6	Advanced Real Analysis	6	4	40	60	100
8.		19PG2M7	Differential Equations	6	4	40	60	100
9.		19PG2M8	Graph Theory	6	4	40	60	100
10.			Library	3	-			

11.	**III**	19PG3M9	Measure and Integration	6	4	50	50	100
12.		19PG3M10	Optimization Techniques	6	4	40	60	100
13.		19PG3M11	Combinatorics	6	4	40	60	100
14.		19PG3M12	Topology	6	6	40	60	100
15.			Library/Seminar	2	-	-	-	-
16.	**IV**	19PG4M13	Complex Analysis	6	5	40	60	100
17.		19PG4M14	Statistics	6	5	40	60	100
18.		19PG4M15	Methods of Applied Mathematics	6	5	40	60	100
19.		19PG4M16	Functional Analysis	6	5	40	60	100
20.			Library/Seminar	2	-	-	-	-
			TOTAL	**106**	**70**			

MAJOR ELECTIVE / EXTRA DEPARTMENTAL COURSE / INTERNSHIP/ PROJECT -20 CREDITS

S. No	SEM.	COURSECODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	TOT. Mks
1.	**I**	19PGM1EDC	Optimization Methods	3	3	40	60	100
2.	**II**	19PGM2EDC	Optimization Methods	3	3	40	60	100
3.	**III**	19PG3ME1/ 19PG3ME2	Fuzzy sets and Applications/ Numerical Analysis	4	4	40	60	100
4.		19PG3SIM1	Summer Internship	-	3	40	60	100
5.	**IV**	19PG4ME3/ 19PG4ME4	Formal Languages/ Algebraic Graph Theory	4	4	40	60	100
6.		19PG4M17	Project	-	3	40	60	100
			TOTAL	**14**	**20**			

OFF-CLASS PROGRAMMES

ADD-ON COURSES

COURSES	HRS.	CREDITS	SEMESTER IN WHICH THE COURSE IS OFFERED	CIA MKS	ESE MKS	TOTAL MARKS
SOFT SKILLS	40	3	I	40	60	100
COMPUTER APPLICATIONS - LaTex	40	4	II	40	60	100
COMPREHENSIVE VIVA (Question bank to be prepared for all the courses by the respective course teachers)	-	2	IV	-	-	100
READING CULTURE	2	1	I- II	-	-	-
TOTAL		**10**				

I M.Sc. Mathematics

SEMESTER –I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M1	Algebra	**Lecture**	6	4

COURSE DESCRIPTION

This course is designed to emphasis the study of Algebra.

COURSE OBJECTIVE/S

To enable the students learn Counting principle, Sylow's theorem, Euclidean rings and Solvable groups.

SYLLABUS

UNIT –I COUNTING PRINCIPLE **(20 HRS.)**

Group Theory: A Counting Principle, **Homomorphisms, Cayley's theorem (self study),** Another Counting Principle.

UNIT –II SYLOW'S THEOREM **(20 HRS.)**

Sylow's theorem, Direct Products, Finite Abelian Groups.

UNIT –III EUCLIDEAN RINGS **(20 HRS.)**

The field of Quotients of an Integral Domain, **Euclidean Rings, A Particular Euclidean Ring (self study)**.

UNIT –IV POLYNOMIAL RINGS **(15 HRS.)**

Polynomial Rings, Polynomials over the Rational Field, Polynomial Rings over Commutative Rings

UNIT –V SOLVABLE GROUPS **(15 HRS.)**

Solvable groups and Jordan Holder theorem**.**

SELF STUDY:

Homomorphisms, Cayley's theorem.

Euclidean Rings, A Particular Euclidean Ring

TEXT BOOKS:

1. Herstein I. N., *Topics in algebra*, John Wiley & Sons, Second Edition, 2002.

2. Surjeet Singh and Qazi Zameeruddin, *Modern algebra*, Vikas Publishing House Pvt.

TEXT BOOK I

UNIT I Chapter 2 : 2.5, 2.7, 2.9, 2.11

UNIT II Chapter 2 : 2.12, 2.13, 2.14

UNIT III Chapter 3 : 3.6, 3.7, 3.8

UNIT IV Chapter 3 : 3.9, 3.10, 3.11

TEXT BOOK II

UNIT V Chapter 5

REFERENCES:

1. Micheal Artin, *Algebra,* Prentice Hall of India, 1991.

2. David M.Fraleigh, *A first course in Modern Algebra* Seventh Edition, Addison Wesley Publishing House, 2006.

3. Serge Lang, *Algebra*, Addison Wesley Publishing House, 1990.

4. Fraleigh J. B., *A first course in Abstract algebra,* , Pearson Education Ltd, 2005.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Recall various properties of algebraic structures and explain counting principle.
CO 2	Describe Sylow's theorems and solve problems
CO 3	Distinguish Integral Domain and Euclidean Rings
CO 4	Classify Rings
CO 5	Describe basic concepts of Solvable groups

I M.Sc. Mathematics

SEMESTER –I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M2	Real Analysis	**Lecture**	6	4

COURSE DESCRIPTION

This course provides a comprehensive idea about the principles of Real Analysis.

COURSE OBJECTIVE/S

To enable the students learn real number system, metric spaces, limits, continuity and differentiation.

SYLLABUS

UNIT –I THE REAL AND COMPLEX NUMBER SYSTEMS (15 HRS.)

Introduction – Ordered Sets – Fields – The Real Field – The Extended Real Number System – The Complex Field – Euclidean Spaces.

UNIT –II BASIC TOPOLOGY (15 HRS.)

Finite, Countable and Uncountable Sets – Metric Spaces (self study) – Compact Sets – Perfect Sets – Connected Sets.

UNIT –III NUMERICAL SEQUENCES AND SERIES (20 HRS.)

Convergent sequences – Subsequences – Cauchy's sequences – Upper and lower limits (self study) – 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.

UNIT –IV CONTINUITY (20 HRS.)

Limit of Functions – Continuous Functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic functions – Infinite Limits and Limits at Infinity.

UNIT –V DIFFERENTIATION (20 HRS.)

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

SELF STUDY:

Finite, Countable and Uncountable Sets – Metric Spaces.

Convergent sequences – Subsequences – Cauchy's sequences – Upper and lower limits

TEXT BOOKS:

1. Walter Rudin - *Principles of Mathematical Analysis* - McGraw-Hill - Third Edition - 1976.
   UNIT I : Chapter: 1
   UNIT II : Chapter: 2
   UNIT III : Chapter: 3
   UNIT IV : Chapter: 4
   UNIT V : Chapter: 5

REFERENCES:

1. Richard R. Goldberg - *Methods of Real Analysis* - Oxford & IBH Publishing Company - 1970
2. Apostol - *Mathematical Analysis* - Narosa Publishing House - Twentieth Reprint - 2002.
3. D. Somasundaram and Choudhary - *A first Course in Mathematical Analysis* - Narosa corrected Edition - 1999.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Describe analysis concepts in Real and Complex Number systems
CO 2	Explain concepts of metric, compact and connected sets
CO 3	Recall Sequence and series in Real line
CO 4	Differentiate Continuous functions and Uniformly continuous functions
CO 5	Describe Derivatives of functions

I M.Sc. Mathematics

SEMESTER –I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M3	NUMBER THEORY	Lecture	6	4

COURSE DESCRIPTION

This course discovers interesting and unexpected relationships between different sorts of numbers and to prove that these relationships are true.

COURSE OBJECTIVE/S

To help the students to learn the concepts of Divisibility, Congruences, Quadratic Reciprocity, some functions and Diophantine equations in Number Theory.

SYLLABUS

UNIT –I DIVISIBILITY (15 HRS.)

Introduction, Divisibility, **Primes (Self Study).**

UNIT –II CONGRUENCES (20 HRS.)

Congruences, Solutions of Congruences, Congruences of Degree 1, the Function φ (n), Congruences of Higher Degree, Prime Power Moduli, Prime Modulus, Power Residues.

UNIT –III QUADRATIC RECIPROCITY (15 HRS.)

Quadratic Residues, Quadratic Reciprocity, **The Jacobi Symbol (Self study).**

UNIT –IV SOME FUNCTIONS OF NUMBER THEORY (20 HRS.)

Greatest Integer Function, Arithmetic Functions , the Moebius Inversion Formula, Recurrence Functions.

UNIT –V SOME DIOPHANTINE EQUATIONS (20 HRS.)

Diophantine Equations, The Equation ax + by = c, Positive Solutions, Other Linear Equations, **The Equation $x^2 + y^2 = z^2$ (Self study)** , **The Equation $x^4 + y^4 = z^2$ (Self study)** , Sums of Four and Five Squares, Sum of Fourth Powers, Sum of Two Squares.

SELF STUDY:

Primes , The Jacobi Symbol.

The Equation $x^2 + y^2 = z^2$, The Equation $x^4 + y^4 = z^2$

TEXT BOOKS:

Ivan Nivan and Herbert S. Zuckerman, *An Introduction to the Theory of Numbers*, Third Edition, Wiley Eastern Ltd, 1976.

Unit 1 : Chapter 1 : 1.1 – 1.3

Unit 2 : Chaoter 2 : 2.1 – 2.7 , 2.9

Unit 3 : Chapter 1 : 3.1 – 3.3

Unit 4 : Chapter 1 : 4.1 – 4.3 , 4.5

REFERENCES:

1. T. M. Apostle, *Introduction to Analytic number theory*, Narosa Publishing House, 1998.
2. D.M.Burton, *Elementary Number Theory*, McGraw Hill Book Company, 7th Edition , 2006.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Define and interpret the concepts of divisibility
CO 2	Explain properties of congruences
CO 3	Apply the Law of Quadratic Reciprocity
CO 4	Classify functions of number theory
CO 5	Solve Linear Diophantine equation

I M.Sc. Mathematics

SEMESTER –I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M4	CLASSICAL MECHANICS	Lecture	6	4

COURSE DESCRIPTION

This course provides a sound knowledge of the concepts and principles in mechanics

COURSE OBJECTIVE/S

The aim of the course is to help the students to understand mechanics of a particle, Lagrange's equations, Hamilton's principles, Two body problem and Kepler's problem and apply it for solving problems.

SYLLABUS

UNIT –I MECHANICS OF A PARTICLE (15HRS.)

Mechanics of a particle, Mechanics of a system of particles, Constraints, D'Alambert's principle.

UNIT –II LAGRANGE'S EQUATIONS (15HRS.)

Lagrange's equations, velocity – dependent potentials and the dissipation function, simple application of the Lagrangian formulation

UNIT –III HAMILTON'S PRINCIPLE (20 HRS.)

Hamilton's principle, some techniques of the calculus of variations, Derivation of Lagrange's equation from Hamilton's principle

UNIT –IV: LAGRANGE'S EQUATIONS FOR NON-HOLONOMIC SYSTEMS AND SYMMETRIC PROPERTIES (20HRS.)

Extension of Hamilton's principle to non-holonomic systems, **Advantages of a variational principle formulation (self study)**, conservation theorems and symmetry properties.

UNIT –V CLASSIFICATION OF ORBITS (20 HRS.)

Two body central force problem – reduction to the equivalent one-body problem – the equations of motions and first integrals – the equivalent one -

dimensional problem and classification of orbits – the Virial theorem – **the differential equation for the orbit and integrable power law potentials – The Kepler problem; Inverse square law of force** - **The motion in time in the Kepler's problem-The Laplace –Runge-Lenz vector (self study**)

SELF STUDY:

Advantages of a variational principle formulation

The differential equation for the orbit and integrable power law potentials – The Kepler problem; Inverse square law of force - The motion in time in the Kepler's problem-The Laplace – Runge-Lenz vector.

TEXT BOOKS:

1..Herbert Goldstein , *Classical Mechanics* , Narosa Publishing House, Second Edition, 2001.

UNIT I : Chapter: 1(1.1-1.4)
UNIT II : Chapter: 1(1.4-1.6)
UNIT III : Chapter: 2(2.1-2.3)
UNIT IV : Chapter: 2(2.4-2.6)
UNIT V : Chapter: 3(3.1 - 3.5,3.7-3.9)

REFERENCES:

1. Rutherford,*Classical Mechanics,* Oliver and Boyd Ltd, 1964

2. RanaN.C. and JoagR.S., *Classical Mechanics,* TMH Publishers

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Describe analysis concepts in Real and Complex Number systems
CO 2	Explain concepts of metric, compact and connected sets
CO 3	Recall Sequence and series in Real line
CO 4	Differentiate Continuous functions and Uniformly continuous functions
CO 5	Describe Derivatives of functions

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SEMESTER –II

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG2M5	ADVANCED ALGEBRA	Lecture	6	4

COURSE DESCRIPTION

This course enables the students to study some advanced concepts in Algebra.

COURSE OBJECTIVE/S

To study the Dual spaces, Matrices, Linear Transformations and Galois Theory.
This course is designed to emphasis the study of Algebra.

SYLLABUS

UNIT –I DUAL SPACES (15 HRS.)

Dual spaces, the algebra of linear transformations, Characteristic roots.

UNIT –II MATRICES & TRANSFORMATIONS (20 HRS.)

Matrices (Self-study) , Canonical forms: triangular form, Nilpotent transformations.

UNIT –III TYPES OF LINEAR TRANSFORMATIONS (15 HRS.)

Hermitian, Unitary and Normal transformations, **Real quadratic forms. (Self-study).**

UNIT –IV ROOTS IN EXTENSION FIELDS (20 HRS.)

Extension Fields, Roots of polynomials, **More about roots (Self-study).**

UNIT –V GALOIS THEORY (15 HRS.)

The elements of Galois Theory, Solvability by radicals, **Finite fields (Self-study)**

SELF STUDY:

Matrices, Real quadratic forms, More about roots, Finite fields

TEXT BOOK:

1) I. N. Herstein -*Topics in algebra,* 2nd Edition, John Wiley and Sons, 2002.

UNIT I : Chapter 4 (Section 4.3) , Chapter 6 (Section 6.1, 6.2)

UNIT II : Chapter 6 (Section 6.3, 6.4, 6.5)

UNIT III : Chapter 6 (Section 6.10 , 6.11)

UNIT IV : Chapter 5 (Section 5.1 , 5.3, 5.5)

UNIT V : Chapter 5 (Section 5.6) , Section 5.7 (Lemma 5.7.3, Theorms 5.7.2 & 5.7.3)

Chapter 7 (Section 7.1)

REFERENCES:

1. Micheal Artin - *Algebra*, Prentice Hall of India, 2002.

2. Surjeet Singh and Quazi Zameeruddin - *Modern Algebra*, 7th Edition, Vikas Publishing House Pvt Ltd., 1990.

3. K. Hoffman and R. Kunze - *Linear Algebra*, Prentice Hall, 1972.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Appraise characteristic roots of linear transformations.
CO 2	Explain Matrices and Nilpotent transformation.
CO 3	Classify transformations.
CO 4	Describe various concepts of fields.
CO 5	Analyse Galois theory.

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SEMESTER –II

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	**19PG2M6**	**Advanced Real Analysis**	**Lecture**	6	4

COURSE DESCRIPTION

This course enables the students to study some advanced concepts in Real Analysis.

COURSE OBJECTIVE/S

To study the Riemann integral, sequences and series of functions and special functions.

SYLLABUS

UNIT –I THE RIEMANN - STIELTJES INTEGRAL (20 HRS.)

Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector-valued Functions – Rectifiable Curves.

UNIT –II SEQUENCES AND SERIES OF FUNCTIONS (20 HRS.)

Discussion of Main problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Families of Functions – The Stone-Weierstrass Theorem.

UNIT –III SOME SPECIAL FUNCTIONS (20 HRS.)

Power Series – The Exponential and Logarithmic Functions – **The Trigonometric Functions (self study)** – The Algebraic Completeness of the Complex Field – **Fourier Series – The Gamma Function (self study)**.

UNIT –IV FUNCTIONS OF SEVERAL VARIABLES (15 HRS.)

Linear Transformations – Differentiation – The Contraction Principle – The Inverse Function Theorem

UNIT –V FUNCTIONS OF SEVERAL VARIABLES (15 HRS.)

The Implicit Function Theorem – The Rank Theorem – Determinants – Derivative of Higher Order – Differentiation of Integrals.

SELF STUDY:

Power Series – The Exponential and Logarithmic Functions – The Trigonometric Functions

Fourier Series – The Gamma Function

TEXT BOOK:

1.Walter Rudin, *Principles of Mathematical Analysis*, McGraw-Hill, Third edition, 1976.

UNIT I **:** Chapters: 6
UNIT II **:** Chapters: 7
UNIT III **:** Chapter: 8
UNIT IV **:** Chapter: 9 : pages 204 - 222
UNIT V **:** Chapter: 9 : pages 223 - 238

REFERENCES:

1. Richard R. Goldberg, *Methods of Real Analysis,* Oxford & IBH Publishing Company,1970
2. Apostol, *Mathematical Analysis* - Narosa Publishing House, Twentieth Reprint, 2002.
3. D. Somasundaram and Choudhary, *A first Course in Mathematical Analysi,* Narosa corrected Edition, 1999.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Identify Riemann Integral and Riemann - Stieltjes Integral
CO 2	Explain Uniform convergence of functions
CO 3	Define Power Series and Fourier Series
CO 4	Describe Linear Transformations
CO 5	Explain Implicit function theorem and Rank theorem

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SEMESTER –II

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG2M7	DIFFERENTIAL EQUATIONS	**Lecture**	6	4

COURSE DESCRIPTION

This course will provide the knowledge for solving of ordinary and partial differential equations in physical and other phenomena.

COURSE OBJECTIVE/S

To give an in-depth knowledge for solving differential equations which are frequently used in Physics, Chemistry, Biology, Economics and Mechanics.

SYLLABUS

UNIT –I: LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS (20 HRS)

Introduction-The second order homogeneous equation-Initial value problems for second order equations - Linear dependence and independence-A formula for the Wronskian - the non-homogeneous equation of order two-the homogeneous equation of order n- Initial value problems for n-th order equations-the non homogeneous equation of order n.

UNIT –II LINEAR EQUATIONS WITH VARIABLE COEFFICIENT (20 HRS)

Initial value problems for the homogeneous equations – solutions of the homogeneous equations – The Wronskian and linear independence – reduction of the order of a homogeneous equation - the non-homogeneous equation- homogeneous equation with analytic coefficients – the Legendre equation**.**

UNIT –III: LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS

(15 HRS)

The Euler equation – second order equations with regular singular points – an example – The Bessel Equation – The Bessel Equations (Continued).

UNIT –IV PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

(20 HRS)

Linear equations of the first order – integral surfaces passing through a given curve – Compatible systems of first order equations - **Charpit's method** – **solutions satisfying given conditions – Jacobi's method.**

UNIT –V PARTIAL DIFFERENTIAL EQUATIONS OF THE SECOND ORDER

(15 HRS)

The origin of second order equations – linear partial equations with constant coefficients (self study) – equations with variable coefficients – separation of variables.

SELF STUDY:

Charpit's method – solutions satisfying given conditions – Jacobi's method. The origin of second order equations – linear partial equations with constant coefficients .

TEXT BOOKS:

1. Earl. A. Coddington, *An Introduction to Ordinary Differential Equations,* Prentice Hall of India – 1987

Unit I **:** Chapter 2: 2.1- 2.8, 2.10

Unit II **:** Chapter 3**:** 3.1 - 3.8

Unit III **:** Chapter 4 **:** 4.1 - 4.3, 4.7 - 4.8

2. Ian Sneddon -*Elements of Partial differential equations,* McGraw-Hill International Editions, 1986

Unit IV **:** Chapters 2 : 2.4 - 2.5, 2.9 - 2.13

Unit V **:** Chapters 3**:** 3.1, 3.4, 3.5, 3.9

REFERENCES:

1. S. G. Deo, & V. Raghvendra Rao- *Ordinary Differential Equations and stability Theory* - Prentice Hall Second Edition - 1988
2. John. F, Narosa - *Partial Differential Equations* - 3rd Edition – 1979
3. D. Somasundaram, Narosa - *Ordinary Differential Equations* - Narosa Publishing House - Fifth Reprint -2011.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Explain Automorphism Group of a Graph
CO 2	Describe Cayley Graphs
CO 3	Explain Transitive graphs
CO 4	Describe Homomorphism
CO 5	Explain the concept of Matrix Theory

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SEMESTER –II

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	**19PG2M8**	**GRAPH THEORY**	**Lecture**	6	4

COURSE DESCRIPTION

This course enables the students to study some advanced concepts in Graph Theory.

COURSE OBJECTIVE/S

To study the concepts of Connectivity, Digraphs, Matchings, Planarity and Domination in Graphs.

SYLLABUS

UNIT –I : CONNECTIVITY (15 HRS)

Cut vertices, Blocks, Connectivity, Menger's theorem.

UNIT –II TRAVERSABILITY (20 HRS)

Eulerian graphs, Hamiltonian graphs, **Hamiltonian walks and numbers (self study).**

UNIT –III DIGRAPHS, MATCHINGS AND FACTORIZATION (20 HRS)

Strong digraphs, Tournaments, Matchings, Factorization.

UNIT –IV PLANARITY AND COLORING (20 HRS)

Planar graphs, Four color problem, Vertex coloring, **edge coloring (self study)**.

UNIT –V DISTANCE AND DOMINATION (15 HRS)

The center of a graph, **distant vertices (self study)**, the domination number of a graph.

SELF STUDY:

Hamiltonian walks and numbers ,edge coloring ,distant vertices

TEXT BOOK:

1.Gary Chartrand and Ping Zhang ,*Introduction to graph theory*, Tata McGraw Hill Publishing Company Ltd, Edition 2006.

UNIT I: Chapters 5: Sections 5.1 - 5.4,

UNIT II: Chapter 6: Sections 6.1 - 6.3

UNIT III: Chapter 7: Sections 7.1, 7.2,
Chapter 8: Sections 8.1, 8.2

UNIT IV: Chapter 9: Section 9.1
Chapter 10: Sections 10.1 - 10.3

UNIT V: Chapter 12: Sections 12.1, 12.2
Chapter13: Section 13.1

REFERENCES

1.Harary ,*Graph Theory*, Narosa Publishing company, 2001

2.Douglas West, *Introduction to graph Theory*, Pearson Prentice Hall, 2nd Edition, 2006.

3.Bondy J. A and Murty V. S. R, *Graph Theory with applications* Macmillan Press Ltd, 1976.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Build the knowledge of Connectivity in graphs
CO 2	Identify Eulerian and Hamiltonian graphs
CO 3	Explain Digraphs, Matchings and Factorization in graphs
CO 4	Describe Planarity and Coloring in graphs
CO 5	Define and Explain Domination in graph

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SEMESTER –I & II

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PGM1EDC/19PGM2EDC	OPTIMIZATION METHODS	Lecture	3	3

COURSE DESCRIPTION

This course helps the students to convert real life problems into mathematical models and solve them using various techniques

COURSE OBJECTIVE/S

To enable the students to learn Transportation, Assignment Problems, Sequencing Problem and Game Theory.

SYLLABUS

UNIT –I TRANSPORTATION PROBLEM (9 HRS.)

Transportation Problem: Mathematical formulation - Existence of feasible solution - Feasible solution by (i) North – West corner rule (ii) Matrix – Minima method (iii) Vogel's approximation method.

UNIT –II MODIFIED DISTRIBUTION METHOD (9HRS.)

Optimal solution to a T.P by modified distribution method – **Degeneracy in T.P – Unbalanced T.P .(Self Study)**

UNIT –III ASSIGNMENT PROBLEM (9 HRS.)

Introduction – Mathematical formulation of the problem – The assignment method – **Special cases in assignment problems.(Self study)**

UNIT –IV SEQUENCING PROBLEM (9 HRS.)

Introduction – problem of sequencing – Basic terms used in sequencing – Processing n jobs through two machines – Processing n jobs through k machines – Processing 2 jobs through k machines.

UNIT –V GAME THEORY (9HRS.)

Introduction – Two person zero sum games – Some basic terms - The maximin-minimax principle – Games without saddle points – mixed strategies – Graphical solution of 2 x n and m x 2 games – Dominance property .

SELF STUDY:

Degeneracy in T.P – Unbalanced T.P .

Special cases in assignment problems.

TEXT BOOKS:

1.Kanti Swarup, P.K.Gupta, Man Mohan - Operations Research, 2006 – Sultan Chand & Sons, New Delhi.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Distinguish Transportation problem and Assignment problem.
CO 2	Classify the methods of finding IBFS to a transportation problem.
CO 3	Explain assignment problem and solve
CO 4	Solve Sequencing problem.
CO 5	Define two person zero sum game, saddle point and solve problems

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SEMESTER –III

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M9	MEASURE AND INTEGRATION	Lecture	6	4

COURSE DESCRIPTION

This course presents the fundamental concepts and techniques of measure theory. It includes measures, measurable sets, functions, integrals as measures, modes of convergence and product measure.

COURSE OBJECTIVE/S

To provide the students a comprehensive idea about the measures on the real line, Integration of Functions of a real variable, Abstract Measure Spaces, Signed Measures, Measure and Integration in a Product space.

SYLLABUS

UNIT –I MEASURE ON THE REAL LINE (20 HRS.)

Lebesgue outer Measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue Measurability.

UNIT –II INTEGRATION OF FUNCTIONS OF A REAL VARIABLE (20 HRS.)

Integration of non-negative functions, the general integral, integration of series, Riemann and Lebesgue integrals.

UNIT –III ABSTRACT MEASURE SPACES (20 HRS.)

Measures and outer Measures, Extension of a Measure, Uniqueness of extension, Completion of a Measure, Measure spaces and Integration with respect to a Measure.

UNIT –IV SIGNED MEASURES (15 HRS.)

Signed Measures and Hahn Decomposition, The Jorden Decomposition and **the Radon – Nikodym Theorem (self study)**.

UNIT –V MEASURE AND INTEGRATION IN A PRODUCT SPACE (15 HRS.)

Measurability in a Product space, **The Product Measure and Fubini's theorem (self study).**

SELF STUDY:

the Radon – Nikodym Theorem

The Product Measure and Fubini's theorem

TEXT BOOK:

1) G.de Barra, *Measure Theory and Integration*, New age International (p) Ltd. Publishers,

2008.

REFERENCES

1. Royden H.L, *Real Analysis,* Prentice Hall of India Pvt. Ltd, 2004

2. Paul R. Halmos, *Measure Theory*, Narosa Publishing House, 2000.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Explain Lebesgue measurable sets and measurability
CO 2	Classify Riemann and Lebesgue Integrals
CO 3	Describe Abstract measure spaces
CO 4	Define Signed Measures and distinguish Hahn Decomposition and Jorden Decomposition
CO 5	Explain the concept of measurability in product space

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SEMESTER –III

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M10	OPTIMIZATION TECHNIQUES	Lecture	6	4

COURSE DESCRIPTION

This course makes the better decisions in complex scenarios by the application of a set of advanced analytical methods.

COURSE OBJECTIVE/S

To enable the students to become aware of and appreciate the potential of the theory of optimization and to introduce various decision making tools and techniques based on optimization.

SYLLABUS

UNIT –I REVISED SIMPLEX METHOD (15 HRS.)

Introduction, Standard forms for Revised Simplex Method, Computational Procedure for Standard Form I, Comparison of Simplex Method and Revised Simplex Method.

UNIT –II INTEGER LINEAR PROGRAMMING (20 HRS.)

Introduction, Types of Integer Linear Programming Problems, Enumeration and Cutting Plane Solution Concept, Gomory's All Integer Cutting Plane Method , **Gomory's mixed Integer Cutting Plane method(Self Study)** , Branch and Bound Method

UNIT –III DYNAMIC PROGRAMMING (15 HRS.)

Introduction, Dynamic Programming Terminology, Developing Optimal Decision Policy, Dynamic Programming Under Certainty, **Dynamic Programming Approach for Solving Linear Programming Problem(Self Study).**

UNIT –IV DETERMINISTIC INVENTORY CONTROL MODEL (20 HRS.)

Introduction, The Meaning of Inventory Control, Functional Role of Inventory, Reasons of Carrying Inventory, Factors Involved in Inventory Problem Analysis, Inventory Model building, Inventory Control Models without Shortage, **Inventory Control Models with Shortages (Self Study)**

UNIT –V QUEUING THEORY (20 HRS.)

Introduction, The structure of Queuing system, Performance Measures of a Queuing system, Probability Distributions in Queuing systems, Classification of Queuing Models, **Single server Queuing Models, Multi server Queuing Models, Finite calling population Queuing Models (Self Study)**

SELF STUDY:

Gomory's mixed Integer Cutting Plane method

Dynamic Programming Approach for Solving Linear Programming Problem

Inventory Control Models with Shortages

Single server Queuing Models, Multi server Queuing Models, Finite calling population Queuing Models

TEXT BOOK:

1.J.K. Sharma, *Operations Research Theory and Applications,*Second Edition, Macmillan (India) New Delhi 2005

REFERENCES:

1.J. Lieberman, F.S. Hiller, *Introduction to Operations Research,* 7th Edition, Tata- McGraw Hill Company, New Delhi, 2001.

2.Kanti Swarup, Manmohan, P.K. Gupta,*Operations Research*, , Sultan & Chand Publications, 2003.

3.Hamdy A. Taha, *Operations Research, ,* (Edition 7), Prentice - Hall of India Private Limited, New Delhi, 1997.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Explain revised simplex method and solve problems
CO 2	Classify integer programming problem and explain cutting plane and branch and bound methods
CO 3	Recognize dynamic programming problem and formulate recurrence relation
CO 4	Distinguish inventory control models
CO 5	Identify Queuing models

II M.Sc. Mathematics

SEMESTER –III

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M11	COMBINATORICS	Lecture	6	4

COURSE DESCRIPTION

Combinatorics may be defined as the study of discrete structures and how these structures can be combined subject to various constraints. It can be described as the art of counting

COURSE OBJECTIVE/S

To introduce topics and techniques of discrete and combinatorial methods. Topics that will be studied includes generating functions, recurrence relations, the principle of inclusion and exclusion, Polya's theory of counting and methods to solve different equations.

SYLLABUS

UNIT –I PERMUTATIONS AND COMBINATIONS (15 HRS.)

Introduction, rules of sum and product, Permutations and Combinations, Distributions of distinct objects, distributions of non distinct objects.

UNIT –II GENERATING FUNCTIONS (20 HRS.)

Generating functions for combinations, enumerators for permutations, Distributions of distinct objects into non distinct cells, partitions of integers.

UNIT –III RECURRENCE RELATIONS (20 HRS.)

Linear Recurrence relations with constant coefficients, Solution by the technique of generating functions, **A Special class of nonlinear difference equations,Recurrence relation with two indices (Self study).**

UNIT –IV THE PRINCIPLE OF INCLUSION AND EXCLUSION(15HRS.)

The principle of Inclusion and Exclusion, **the general formula, Derangements (Self Study),** Permutations with restrictions on relative positions.

UNIT –V POLYA'S THEORY OF COUNTING (20 HRS.)

Equivalence classes under a permutation group, Equivalence classes of functions, Weights and inventories of functions, Polya's fundamental theorem.

SELF STUDY:

A Special class of nonlinear difference equations,Recurrence relation with two indices , the general formula, Derangements

TEXT BOOK:

Liu C. L., *Introduction to Combinatorial Mathematics*, McGraw Hill, 1968.

UNIT I : Chapter1:Sections 1.1 -1.6,
UNIT II : Chapter 2: Sections 2.1 - 2.7,
UNIT III : Chapter 3: Sections 3.1 - 3.5,
UNIT IV : Chapter 4: Sections 4.1 - 4.5,
UNIT V : Chapter 5: Sections 5.3 - 5.6.

REFERENCES:

1. Alan Tucker , *Applied Combinatorics*, John Wiley and Sons (Asia) 2004
2. Herbert John Ryser, *Combinatorial Mathematics,* The Mathematical Association of America, 1963
3. I. A. Cohen, *Combinatorics,*
4. V.Krishnamurthy, *Combinatorics: Theory and Applications*, East-West Press, 2000.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Explain the rules of sum and product of permutations and combinations.
CO 2	Describe distributions of distinct objects into non-distinct cells and partitions of integers.
CO 3	Identify solutions by the technique of generating functions and recurrence relations with two indices
CO 4	Solve problems on principle of inclusion and exclusion
CO 5	Apply Polya's theory using configuration.

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SEMESTER –III

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M12	TOPOLOGY	Lecture	6	6

COURSE DESCRIPTION

This course introduces the fundamental notions of topology which provides foundation for many other branches of mathematics.

COURSE OBJECTIVE/S

To enable the students to learn open sets, closed sets, continuous functions, compactness, connectedness and separation axioms in Topological spaces.

SYLLABUS

UNIT –I TOPOLOGICAL SPACES (20 HRS.)

Topological Spaces, Basis for a topology, the order topology, the product topology on $X \times Y$, **the subspace topology**, **Closed sets and limit points (self study)**.

UNIT –II CONTINUOUS FUNCTIONS (15 HRS.)

Continuous functions, The Product topology, The Metric topology.

UNIT –III CONNECTED SPACES (15HRS.)

Connected Spaces, connected subspaces of the real line, Components and Local connectedness

UNIT –IV COMPACT SPACES (20 HRS.)

Compact Spaces, Compact subspaces of the real line (self study), limit point compactness.

UNIT –V COUNTABILITY AND SEPARATION AXIOMS (20 HRS.)

The Countability axioms, The Separation axioms, Normal spaces, Urysohn lemma - Urysohn Metrization theorem.

SELF STUDY:

The subspace topology, Closed sets and limit points

Compact Spaces, Compact subspaces of the real line

TEXT BOOK:

1) James. R Munkres, *Topology*, Prentice Hall of India Private Ltd, New Delhi, Second Edition, 2012

REFERENCES:

1. George F.Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill Book Co., INC, 1963

2. S. T. Hu, *Elements of General Topology*, London :Holden day, 1964.

3. K. D. Joshi, Introduction to General *Topology*, Wiley Eastern, 1983.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Classify various Topologies in Topological spaces
CO 2	Explain connectedness and Components in Topological spaces
CO 3	Describe compactness in Topological spaces
CO 4	Identify Seperation axioms
CO 5	Explain Urysohn Metrization theorem

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SEMESTER –III

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3ME1	FUZZY SETS AND APPLICATIONS	Lecture	4	4

COURSE DESCRIPTION

This course is focused on the fundamental theory of fuzzy sets, fuzzy logic which can be applied in data mining and decision making in various fields.

COURSE OBJECTIVE/S

To enable the students to understand the basic concepts of Crisp sets, Fuzzy sets, operations on fuzzy set, Fuzzy relations and applications of Fuzzy sets.

SYLLABUS

UNIT –I CRISP SETS AND FUZZY SETS (12 HRS.)

Crisp sets : An over view, the notion of Fuzzy sets, Basic concepts of Fuzzy sets, Classical Logic: an over view, Fuzzy logic.

UNIT –II OPERATIONS ON FUZZY SETS (12 HRS.)

General discussion, Fuzzy Complements, Fuzzy Union, Fuzzy Intersection, Combinations of operations.

UNIT –III FUZZY RELATIONS (12 HRS.)

Crisp and Fuzzy Relations, Binary Relations on a single set, **Equivalence and similarity Relations (self study)**..

UNIT –IV FUZZY MEASURES (12 HRS.)

General Discussion, Belief and Plausibility Measures, Possibility and Necessity Measures.

UNIT –V APPLICATIONS (12 HRS.)

General Discussion, natural, Life and Social Sciences, **Engineering**, **Medicine and Management and Decision making (self study)**.

SELF STUDY:

Equivalence and similarity Relations

Engineering, Medicine and Management and Decision making

TEXT BOOK:

1.George J. Klir And Tina A. Folger, *Fuzzy Sets*, Uncertainty and Information-Prentice Hall of India Private Limited, New Delhi – 1, 2009.

REFERENCES:

1. George J. Llir and Boyuan, *Fuzzy Sets and Fuzzy logic, Theory and applications*- Prentice Hall of India, 2002.

2. Zimmermann, *Fuzzy Set Theory and its applications*, Affiliated East West Press Pvt , Ltd, Second Edition 1996.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Distinguish crisp sets and Fuzzy sets
CO 2	Classify operators on Fuzzy sets
CO 3	Describe Fuzzy relations
CO 4	Describe Fuzzy Measures
CO 5	Apply Fuzzy sets in real life situations

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SEMESTER –III

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3ME2	NUMERICAL ANALYSIS	Lecture	4	4

COURSE DESCRIPTION

This course provides knowledge to solve equations using Numerical methods.

COURSE OBJECTIVE/S

To enable the students to solve equations like Algebraic, Transcendental, Differential Equations and Integrals by various Numerical methods.

SYLLABUS

UNIT –I SOLVING SETS OF EQUATIONS (12 HRS.)

The Elimination Method, The Gaussian Elimination and Gauss- Jordan Method, Iterative Methods - The Relaxation Method.

UNIT –II INTERPOLATION AND CURVE FITTING (12 HRS.)

Lagrangian Polynomials, Divided Differences, Interpolation with Cubic Spline, **Least-Square Approximation (self study).**

UNIT –III NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION (12HRS.)

Derivatives form Difference tables, Extrapolation Techniques, The Trapezoidal Rule –A Composite formula, **Simpson's rules (self study).**

UNIT –IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (12 HRS.)

The Taylor – Series method (self study), Euler and Modified Euler methods, Runge- Kutta Methods, **Milne's Method (self study)**,

UNIT –V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (12 HRS.)

Introduction, Difference Quotients, Geometrical representation of partial differential quotients.

SELF STUDY:

Least-Square Approximation,Simpson's rules ,The Taylor – Series method , Milne's Method

TEXT BOOK:

1) Curtis .F. Gerald, Patrick O. Wheatley, *Applied Numerical Analysis*, 5th Edition Pearson Education, New Delhi, 2005.

UNIT I : Chapter 2 : Sections 2.3-2.4 & 2.10-2.11

UNIT II: Chapter 3: Sections 3.2-3.4 & 3.7

UNIT III: Chapter 5: Sections 5.2, 5.4 & 5.6-5.7

UNIT IV: Chapter 6: Sections 6.2- 6.4 & 6.6

UNIT V: Chapter 12 : Sections 12.1 – 12.3

REFERENCES:

1. R.L. Burden, J. Dougles Faires, *Numerical Analysis*, Thompson Books, USA, 2005.

2. S.S Sastry, *Introductory Methods of Numerical Analysis* , Prentice- Hall of India Pvt. Ltd., New Delhi, 2005.

3. M.K.Jain , S.R.K. Lyengar, R.K. Jain, *Numerical Methods for scientific and Engineering Computation*, 3rd Edition, Wiley Eastern Ltd., New Delhi, 1993.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Identify the various methods of solving simultaneous linear algebraic equations.
CO 2	Recognize difference operators and apply the concept of interpolation.
CO 3	Compute the values of the derivatives at some point using numerical differentiation and integration.
CO 4	Solve problems on higher order differential equations using Euler's, Runge- kutta methods
CO 5	Explain Geometrical representation of partial differential quotients.

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SEMESTER –IV

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG4M13	COMPLEX ANALYSIS	Lecture	6	5

COURSE DESCRIPTION

This course enables the students to study some advanced concepts in Complex Analysis

COURSE OBJECTIVE/S

To enable the students to understand the notions complex functions, complex integration, harmonic functions, series, product development and elliptic functions.

SYLLABUS

UNIT –I COMPLEX FUNCTIONS (20 HRS.)

Spherical Representation of complex numbers, **limits and continuity, analytic functions, polynomials, sequences, series, uniform convergence (self study)**, power series, Abel's limit theorem.

UNIT –II COMPLEX INTEGRATION (20 HRS.)

Line integrals as functions of arcs, Cauchy's theorem for a rectangle, the index of a point with respect to a closed curve, the integral formula, higher derivatives, removable singularities, Taylor's theorem, zeros and poles.

UNIT –III HARMONIC FUNCTIONS (15 HRS.)

Definition and basic properties, the mean value property, Poisson's formula, Schwartz's theorem.

UNIT –IV SERIES AND PRODUCT DEVELOPMENTS (15 HRS.)

Weierstrass's theorem, the Taylor series, the Laurent series, partial fractions and infinite products.

UNIT –V ELLIPTIC FUNCTIONS (20 HRS.)

Representation by exponentials, the Fourier Development, functions of finite order, the period module, Unimodular transformation, the canonical basis,

general properties of Elliptic functions,**the Wierstrass ρ-function, the functions ζ(z) and σ(z).**

SELF STUDY:

limits and continuity, analytic functions, polynomials, sequences, series, uniform convergence ,the Wierstrass ρ-function, the functions ζ(z) and σ(z).

TEXT BOOK:

LarsV. Ahlfors, *Complex Analysis*, 3rd McGraw-Hill International Edition,1979

REFERENCES:

1. ConwayJ. B, *Functions of one Complex Variable,* Springer-Verlog, International Student Edition, Narosa Publishing Company,2002.

2. Copson, *Introduction to theory of function of a Complex variable,*London Oxford University Press,1962.

3. KarunakaranV, *Complex Analysis,* Second edition, Narosa Publishing House pvt. Ltd. 2005.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Identify continuous, differentiable and analytic functions.
CO 2	Explain Cauchy's theorem for rectangle and Cauchy's integral formula
CO 3	Summarize the conditions for a complex variable to be harmonic
CO 4	Compute analytic functions in series form.
CO 5	Identify the conditions for a function to be elliptic and bring out its properties.

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SEMESTER –IV

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG4M14	STATISTICS	Lecture	6	5

COURSE DESCRIPTION

This course provides various concepts of Statistics which can be applied in real life situations

COURSE OBJECTIVE/S

To enable the students to understand some discrete and continuous distributions, Testing of hypothesis and Estimation

SYLLABUS

UNIT –I SOME SPECIAL DISTRIBUTIONS (20 HRS.)

The Binomial and Related Distributions – The Poisson distribution – **The Gamma, Chi-square and Beta distributions (self study)** - The Normal distribution .

UNIT –II T, F DISTRIBUTIONS AND LIMITING DISTRIBUTIONS (20 HRS.)

t and F distributions, Expectations of Functions(self study), Convergence in Probability, Convergence in Distribution, central Limit theorem.

UNIT –III SOME ELEMENTARY STATISTICAL INFERENCES (15 HRS.)

Sampling and Statistics, More on confidence Intervals, Introduction to hypothesis testing, Additional Comments about Statistical Tests.

UNIT –IV MAXIMUM LIKLELIHOOD METHODS AND SUFFICIENCY (20 HRS.)

Maximum Likelihood Estimation, Rao-Cramer Lower Bound and efficiency, Maximum Likelihood Tests. Measures of quality of Estimators, A sufficient statistic for a parameter, Properties of a sufficient statistic .

UNIT –V OPTIMAL TESTS OF HYPOTHESES (15 HRS.)

Most Powerful Tests, **Uniformly Most Powerful Test (self study)**, Likelihood Ratio Tests.

SELF STUDY:

The Gamma, Chi-square and Beta distributions, t and F distributions, Expectations of Functions, Uniformly Most Powerful Test

TEXT BOOK:

1. Robert V. Hogg, Joseph W.McKean and Allen T. Craig, *Introduction to mathematical statistics*, Sixth Edition , Pearson Education. Inc. and Dorling Kindersley Publishing, Inc.2007.

REFERENCES:

1. John E. Freund, M T.J. Wilmore, *Mathematical Statistics*, Prentice Hall of India,2000.
2. Rohatgi V. K. and A. K. Md. L Saleh, *An Introduction to Probability and Statistics,* 2nd Edition, John Wiley & Sons, New York, 2002.
3. A. M. Mood, F. A. GrayBill and D. C. Bose, *Introduction to the Theory of Statistics*, Third Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2001.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Classify discrete and continuous distributions
CO 2	Describe t, F and limiting distributions
CO 3	Explain statistical tests
CO 4	Summarize maximum likelihood methods
CO 5	Distinguish tests of hypothesis

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SEMESTER –IV

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG4M15	METHODS OF APPLIED MATHEMATICS	Lecture	6	5

COURSE DESCRIPTION

This course provides various methods of Applied Mathematics which will be helpful for the students to attempt NET/SET exams.

COURSE OBJECTIVE/S

To enable the students to study the concepts of Calculus of variations, Boundary value problems, Differential and Integral equations, Fourier transforms.

SYLLABUS

UNIT –I CALCULUS OF VARIATIONS (18 HRS.)

Calculus of variations-maxima and minima -The simplest case-Natural and Transition boundary conditions-variational notation-more general case.

UNIT –II BOUNDARY VALUE PROBLEMS (18 HRS.)

Constraints and Lagrange multipliers-variable end points-sturm liouville problems-small vibrations about equilibrium-variation problems for deformable bodies-Rayleigh-Ritz method.

UNIT –III DIFFERENTIAL AND INTEGRAL EQUATIONS (18 HRS.)

Integral equations-Relations between differential and integral equations-Green's function-Fredholm equations with separable kernels.

UNIT –IV METHODS FOR SOLVING INTEGRAL EQUATIONS (18 HRS.)

Hilbert Schmidt theory-Iterative methods for solving equations of the second kind.Neumann series-**Fredholm theory-singular integral equations-special devices.(self study)**

UNIT –V FOURIER TRANSFORMS (18 HRS.)

Fourier Transform-Fourier sine and cosine transforms-properties - convolution-**solving integral equations- Finite Fourier sine and cosine transforms-Fourier integral theorem-parseval's identity.(self study)**

SELF STUDY:

Fredholm theory-singular integral equations-special devices,solving integral equations- Finite Fourier sine and cosine transforms-Fourier integral theorem-parseval's identity

TEXT BOOKS:

1. Hildebrand F.B., *Methods of Applied Mathematics*, Second Edition, PHI, New Delhi,1972.
2. Goyal & Gupta, *Laplace and Fourier Transforms*, Pragati Prakashan, Meerut,1987.

REFERENCES

1.Sharma, D. C and Goyal, M. C, *Integral equations*, PHI, New Delhi, 2017

2.Sharma, R. K, *Calculus of variations, Meditech, 2017.*

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Explain Eulers equation and its applications
CO 2	Solve variational problems
CO 3	Distinguish Integral equations.
CO 4	Describe various methods for solving integral equations
CO 5	Solving problems using fourier transforms

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SEMESTER –IV

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG4M16	FUNCTIONAL ANALYSIS	Lecture	6	5

COURSE DESCRIPTION

This course enables the students to study the advanced concepts of Functional Analysis.

COURSE OBJECTIVE/S

To enable the students to understand the concepts of Banach spaces, Hilbert spaces and Finite dimensional spectral theory

SYLLABUS

UNIT I: BANACH SPACES (20 HRS.)

The definition and some examples, continuous linear transformations, the Hahn-Banach theorem.

UNIT II: BANACH SPACES (CONTINUED) (15 HRS.)

The natural imbedding of N in N**, the open mapping theorem, the conjugate of an operator.

UNIT III: HILBERT SPACES (20 HRS.)

The definition and some simple properties, orthogonal complements, Orthonormal sets, the conjugate space H*.

UNIT IV: HILBERT SPACES (CONTINUED) (15 HRS.)

The adjoint of an operator**, self-adjoint operators, normal and unitary operators (Self Study).**

UNIT V: FINITE DIMENSIONAL SPECTRAL THEORY (20 HRS.)

Matrices, determinants (Self Study) and the spectrum of an operator, the spectral theorem.

SELF STUDY:

self-adjoint operators, normal and unitary operators

Matrices, determinants

TEXT BOOK:

1. Simmons. G. F, *Introduction to Topology and Modern Analysis*, Tata McGraw Hill Publishing Company Ltd, edition 2004. (Chapters: **9**, **10**(except 59), **11**(60, 61, 62))

REFERENCE BOOKS:

1. Dr.D.Somasundaram, *Functional Analysis*, Viswanathan Printers and Publishers Ltd, 1999.
2. Balmohan V. Limaye, *Functional Analysis*, New Age International Publishers, Revised 2nd Edition, 2006.
3. S. Ponnusamy, *Foundation of Functional Analysis,* Narosa, 2002.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Create knowledge with the basic concepts, principles and methods of functional analysis and its applications.
CO 2	Analyze the concept of normed spaces, Banach spaces, and the theory of linear operators
CO 3	Explain in detail the Hahn-Banach theorem, the open mapping and closed graph theorems
CO 4	Define and thoroughly explain Hilbert spaces and self-adjoint operators
CO 5	Discuss in detail the study of the spectrum of an operator and its properties

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SEMESTER –IV

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG4ME3	FORMAL LANGUAGES	Lecture	4	4

COURSE DESCRIPTION

This course explains and manipulates the different concepts in Automata Theory and Formal Languages

COURSE OBJECTIVE/S

To introduce some fundamental concepts in automata theory and formal languages including grammar, finite automaton and Regular Grammars

SYLLABUS

UNIT –I GRAMMARS (10 HRS.)

Alphabets and Languages, Motivation, The Formal Notion of a Grammar, The Types of Grammars.

UNIT –II GRAMMARS (CONTINUED) (10 HRS.)

The empty sentence, Recursiveness of Context-sensitive Grammars, **Derivation Trees of Context-Free Grammars.(self study)**

UNIT –III FINITE AUTOMATA (10 HRS.)

The Finite Automaton, Equivalence Relations and Finite Automata, Nondeterministic Finite Automata

UNIT –IV FINITE AUTOMATA AND REGULAR GRAMMARS (15 HRS.)

Finite Automata and Type3 languages.(self study), Properties of Type3 Languages, Solvable Problems concerning Finite Automata

UNIT –V CONTEXT-FREE GRAMMARS (15 HRS.)

Simplification of Context-Free Grammars.(self study), Chomsky Normal Form, Greibach Normal Form, Solvability of Finiteness and the *uvwxy* theorem, The self-embedding property.

SELF STUDY:

Derivation Trees of Context-Free Grammars, Finite Automata and Type3 languages, Simplification of Context-Free Grammars

TEXT BOOK:

1. E. Hopcroft and Jeffrey D. Ullman, *Formal Languages and their Relation to Automata,* John, Addison Wesley Publishing Company, 1969.

Chapters: 2 – 4 (Except section 3.7 from page 41 - 44)

REFERENCES:

1. John E.Hopcroft and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages and Computation*, Narosa Publishing House, 1999.

2.Alexander Meduna, *Automata and Language,s* Springer, 2000.

3.Rani Siromoney, *Formal Languages*.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Design the basic concepts in automata theory and formal languages
CO 2	Identify different formal language classes and their relationships
CO 3	Transform between equivalent deterministic and non-deterministic finite automata, and regular expressions
CO 4	Discuss about the automata, regular expressions and context-free grammars accepting or generating a certain language
CO 5	Simplify the theorems in automata theory using its properties

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SEMESTER –IV

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG4ME4	ALGEBRAIC GRAPH THEORY	Lecture	4	4

COURSE DESCRIPTION

This course enables the students to study some concepts in Algebraic Graph Theory

COURSE OBJECTIVE/S

To study the Automorphism Group of a Graph, Cayley Graphs, Transitive Graphs, Homomorphism and Matrix Theory of Graphs

SYLLABUS

UNIT –I THE AUTOMORPHISM GROUP OF A GRAPH (12 HRS.)

Definitions - Operations on Permutations Groups - Computing Automorphism Groups of Graphs - Graphs with a Given Automorphism Group.

UNIT –II CAYLEY GRAPHS (12 HRS.)

The Cayley Color Graph of a Group Presentation: Definitions - Automorphisms - Properties - Products - Cayley Graphs.

UNIT –III TRANSITIVE GRAPHS (12 HRS.)

Vertex Transitive Graphs - Edge Transitive Graphs - Edge Connectivity - Vertex Connectivity

UNIT –IV HOMOMORPHISM (12 HRS.)

The Basics of Homomorphism - Cores - Products - The Map Graph - Counting Homomorphisms

UNIT –V MATRIX THEORY OF GRAPHS (12 HRS.)

The Adjacency Matrix, The Incidence Matrix, The Incidence Matrix of an Oriented Graph

SELF STUDY:

The Adjacency Matrix, The Incidence Matrix, The Incidence Matrix of an Oriented Graph

TEXT BOOKS :

1. Arthur T.White, Graphs of Groups on Surfaces: Interactions and Models, Elsevier Science B.V., North-Holland, 2001.

REFERENCES:

1) Norman Biggs, Algebraic Graph Theory, Cambridge University Press, 1974.
2) L. W. Beineke and Robin Wilson, Topics in Algebraic Graph Theory, Cambridge University Press, 2005.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES
CO 1	Explain Automorphism Group of a Graph
CO 2	Describe Cayley Graphs
CO 3	Explain Transitive graphs
CO 4	Describe Homomorphism
CO 5	Explain the concept of Matrix Theory