M.Sc. Mathematics

Syllabus

AFFILIATED COLLEGES

Program Code: 32A

2023 – 2024 onwards

BHARATHIAR UNIVERSITY

**(A State University, Accredited with "A++" Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)**

Coimbatore - 641 046, Tamil Nadu, India

BHARATHIAR UNIVERSITY, COIMBATORE.
M. Sc. MATHEMATICS DEGREE COURSE (AFFILIATED COLLEGES)
(For the candidates admitted from the academic year 2023-24 onwards)

SCHEME OF EXAMINATIONS – CBCS PATTERN

Semester.	Study Components	Course title	Ins. hrs/week	Examinations				Credit
				Dur.Hrs.	*CIA*	*Marks*	Total Marks	
I	Paper 1	Abstract Algebra*	6	3	25	75	100	4
	Paper 2	Real Analysis	7	3	25	75	100	4
	Paper 3	Ordinary Differential Equations*	7	3	25	75	100	4
	Paper 4	Numerical Methods	6	3	25	75	100	4
	Elect. Paper I		4	3	25	75	100	4
II	Paper 5	Linear Algebra*	6	3	25	75	100	4
	Paper 6	Complex Analysis	7	3	25	75	100	4
	Paper 7	Partial differential equations*	7	3	25	75	100	4
	Paper 8	Mechanics	6	3	25	75	100	4
	Elect. Paper II		4	3	25	75	100	4
III	Paper 9	Topology	7	3	25	75	100	4
	Paper 10	Fluid Dynamics	7	3	25	75	100	4
	Paper 11	Mathematical Statistics*	6	3	25	75	100	4
	Paper 12	Graph Theory	6	3	25	75	100	4
	Elective Paper III		4	3	25	75	100	4
V	Paper 13	Functional Analysis	7	3	25	75	100	4
	Paper 14	Mathematical Methods	7	3	25	75	100	4
	Paper 15	Optimization Techniques*	6	3	25	75	100	4
	Paper 16	Computer Programming (C++ Theory)	4	3	25	75	100	4
	Practical	Computer Programming (C++ Practical)	2	3	40	60	100	4
	Elect. Paper IV		4	3	25	75	100	4
	Project						150@	6
		Total					2250	90

@ For Project report – 120 marks, Viva-voce – 30 marks.

The number of students for conducting Project Viva-voce is 10 per session. If the number of the remaining students exceeds 5 then the Viva-voce for them can be conducted in the next session.

LIST OF ELECTIVES

1. Number Theory*
2. Differential Geometry
3. Neural Networks
4. Magnetohydrodynamics
5. Fuzzy Logic and Fuzzy Sets*
6. Control Theory
7. Cryptography
8. MATLAB
9. LaTex
10. Elements of Stochastic Process*

*** New Course Added / Course Syllabus Modified**

Matlab, LaTex	**Theory**			20	55	100	
	Practical			10	15		

Note. Syllabi for all the papers for the students joining in the academic year 2023-24 are given below


First
Semester

Paper 1: ABSTRACT ALGEBRA

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

UNIT II:
Direct Products: External and Internal direct Products, Euclidean Rings, A Particular Euclidean Rings, Polynomial rings.

UNIT III:
Polynomials over rational fields – extension fields – roots of polynomials – splitting fields.

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

UNIT V:
Solvability by radicals: Solvable group – the commutator subgroup – Solvability by radicals - Finite fields.

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	: Sections 2.13
	Chapter 3	: Section 3.7 - 3.9
UNIT III:	Chapter 3	: Section 3.10
	Chapter 5	: Sections 5.1,5.3
UNIT IV:	Chapter 5	: Sections 5.5,5.6
UNIT V:	Chapter 5	: Section 5.7
	Chapter 7	: Section 7.1

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.

PAPER 2: REAL ANALYSIS

UNIT I:

RIEMANN STILTJES INTEGRAL: Definition and Existence of the Integral – properties of the integral – Integration and differentiation – Integration of vector valued function – rectifiable curves.

UNIT II:

SEQUENCES AND SERIES OF FUNCTIONS: Uniform convergence and continuity – uniform convergence and integration - uniform convergence and differentiation – equicontinuous families of functions – The Stone Weierstrass theorem.

UNIT III:

FUNCTIONS OF SEVERAL VARIABLES: Linear transformation – contraction principle – Inverse function theorem – Implicit function theorem.

UNIT IV:

LEBESGUE MEASURE: Outer measure – Measurable sets and Lebesgue measure – Measurable functions –Littlewood‟s Theorem

UNIT V:

LEBESGUE INTEGRAL: The Lebesgue integral of bounded functions over a set of finite measure – integral of a non – negative function – General Lebesgue Integral.

Text Book:

1. Principles of Mathematical Analysis by W. Rudin, McGraw Hill, New York, 1976.
   Unit I &II : Chapter 6 & 7.
   Unit III : Chapter 9 (Pages 204 to 227)

2. Real Analysis by H.L. Roydon, Third Edition, Macmillan, New York, 1988.

   Unit IV : Chapter 3 (except Section – 4)
   Unit V :Chapter 4 (Sections 2, 3 & 4 only)

Reference Books:

1.R.G.Bartle, Elements of Real Analysis, 2nd Edition, John Wily and Sons, New York, 1976.
2.W.Rudin, Real and Complex Analysis, 3rd Edition, McGraw-Hill, New York, 1986.

Paper 3: ORDINARY DIFFERENTIAL EQUATIONS

UNIT I: LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS

Introduction - Second order homogenous equations - Initial value problem for second order equations - Linear dependence and independence - A formula for Wronskian

UNIT II: LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS (Cont'd.):

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

UNIT III: LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS

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

UNIT IV: LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS

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

UNIT V: EXISTENCE AND UNIQUENESS OF SOLUTIONS TO FIRST ORDER EQUATIONS: Equations with variable separated - Exact equations - The method of successive approximation - The Lipschitz Condition - Convergence of the successive approximation - Non-local existence of solutions - Approximations and uniqueness of solutions.

TEXT BOOK:

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

UNIT I:	Chapter 2	: Sections 2.1 – 2.5.
UNIT II:	Chapter 2	: Sections 2.6 – 2.8, 2.10,2.11.
UNIT III:	Chapter 3	: Sections 3.1 – 3.8
UNIT IV:	Chapter 4	: Sections 4.1 – 4.4, 4.6 – 4.8
UNIT V:	Chapter 5	: Sections 5.1 – 5.8

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 . S.G.Deo and V.Raghavendra., Ordinary Differential Equations and Stability Theory, Tata McGraw-Hill, New Delhi 1980.
3. George F. Simmons, Differential Equations with Application and Historical Notes, Tata McGraw Hill, New Delhi 1974

Paper 4: NUMERICAL METHODS

UNIT I:

SOLUTION OF NONLINEAR EQUATIONS: Newton‟s method – Convergence of Newton‟s method – Bairstow”s Method for quadratic factors.

NUMERICAL DIFFERENTIATION AND INTEGRATION: Derivatives from Differences tables – Higher order derivatives – Divided difference, Central- Difference formulas– Composite formula of Trapezoidal rule – Romberg integration – Simpson‟s rules.

UNIT II:

SOLUTION OF SYSTEM OF EQUATIONS: The Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method – Matrix inversion by Gauss- Jordan method – Methods of Iteration – Jacobi and Gauss Seidal Iteration – Relaxation method – Systems of Nonlinear equations.

UNIT III:

SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method – Euler and Modified Euler methods – Runge-kutta methods – Multistep methods – Milne‟s method – Adams Moulton method.

UNIT IV:

BOUNDARY VALUE PROBLEMS AND CHARACTERISTIC VALUE PROBLEMS: The shooting method – solution through a set of equations – Derivative boundary conditions – Characteristic value problems – Eigen values of a matrix by Iteration – The power method.

UNIT V:

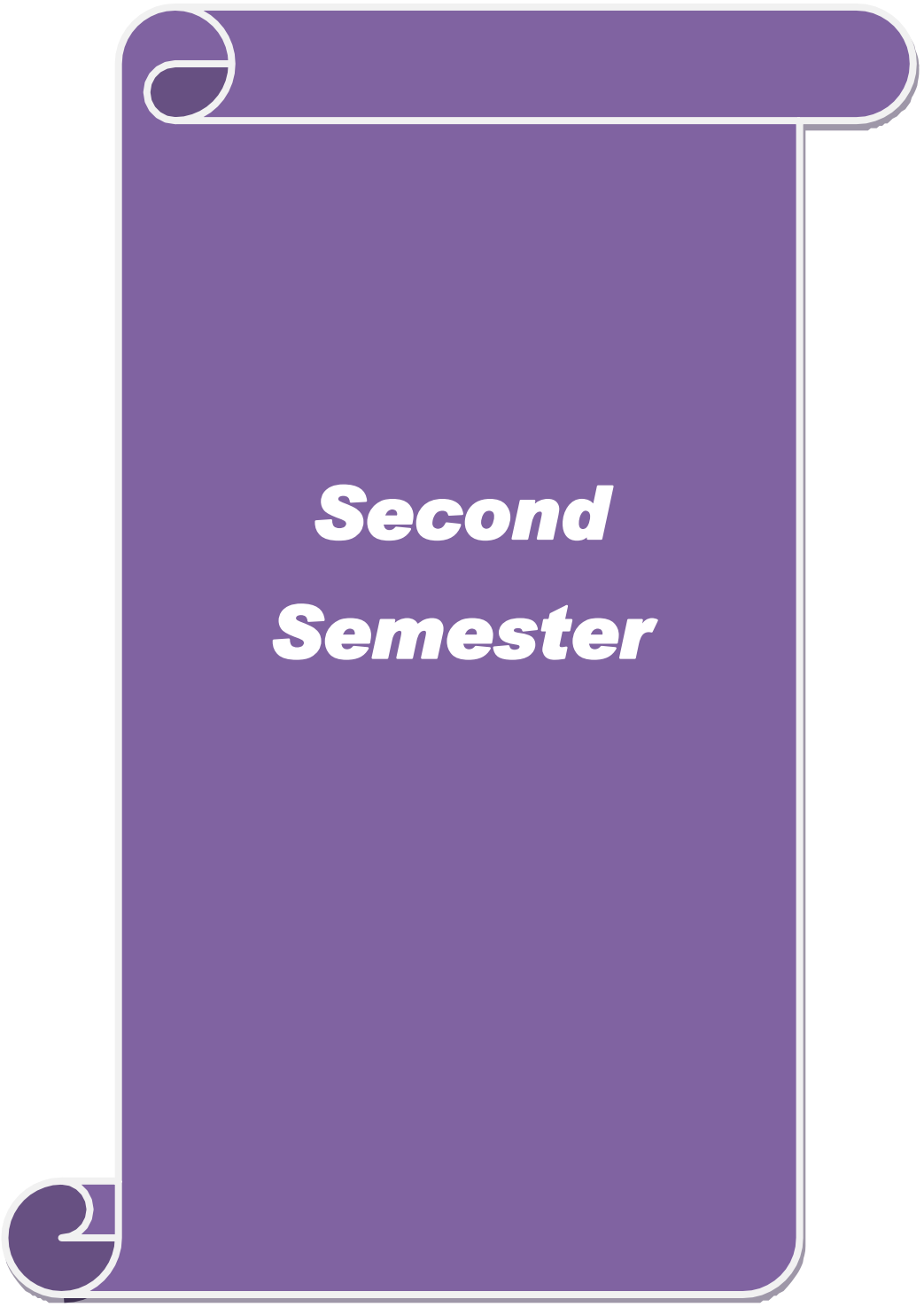
NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: (Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations) Representation as a difference equation – Laplace‟s equation on a rectangular region – Iterative methods for Laplace equation – The Poisson equation – Derivative boundary conditions – Solving the equation for time-dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – solving the wave equation by Finite Differences.

Text Book:

APPLIED NUMERICAL ANALYSIS by C.F.Gerald and P.O.Wheatley, Fifth Edition, Addison Wesley, (1998).

Reference Books:

1. S.C. Chapra and P.C. Raymond: Numerical Methods for Engineers, Tata McGraw Hill, New Delhi, (2000)
2 .S.S. Sastry: Introductory methods of Numerical Analysis, Prentice Hall of India, New Delhi, (1998).
3 .P.Kandasamy et al., Numerical Methods, S.Chand & Co.Ltd., New Delhi(2003)


Second
Semester

Paper 5: LINEAR ALGEBRA

UNIT I: Linear transformations

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

UNIT II: Algebra of polynomials

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

UNIT III: Determinants

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

UNIT IV: Diagonalization

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

UNIT V: The Rational and Jordan forms

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

TEXT BOOK:

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:	Chapter 4	: Sections 4.1, 4.2, 4.4, 4.5
	Chapter 5	: Sections 5.1, 5.2
UNIT III:	Chapter 5	: Sections 5.3, 5.4
	Chapter 6	: Sections 6.1-6.3
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.

Paper 6: COMPLEX ANALYSIS

UNIT I:

Introduction to the concept of analytic function: Limits and continuity – Analytic functions – Polynomials – Rational functions

Conformality: Arcs and closed curves – Analytic functions in regions – Conformal Mapping – Length and Area.

Linear Transformations: The Linear group – The Cross ratio – Elementary Riemann Surfaces.

UNIT II:

Complex Integration: Line Integrals Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy‟s theorem for a rectangle - Cauchy‟s theorem in a disk.

Cauchy's Integral formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives Removable singularities, Taylor‟s Theorem – Zeros and Poles – The Local Mapping– The Maximum principle – chains and cycles.

UNIT III:

The Calculus of Residues: The Residue theorem – The Argument principle – Evaluation of definite integrals.

Harmonic functions: The Definitions and basic Properties – Mean value property – Poisson‟s Formula.

UNIT IV:

Series and Product Developments: Weierstrass Theorem – The Taylor Series – The Laurent Series.

Partial fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products.

UNIT V:

Elliptic functions

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 $\wp$-function

Text Book:

Complex Analysis by L.V. Ahlfors, McGraw Hill, New York, 1979.

Unit I:	Chapter – 2	Sections 1.1 – 1.4
	Chapter – 3	Sections 2.1 – 2.4, 3.1, 3.2 and 3.4
Unit II:	Chapter – 4	Sections 1.1 – 1.5, 2.1 – 2.3, 3.1 - 3.4 and 4.1
Unit III:	Chapter – 4	Sections 5.1 – 5.3, 6.1 – 6.3
Unit IV:	Chapter – 5	Sections 1.1 – 1.3, 2.1 – 2.3
Unit V:	Chapter – 7	Sections 1.1 – 3.3

Paper 7: PARTIAL DIFFERENTIAL EQUATIONS

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UNIT I: PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER:

Partial Differential Equations – Origins of First Order Differential Equations – Cauchy‟s Problem for first order equations – Linear Equations of the first order – Nonlinear partial differential equations of the first order – Cauchy‟s method of characteristics – Compatible system of First order Equations – Solutions satisfying Given Condition, Jacobi‟s method

UNIT II: PARTIAL DIFFERENTIAL EQUATIONS OF THE 2nd ORDER:

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.

UNIT III: LAPLACE'S EQUATION:

Elementary solutions of Laplace equation – Families of Equipotential 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 WAVE EQUATION:

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: THE DIFFUSION EQUATION:

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

TEXT BOOK:

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

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

Paper 8: MECHANICS

UNIT-I:

INDRODUCTORY CONCEPTS: Mechanical system – Generalized Coordinates – Constraints – Virtual Work – Energy and Momentum.

UNIT-II:

LAGRANGE'S EQUATIONS: Derivations of Lagrange‟s Equations: Derivations of Lagrange‟s Equations – Examples – Integrals of Motion.

UNIT-III:

HAMITON'S EQUATIONS: Hamilton‟s Principle – Hamilton‟s Equations.

UNIT-IV:

HAMILTON – JACOBI THEORY: Hamilton‟s Principle function – Hamilton – Jacobi Equation – Separability.

UNIT-V:

CANONICAL TRANSFORMATIONS: Differential forms and Generating Functions – Lagrange and Poisson Brackets.

Text Book:

D.T.Greenwood, Classical Dynamics, Dover Publication, New York, 1997.

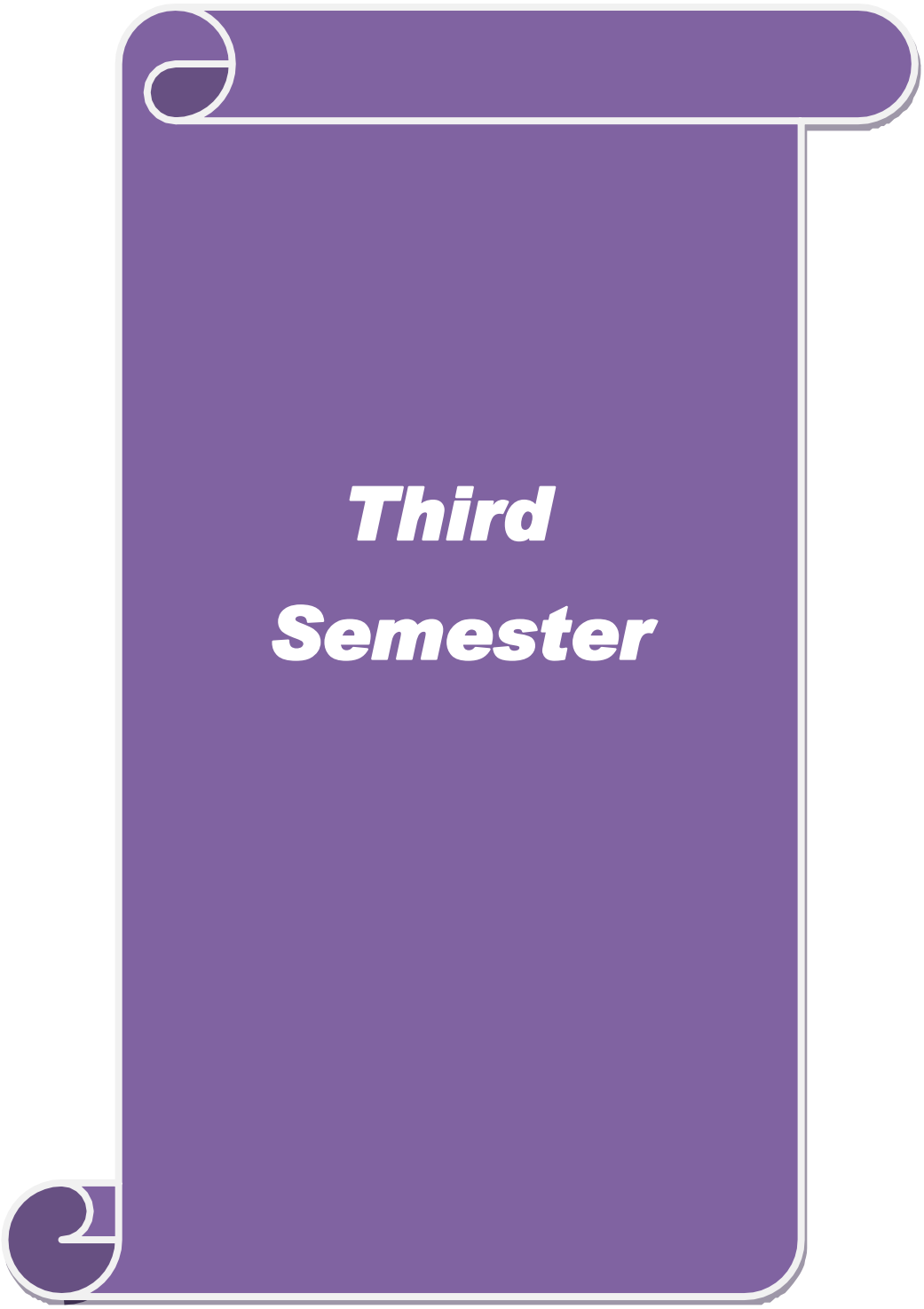
Unit-I:	Chapter 1:	Sections 1.1 – 1.5
Unit-II:	Chapter 2:	Sections 2.1 – 2.3
Unit-III:	Chapter 4:	Sections 4.1 – 4.2
Unit-IV:	Chapter 5:	Sections 5.1 – 5.3
Unit-V:	Chapter 6:	Sections 6.1, 6.3

Reference Books:

1.F. Gantmacher, Lectures in Analytic Mechanics, MIR Publishers, Moscow, 1975.

2.I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice Hall.

3.S.L. Loney, An Elementary Treatise on Statics, Kalyani Publishers, New Delhi, 1979.


Third
Semester

Paper 9: TOPOLOGY

UNIT I:

Types of Topological Spaces and Examples - Basics for a topology - The order topology - The product topology on X x Y - The subspace topology - Closed sets and limits 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 Cech compactifications.

TEXT BOOK:

James R.Munkres, Topology (Second Edition), Prentice – Hall of India, Private Ltd, New Delhi (2006).

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).

PAPER 10: FLUID DYNAMICS

UNIT I:

Introductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure. Differentiation following the Fluid – Equation of continuity – Boundary conditions – Kinematical and physical – Rate of change of linear momentum – Equation of motion of an inviscid fluid.

UNIT II:

Euler‟s momentum Theorem – Conservative forces – Bernoulli‟s theorem in steady motion – energy equation for inviscid fluid – circulation – Kelvin‟s theorem – vortex motion – Helmholtz equation.

UNIT III:

Two Dimensional Motion – Two Dimensional Functions – Complex Potential – basic singularities – source – sink – Vortex – doublet – Circle theorem. Flow past a circular cylinder with circulation – Blasius Theorem – Lift force. (Magnus effect)

UNIT IV:

Viscous flows – Navier-Stokes equations – Vorticity and circulation in a viscous fluid – Steady flow through an arbitrary cylinder under pressure – Steady Couettc flow between cylinders in relative motion – Steady flow between parallel planes.

UNIT V:

Laminar Boundary Layer in incompressible flow: Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness – integral equation of boundary layer – flow parallel to semi infinite flat plate – Blasius equation and its solution in series.

TEXT BOOKS:

For Units I and II: Theoretical Hydro Dynamics by L.M. Milne Thomson, Macmillan Company, 5th Edition (1968).

Chapter I	:	Sections 1.0 – 1.3., 3.10-3.41 (omit 3.32)
Chapter III	:	Sections 3.42 – 3.53 (omit 3.44)

For Units III, IV and V: Modern Fluid Dynamics (Volume I) by N. Curlea and H.J. Davies, D Van Nostrand Company Limited., London (1968).

Chapter III	:	Sections 3.1	– 3.7.5 (omit 3.3.4, 3.4, 3.5.2,3.6)
Chapter V	:	Sections 5.1	– 5.3.3
Chapter VI	:	Sections 6.1	– 6.3.1 (omit 6.2.2., 6.2.5)

References:

1. F.Chorlton, Textbook of Fluid Dynamics, CBS Publishers, New Delhi, 2004.
2.A.J.Chorin and A.Marsden, A Mathematical Introduction to Fluid Dynamics, Springer-Verlag, New York, 1993.

Paper 11: MATHEMATICAL STATISTICS

UNIT– I:
Probability and Distributions: Introduction - Set Theory - The Probability Set Function - Conditional Probability and Independence –Random Variables - Discrete Random Variables- Continuous Random Variables.

UNIT – II:
Probability and Distributions (continued): Expectation of a Random Variables - Some Special Expectations - Important Inequalities.

Multivariate Distributions: Distributions of Two Random Variables - Transformations: Bivariate Random Variables - Conditional Distributions and Expectations - Independent Random Variables.

UNIT – III:
Some Special Distributions: The Binomial and Related Distributions - The Poisson Distribution - The Γ, $\chi 2$, and β Distributions - The Normal Distribution.

UNIT – IV:
Some Special Distributions (continued): t and F-Distributions.

Unbiasedness, Consistency and Limiting Distributions: Expectations of Functions - Convergence in Probability - Convergence in Distribution - Central Limit Theorem.

UNIT– V:
Some Elementary Statistical Inferences: Sampling and Statistics – More on Confidence Intervals - Introduction to Hypothesis Testing - Additional Comments About Statistical Tests - Chi-Square Tests – The Method of Monte Carlo.

Text Book:

Introduction to Mathematical Statistics By Robert V. Hogg, Allen T. Craig and Joseph W. McKean. Pearson, 6th Edn.(2005).
Unit-I: 1.1 – 1.7, Unit-II: 1.8 – 1.10, 2.1 – 2.3, 2.5, Unit-III: 3.1 – 3.4, Unit-IV: 3.6, 4.1 – 4.4, Unit-V: 5.1, 5.4 – 5.8.

Reference Books:

1. The R Book By Michael J. Crawley. John Wiley & Sons, 2nd Edn. (2013).
2. Probability Theory and Mathematical Statistics By Marek Fisz. John Wiley.
3. Statistical Inference By M. Rajagopalan and P. Dhanavanthan. PHI Learning Pvt. Ltd., New Delhi (2012).
4. An Introduction to Probability and Statistics By Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh. Wiley India, 2nd Edn. (2001).

PAPER 12: GRAPH THEORY

UNIT I:

Graphs, Subgraphs: Graphs and Simple Graphs– Graph Isomorphism – The Incidence and Adjacency matrices, Subgraphs – Vertex Degrees – paths and Connection – Cycles.

Trees: Trees – Cut edges and Bonds – cut vertices – Cayley‟s formula

UNIT II:

Connectivity: Connectivity – Blocks.

Euler tours and Hamilton Cycles: Euler tours - Hamilton Cycles

UNIT III:

Matchings: Matchings coverings in Bipartite Graphs – Perfect Matchings.

Edge colourings: Edge chromatic number – Vizing‟s theorem.

UNIT IV:

Independent sets, Cliques: Independent sets – Ramsey‟s theorem.

Vertex Colourings: Chromatic Number – Brook‟s Theorem – Hajo‟s Conjecture – Chromatic Polynomials – Girth and Chromatic number.

UNIT V:

Planar Graphs: Plane and planar Graphs – Dual Graphs – Euler‟s formula – Brides – Kuratowski‟s theorem (Proof omitted) – The Five Colour Theorem and the Four Colour Conjecture

Directed Graphs: Directed Graphs

Simple problems in the exercise of all units can also be included.

Text Book:

J.A.Bondy and U.S.R.Murty, Graph Theory with Applications, American Elsevier Publishing Company Inc., New York, 1976.

Unit-I:	Sections:	1.1	– 1.7 and 2.1 – 2.4.
Unit-II:	Sections:	3.1	– 3.2 and 4.1 – 4.2
Unit-III:	Sections:	5.1	– 5.3 and 6.1 – 6.2
Unit-IV:	Sections:	7.1	-7.2 and 8.1 – 8.5
Unit-V:	Sections:	9.1	–9.6 and 10.1

REFERENCE BOOKS:

1. Harary F , Graph Theory, Addison –Wesley , Reading Mass, 1969.
2. M.Murugan, Graph Theory and Algorithms, Second Edition, Muthali Publishing House, Chennai, 2018.
3. K.R.Parthasarathy, Basic Graph Theory, Tata McGraw Hill, New Delhi,1994.
4. D.B.West, Introduction to graph theory, Prentice Hall of India, 2001.


Fourth
Semester

Paper 13: FUNCTIONAL ANALYSIS

UNIT I:

Banach spaces – The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem –Dual spaces- The natural imbedding of N in N** - The open mapping theorem - Closed Graph theorem.

UNIT II:

The conjugate of an operator – Uniform boundedness Principal - Hilbert spaces – The definition and some simple properties – Orthogonal complements and complements - Orthonormal sets and sequences – Maximal Othonormal sets.

UNIT III:

The Conjugate space H* - Representation of functional on Hilbert spaces -The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections.

UNIT IV:

Matrices – Determinants and the spectrum of bounded operator – The spectral theorem.

UNIT V:

The definition and some examples of Banach algebra – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius.

Text Book:

G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw–Hill Book Company, London, 1963.

Unit I:	Sections: 46 – 50.
Unit II:	Sections: 51 – 54.
Unit III:	Sections: 55 – 59.
Unit IV:	Sections: 60 – 63.
Unit V:	Sections: 64 – 68.

Reference Books:

1.C. Goffman and G. Pedrick, A First Course in Functional Analysis, Prentice Hall of India, New Deli, 1987.

2.G. Bachman and L. Narici, Functional Analysis, Academic Press, New York, 1966.

3.L.A. Lusternik and V.J. Sobolev, Elements of Functional Analysis, Hindustan Publishing Corporation, New Delhi, 1971.

Paper 14: MATHEMATICAL METHODS

UNIT I: INTEGRAL EQUATIONS: Types of Integral equations – Integral Fredholm Alternative - Approximate method – Equation with separable Kernel - Volterra integral equations – Fredholm‟s theory.

UNIT II: APPLICATION OF INTEGRAL EQUATIONS TO ORDINARY INTEGRAL EQUATIONS and SINGULAR INTEGRAL EQUATIONS: Initial value problems Boundary value problems – singular integral equations – Abel Integral equation

UNIT III: FOURIER TRANSFORMS: Fourier Transforms, Fourier sine and cosine transforms – Fourier transforms of derivatives - convolution integral – Parseval‟s Theorem - Solution of Laplace Equations by Fourier transform.

UNIT IV: HANKEL TRANSFORMS: Properties of Hankel Transforms – Hankel transformation of derivatives of functions - The Parseval‟s relation – relation between Fourier and Hankel transforms - Axisymmetric Dirichlet problem for a half space - Axisymmetric Dirichlet problem for a thick plate.

UNIT V: CALCULUS OF VARIATIONS: Variation and its properties – Euler‟s(Euler Lagrange‟s) equation – functionals dependent on the functions of several independent variables – variational problems in parametric form –applications.

TEXT BOOKS:

1. Linear Integral Equations Theory and Technique by R.P.Kanwal, Academic Press, New York, 1971.

Unit I	:	Chapter 2:	2.4 - 2.7, 2.9 – 2.10, 2.16 – 2-(a).(c) 2.16.
Unit II	:	Chapter 5:	5.2 – 5.4, 5.6 – 5.7, 5.10 – 5.12.

2. The Use of Integral Transforms by I.N.Sneddon, McGraw-Hill, NewYork, 1972.

Unit III	:Chapter 2:	2.3 - 2.5,	Chapter 3:	3.3- 3.4.
Unit IV	:Chapter 5:	5.1 – 5.2,	Chapter 8:	8.1– 8.2.

3. Differential Equations and Calculus of Variations by L.Elsgolts, Mir Publishers, Moscow, 1970.

Unit V	:	Chapter 6:	6.1-6.3,6.4-6.7

Paper 15: OPTIMIZATION TECHNIQUES

PRE REQUISITES: The learner should have basic knowledge from linear programming, simplex and dual simplex method and graphical method**.**

UNIT I: INTEGER PROGRAMMING: Introduction – Integer Programming Formulations – Gomory‟s construction–Fractional cut method(all integer)–The Cutting – Plane Algorithm – Branch–and–Bound Technique – Zero–One Implicit Enumeration Algorithm.

UNIT II: DYNAMIC PROGRAMMING: Introduction – Application of Dynamic Programming: Capital Budgeting Problem – Reliability Improvement Problem – Stage–coach Problem – Cargo Leading Problem – Minimizing Total Tardiness in Single Machine Scheduling Problem – Optimal Subdividing Problem – Solution of Linear Programming Problem through Dynamic Programming.

UNIT III: INVENTORY: Introduction–Inventory Decisions–Cost Associated– with Inventories –Factors Affecting inventory–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 – Lagrangean Method –Jacobi Method– Kuhn–Tucker Method – Quadratic Programming – Separable Programming – Chance–Constrained Programming or Stochastic Programming.

TEXT BOOK:

Hamdy A. Taha, Operations Research(sixth edition) Prentice–Hall of India private Limited, New Delhi,1997.

REFERENCE BOOKS:

1. Kanti Swarup, P.K. Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, Educational Publishers, New Delhi.
2. Panneerselvam.R, Operations Research, 2nd Edition, PHI Learning Private Limited, Delhi, 2015
3. Hiller.F.S & Lieberman.J Introduction to Operation Research ,7th Edition, Tata– MCGraw Hill Publishing Company, NewDelhi, 2001.
4. Prem Kumar Gupta.Er, Hira.D.S. Operations Research,7th Edition,S.Chand & Company Pvt.Ltd.2014.
5. I.Griva, S.G.Nash and A.Sofer, Linear and Nonlinear Optimization, SIAM Publication, Universities Press(India) Pvt Ltd,2018.

PAPER 16: COMPUTER PROGRAMMING (C++ THEORY)

UNIT I:

Basic Concept of Object-Oriented Programming: Benefits of OOP – Object-Oriented Languages –Applications of OOP.

Tokens, Expressions and Control Structure: Introduction – Tokens – Keywords – Identifiers and Constants – Basic Data Types – User Defined Data Types – Storage Classes – Derived Data Types –Symbolic Constants – Type Compatibility – Declaration of Variables – Dynamic Initialization of Variables – Reference Variables – Operations in C++ - Scope Resolution Operator – Member Dereferencing Operators – Memory Management Operators – Manipulators – Type Cast Operator – Expressions and Their Types – Special Assignment Expressions – Implicit Conversions – Operator Over Loading – Operator Precedence –Control Structures.

UNIT II:

Functions in C++: Introduction – The Main Function – Function Prototyping – Call by Reference– Return by Reference – Inline Functions – Default Arguments – const Arguments – Recursion – Function Over Loading – Friend and Virtual Functions – Math Library Functions.

Managing Console I/O Operations: Introduction – C++ Streams – C++ Stream Classes – Unformatted I/O Operations - Formatted I/O Operations – Managing Output with Manipulators.

UNIT III:

Classes and Objects: Introduction – C Structures Revisited – Specifying a Class – Defining Member Functions – A C++ Program with Class – Making An Outside Function Inline –Nesting Of Member Functions – Private Member Functions – Arrays Within A Class – Memory Allocation for Objects – Static Data Members – Static Member Functions – Arrays of Objects – Objects as Function Arguments – Friendly Functions – Returning Objects – const Member Functions.

Constructors and Destructors: Introduction – Constructors – Parameterized Constructors– Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initializations of Objects – Copy Constructor –const Objects – Destructors.

UNIT IV:

Operator Overloading: Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators Using Friends – Manipulating of Strings Using Operators – Some Other Operator Overloading Examples – Rules for Overloading Operators.

Inheritance - Extending Classes: Introduction – Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes: Nesting of Classes.

UNIT-V:

Working with Files: Introduction – Classes for File Stream Operations - Opening and Closing a File – Detecting End-of-File – More about open( ): File Modes – File Pointers and their Manipulations – Sequential Input and Output Operations – Updating a File: Random Access – Error Handling During File Operations.

Text Book:

Object–Oriented Programming with C++ by E. Balaguruswamy, Tata McGraw-Hill Publishing Company Limited, Sixth Edition.

Unit I : 1.4 – 1.6 and 3.1 – 3.25
Unit II : 4.1 – 4.12 and 10.1 – 10.6
Unit III : 5.1 – 5.17, 6.1 – 6.7 and 6.10 – 6.11
Unit IV : 7.1 – 7.8 and 8.1 – 8.12
Unit V : 11.1 – 11.9

PRACTICAL - COMPUTER PROGRAMMING (C++ PRACTICAL)

1. friend FUNCTION usage: Create two classes to store the value of distances in meters-centimetres and feet-inches. Write a program that can create the values of the class objects and add one object with another. Use a friend function to carry out addition operation. The result may be stored in any object depending on the units in which results are required. The display should be in the order of meters & centimetre and feet & inches depending on the order of display.

2. OVERLOADING OBJECTS: Create a class that contains one float data member. Overload all the four arithmetic operators so that operate on the objects of the class.

3. OVERLOADING CONVERSIONS: Design a class **Polar** which describes a point in a plane using polar co-ordinates **radius** and **angle**. Use the overloaded + operator to add two objects of **Polar**. Note that we cannot add polar values of two points directly. This requires first the conversion of points into rectangular co-ordinates and finally converting the result into polar co-ordinates. You need to use following trigonometric formulae: *= r * cos (a); = r * sin (a);= ; = ∗ + ∗ .*

4. OVERLOADING VECTOR: Define a class for Vector containing scalar values. Apply overloading concepts for Vector Addition, Multiplication of a Vector by a scalar quantity, replace the values in a Position Vector.

5. OVRELOADING MATRIX:
Create a class **MAT** of size m * n. Define all possible matrix operations for **MAT** type objects. Verify the identity: $(A-B)^2 = A^2+B^2 - 2AB$.

6. INHERITANCE: Create three classes: **alpha, beta** and **gamma**, each containing one data member. The class **gamma** should be inherited from both **alpha** and **beta**. Use a constructor function in the class **gamma** to assign values to the data members of all the classes. Write a program to print the value of data members of all the three classes.

7. FILE HANDLING: Write a program to create a disk file containing the list of names and telephone numbers in two columns, using a class object to store each set of data. Design an interactive menu to access the file created and to implement the following tasks:
(a) Determine the telephone number of the specified person.
(b) Determine the name if a telephone number is known.
(c) Update the telephone number, whenever there is a change.


Elective
Course

ELECTIVE PAPERS

Elective 1: NUMBER THEORY

UNIT I: Divisibility and Euclidean algorithm.

UNIT II: Congruences, Euler‟s theorem, Wilson‟s Theorem. Solutions of congruences, Congruences of Degree 1. Chinese Remainder Theorem, The functions $\phi(n)$, Congruences of higher degree

UNIT III: Prime power moduli, Prime modulus. Quadratic residues.- Quadratic reciprocity.

UNIT IV: The Jacobi symbol – Greatest integer function - Arithmetic functions – The Moebius Inversion formula

UNIT V: Multiplication of arithmetic functions, Linear Diophantine equations – The equation $x^2 + y^2 = z^2$ - The equation $x^4 + y^4 = z^2$.

Text Book:

.An Introduction to Theory of Numbers by Ivan Nivan and Herberts Zucherman. Third Edition, 1972, Wiley Eastern Limited, New Delhi.

Unit-I:	Chapter I:	Sections 1.1 – 1.3
Unit-II:	Chapter II:	Section: 2.1 – 2.5
Unit-III:	Chapter II:	Section: 2.6 – 2.7
	Chapter III:	Sections: 3.1 – 3.2
Unit-IV:	Chapter III:	Sections: 3.3
	Chapter IV:	Sections:4.1-4.3
Unit-V:	Chapter IV:	Sections:4.4
	Chapter V:	Section: 5.1-5.6

Reference Books:

1.T.M. Apostol, Introduction to Analytic Number Theory, Springer Verlag, 1976.

2.Kennath and Rosan, Elementary Number Theory and its Applications, Addison Wesley Publishing Company, 1968.

3.George E. Andrews, Number Theory, Hindustan Publishing, New Delhi, 1989.

ELECTIVE 2: DIFFERENTIAL GEOMETRY

UNIT I:

Curves: Analytic representation - Arc Length – Osculation plane.

UNIT II:

Curvature torsion – Formulas of Frenet - Contact – Natural equations – Helices – General solutions of Natural equations.

UNIT III:

Evolutes and Involutes - Elementary theory of surface: Analytic representation.

UNIT IV:

First fundamental form – Normal, Tangent plane – Developable surfaces - Second fundamental form.

UNIT V:

Meusnier‟s theorem – Euler‟s Theorem – Dupin‟s indicatrix – Some surfaces.

Text Book:

D. Struik, Lectures on Classical Differential Geometry, Addison Wesley Publishing Company, 1961.

ELECTIVE 3: NEURAL NETWORKS

UNIT I:

Mathematical Neuron Model- Network Architectures- Perceptron-Hamming Network- Hopfield Network-Learning Rules.

UNIT II:

Perceptron Architectures and Learning Rule with Proof of Convergence. Supervised Hebbian Learning -Linear Associator.

UNIT III:

The Hebb Rule-Pseudo inverse Rule-Variations of Hebbian Learning-Back Propagation - Multilayer Perceptrons.

UNIT IV:

Back propagation Algorithm-Convergence and Generalization - Performances Surfaces and Optimum Points-Taylor series.

UNIT V:

Directional Derivatives - Minima-Necessary Conditions for Optimality-Quadratic Functions-Performance Optimizations-Steepest Descent-Newton‟s Method-Conjugate Gradient.

Text Book:

Martin T.Hagan, Howard B. Demuth and Mark Beale, Neural Network Design,Vikas Publishing House, New Delhi,2002.

Reference Books:

1. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education, 2003.
2. Robert J. Schalkoff, Artificial Neural Network, McGraw-Hill International Edition, 1997.

ELECTIVE 4: MAGNETOHYDRODYNAMICS

UNIT I:

Electromagnetism – Fundamental Laws – Electrostatic Energy – Electrodynamics Ampere‟s Law – Lorentz force on a moving charge – Magnetostatic Energy – Faraday‟s Law of Induction – Poynting stresses.

UNIT II:

Electromagnetic Equations with respect to moving axes – boundary conditions of electric and magnetic fields. Kinematics of fluid motion – equation of continuity – Stress tensor – Navier-stokes equations – boundary condition – Velocity Magneto fluid dynamic equations.

UNIT III:

MHD approximation – equation of Magnetic diffusion in a moving conducting medium – Magnetic Reynolds number.

UNIT IV:

Alfven‟s theorem Law of isorotation - Magneto hydrostatics – Force-free field – Alfven waves in incompressible MHD.

UNIT V:

Incompressible viscous flows in the presence of magnetic field – Hartmann Flow – unsteady Hartmann flow – Magneto fluid dynamic pipe flow.

Text Books:

1. Crammer K.R. and Pai S.I, Magneto Fluid Dynamics for Engineers and Applied Physicists, McGraw Hill, 1973.
2. Ferraro, VCA and Plumpton, Introduction to Magneto Fluid Dynamics, Oxford, 1966.

ELECTIVE 5: FUZZY LOGIC AND FUZZY SETS

UNIT-I: CRISP SETS AND FUZZY SETS

Introduction-Crisp sets: An over view-The Notion of Fuzzy Sets-basic concepts of Fuzzy Sets – Classical Logic: complement-Fuzzy Union-Fuzzy interaction – Combination of operations – General aggregation of operations.

UNIT-II: FUZZY RELATIONS

Crisp and Fuzzy relations – Binary relations – Binary relations on a single set – Equivalence and similarity relations – Compatibility on Tolerance Relations-Orderings – Morphism – Fuzzy relations Equations.

UNIT-3: FUZZY MEASURES

General discussion – Belief and plausibility Measures –Probability measures – Possibility and Necessity measures .

UNIT-4: FUZZY MEASURES, UNCERTAINTY

Relationship among classes of fuzzy measures - Types of Uncertainty – Measures of Fuzziness-Classical Measures of Uncertainty .

UNIT-5: UNCERTAINTY AND INFORMATION

Measures of Dissonance-Measures of Confusion – Measures of Non-Specificity – Uncertainty and Information – Information and Complexity – Principles of Uncertainty and information.

Text Book:

George J. Klir and Tina A. Folger - Fuzzy Sets, Uncertainty and Information. Prentice Hall of India Private Limited [Fourth printing. June 1995].

Unit-I: 1.1 – 1.5, 2.2 - 2.6, Unit-II: 3.1 – 3.8, Unit-III: 4.1 – 4.4, Unit-IV: 4.5, 5.1 – 5.3, Unit-V: 5.4 – 5.9.

Reference Book:

1. George J. Klir and Boyuan - Fuzzy Sets and Fuzzy Logic - Theory and Applications, Prentice-Hall of India Private Limited

ELECTIVE 6: CONTROL THEORY

UNIT I:

OBSERVABILITY: Linear Systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear Systems

UNIT II:

CONTROLLABILITY: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems

UNIT III:

STABILITY: Stability – Uniform Stability – Asymptotic Stability of Linear Systems.

UNIT IV:

Linear time varying systems – Perturbed linear systems – Nonlinear systems

UNIT V:

STABILIZABILITY: Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilization with restricted feedback

Text Book:

Elements of Control Theory by K.Balachandran and J.P.Dauer, Narosa, New Delhi, 1999.

Reference Books:

1. Linear Differential Equations and Control by R.Conti, Academic Press, London, 1976.
2. Functional Analysis and Modern Applied Mathematics by R.F.Curtain and A.J.Pritchard, Academic Press, New York, 1977.
3. Controllability of Dynamical Systems by J.Klamka, Kluwer Academic Publisher, Dordrecht, 1991.
4. Mathematics of Finite Dimensional Control Systems by D.L.Russell, Marcel Dekker, New York, 1979.
5. E.B. Lee and L. Markus, Foundations of optimal Control Theory, John Wiley, New York, 1967

ELECTIVE 7: CRYPTOGRAPHY

UNIT I:

Introduction – Encryption and Secrecy – The objective of Cryptography - Number Theory – Introduction – Modular Arithmetic.

UNIT II:

Integer factorization problem – Pollard‟s rho factoring – Elliptic curve factoring – Discrete logarithm problem

UNIT III:

Finite fields – Basic properties – Arithmetic of polynomials –Factoring polynomials over finite fields – Square free factorization

UNIT IV:

Symmetric key encryption – Stream ciphers – Block Ciphers – DES

UNIT V:

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

Reference Books:

1. Hans Delfs, Helmut Knebl, Introduction to Cryptography, Springer Verlag, 2002
2. Alfred J. Menezes, Paul C. Van Oorschot, Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2000
3. William Stallings, Cryptography and Network Security, Prentice Hall of India, 2000

ELECTIVE 8 : MATLAB

Unit – I:
STARTING WITH MATLAB: Starting MATLAB, MATLAB Windows - Working in the Command Window - Arithmetic Operations with Scalars - Display Formats - Elementary Math Built-In Functions - Defining Scalar Variables - Useful Commands for Managing Variables - Script Files - Examples of MATLAB Applications.

CREATING ARRAYS: Creating a One-Dimensional Array (Vector) - Creating a Two-Dimensional Array (Matrix) - Notes about Variables n MATLAB - The Transpose Operator - Array Addressing - Using a Colon : In Addressing Arrays - Adding Elements to ExistingVariables - Deleting Elements - Built-In Functions for Handling Arrays - Strings and Strings as Variables.

Unit – II:
MATHEMATICAL OPERATIONS WITH ARRAYS: Addition and Subtraction - Array Multiplication - Array Division - Element-By-Element Operations - Using Arrays In MATLAB Built-In Math Functions - Built-In Functions For Analyzing Arrays - Generation Of Random Numbers - Examples Of MATLAB Applications.

USING SCRIPT FILES AND MANAGING DATA: The MATLAB Workspace and the Workspace Window - Input To A Script File - Output Commands - The Save And Load Commands - Importing And Exporting Data - Examples Of MATLAB Applications.

Unit – III:
TWO-DIMENSIONAL PLOTS: The plot Command - The fplot Command - Plotting Multiple Graphs in the Same Plot - Formatting a Plot - Plots With Logarithmic Axes - Plots With Error Bars - Plots With Special Graphics - Histograms - Polar Plots - Putting Multiple Plots on the Same Page - Multiple Figure Windows - Examples of MATLAB Applications.

THREE-DIMENSIONAL PLOTS: Line Plots - Mesh and Surface Plots - Plots With Special Graphics - The View Command - Examples owMatlab Applications.

Unit – IV:
PROGRAMMING IN MATLAB: Relational and Logical Operators - Conditional Statements - The Switch-Case Statement - Loops - Nested Loops and Nested Conditional Statements - The Break and Continue Commands - Examples of MATLAB Applications.

USER-DEFINED FUNCTIONS AND FUNCTION FILES: Creating A Function File - Structure of a Function File - Local And Global Variables - Saving A Function File - Using A User- Defined Function - Examples of Simple User-Defined Functions - Comparison Between Script Files and Function Files - Anonymous And Inline Functions - Function Functions - Subfunctions
- Nested Functions - Examples Of MATLAB Applications.

Unit – V:
POLYNOMIALS, CURVE FITTING, AND INTERPOLATION: Polynomials - Curve Fitting - Interpolation - The Basic Fitting Interface - Examples of MATLAB Applications.

APPLICATIONS IN NUMERICAL ANALYSIS: Solving an Equation with One Variable - Finding a Minimum or a Maximum of a Function - Numerical Integration - Ordinary Differential Equations - Examples of MATLAB Applications.

Treatment as in:
MATLAB An Introduction with Applications By AmosGilat. JOHN WILEY & SONS, INC., 2011.

Reference Books:

1. Getting Started with MATLAB – A Quick Introduction for Scientists and EngineersBy RUDRA PRATAP. Oxford University Press.
2. Introduction to MATLAB 7 for Engineers By William John Palm. McGraw-Hill Professional, 2005.
3. Introduction to MATLAB 7 By Dolores M. Etter, David C. Kuncicky, Printice Hall, 2004.

ELECTIVE 8: MATLAB

List of Practical Problems

1. Solve the following system of five linear equations:

$$3u + 1.5v + w + 0.5x + 4y = -11.75$$
$$-2u + v + 4w - 3.5x + 2y = 19$$
$$6u - 3v + 2w + 2.5x + y = -23$$
$$u + 4v - 3w + 0.5x - 2y = -1.5$$
$$3u + 2v - w + 1.5x - 3y = -3.5$$

Verify the solution by substituting in all the 5 equations.

2. Create a script file to write a program for saving the output in two files using „fprintf" command. The program should generate two unit conversion tables. One table converts velocity units from miles per hour to kilometres per hour, and the other table converts force units from pounds to newtons. Save each conversion table to a different text file.

3(a) Plot the function $f(x)=\cos x \sin(2x)$ and its derivative, both on the same plot, for $\pi \le x \le \pi$. Plot the function with a solid line, and the derivative with a dashed line. Add a legend and label the axes.

(b) Plot the function, $r = 3\cos^2(0.5\theta) + \theta$ for $0 \le \theta \le 2\pi$ using „polar" command.

4. Write a program in a script file that determines e^x by using the Taylor series representation. The program calculates e^x by adding terms of the series and stopping when the absolute value of the term that was added last is smaller than 0.0001. Use a „`while-end`" loop, but limit the number of passes to 30. If in the 30th pass the value of the term that is addedis not smaller than 0.0001, the program stops and displays a message that more than 30 terms are needed. Use the program to calculate e^2, e^{-4}, and e^{21}.

5. Write a programmeinascript file that determines the real roots of a quadratic equation $ax^2 + bx + c = 0$. Name the file „quadroots". When the file runs, it asks the user to enter the values of the constants *a*, *b*, and *c*. To calculate the roots of the equation theprogram calculates the discriminant *D*, given by:

$$D = b^2 - 4ac.$$

If $D > 0$, the program displays message "The equation has two roots," and the roots are displayed in the next line.

If $D = 0$, the program displays message "The equation has one root," and the root is displayed in the next line.

If $D < 0$, the program displays message "The equation has no real roots."

Run the script file in the Command Window three times to obtain solutions to the following three equations:

(*a*) $2x^2 + 8x + 8 = 0$, (*b*) $-5x^2 + 3x - 4 = 0$, (*c*) $-2x^2 + 7x + 4 = 0$.

6. The following data points, which are points of the function $f(x) = 1.5^x \cos(2x)$, are given. Use „linear", „spline", and „pchip" interpolation methods to calculate the value of *y* between the points. Make a figure for each of the interpolation methods. In the figure show the points, a plot of the function, and a curve that corresponds to the interpolation method.

X	0	1	2	3	4	5
Y	1.0	–0.6242	–1.4707	3.2406	–0.7366	–6.3717

Also, use the „Basic Fitting Interface Tool" to show the equation, plot residuals, norm of residuals and the fit.

7. Solve: $\frac{dy}{dx} = \sqrt{x} + \frac{x^2\sqrt{y}}{4}$ for $1 \le x \le 5$ with $y(1) = 1$. Plot the solution.

ELECTIVE 9: LaTex

UNIT I:

Text formatting, TEX and its offspring, What‟s different in LATEX 2ϵ, Distinguishing LaTex 2ϵ, Basics of a LaTex file.

UNIT II:

Commands and Environments–Command names and arguments, Environments, Declarations, Lengths, Special Characters – Spaces and carriage returns, Quotation marks, Hyphens and dashes, Printing command characters, The date, Exercises.

UNIT III:

Document Layout and Organization – Document class, Page style, Parts of the document, Table of contents – Automatic entries, Printing the table of contents, Fine-Tuning text – Line breaking, Page breaking. Displayed Text – Changing font – Emphasis, Choice of font size, Font attributes, Centering and indenting, Lists.

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UNIT IV:

Tables, Printing literal text, Footnotes and marginal notes.

UNIT V:

Mathematical Formulas – Mathematical environments, Main elements of math mode, Mathematical symbols – Greek letters, function names, Additional elements, Fine–tuning mathematics – Horizontal spacing, Selecting font size in formulas.

Text book:

A Guide to LATEX by H. Kopka and P.W. Daly, - Third Edition, Addison – Wesley, London,1999.

Unit I : Chapter 1 : Sections : 1.1-1.3, 1.4.1, 1.5.
Unit II : Chapter 2 : Sections : 2.1-2.4, 2.5.1-2.5.4, 2.5.9, 2.7.
Unit III : Chapter 3 : Sections : 3.1-3.3, 3.4.1, 3.4.2, 3.5.2, 3.5.5,
Chapter 4 : 4.1.1-4.1.3, 4.2, 4.3
Unit IV : Chapter 4 : Sections : 4.8-4.10.
Unit V : Chapter 5: Sections : 5.1, 5.2, 5.31, 5.3.8, 5.4, 5.4.1 – 5.4.8, 5.5.1, 5.5.2.

Reference Book:

Fundamentals of Latex for Mathematicians, Physicists and Engineers

- by Velusamy Kavitha and Mani Mallikarjunan [LAP LAMBERT Academy Publishing, Germany, 2013.]

ELECTIVE 9: LaTex – List of Practical Problems

(Students has to attend two questions - one from each group)

Group - A

A1. Type the following paragraph in LaTex, using the {quote} environment. Format the paragraph with the following: Text height - 9.5inches, Text width - 6.3 Inches, Left margin – 0.1 Inch, Right margin – 0.12 Inch, Top margin - 0.6 Inch, Line space – 1.5 Inches. Also, include a Footnote.

Today (<Current Date>) the rate of exchange between the American dollar and Indian rupee is $1 = ₹65, an increase of 10% over the last year.

A2. Produce a document in LaTex, using two-columns. Insert a title centred for the two columns.

A3. Produce a title page in LaTex, with the following:

(i) Title of the page, (ii) Name and Addresses of two authors, (iii) Footnotes for the telephone members of each author, (iv) Date.

A4. Create a document in LaTex to produce the bibliographic information, using the {bibliography} environment.

Group – B

B1. Create a blank form produced as a framed table. Use the commands *struts* and *\hspace*.

B2. Create the following table using LaTeX:

S.No.	Register Number	Name of the Student	Percentage of Marks	Rank
1	xxxxxx	xxxxxx	xxxxx	xxxx
2	xxxxxx	xxxxxxx	xxxx	xxxx
3	xxxxxx	xxxxxx	xxxx	xxxxx

B3. Using LaTeX, generate the following formula:

$$a_0 + \cfrac{1}{a_1 + \cfrac{1}{a_2 + \cfrac{1}{a_3 + \cfrac{1}{a_4}}}} + \begin{pmatrix} a & b \\ c & d \end{pmatrix} + \sum_{\alpha=0}^{\infty} (\beta^{\alpha} + \Gamma^{\alpha})$$

B4. Using LaTeX, generate the following with {eqnarray} environment:

$$(x + y)(x - y) = x^2 - xy + xy - y^2$$

$$= x^2 - y^2 \tag{1.1}$$

$$(x + y)^2 = x^2 + 2xy + y^2 \tag{1.2}$$

$$x_n u_1 + \cdots + x_{n+t-1}\, u_t = x_n u_1 + (a\, x_n + c) u_2 + \cdots + a^{t-1} x_n + c(a^{t-2} + \cdots + 1)\, u_t$$

$$= (u_1 + a\, u_2 + \cdots + a^{t-1} u_t)\, x_n + h\,(u_1, \ldots, u_t)$$

10 - ELEMENTS OF STOCHASTIC PROCESSES

UNIT I: Continuous Time Markov Chain, Examples, Transient Analysis, Occupancy Times, Limiting Behaviour

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

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

UNIT IV: M/G/1 and G/M/1 Queues and Network of Queues

UNIT V: Standard Brownian Motion, Brownian Motion and First Passage Times

REFERENCE BOOKS:

1. V.G. Kulkarni, Introduction to Modelling and Analysis of Stochastic Systems, Second Edition, Springer (2011)
2. J. Medhi, Stochastic Processes, NEW AGE (2009).
3. S. M. Ross, Stochastic Processes, Wiley Series in Probability and Statistics (1996).