VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. (Mathematics)

Scheme of Teaching and Examination

Semester – I

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
401	Measure Theory	4	--	4	30	70	--	--	30	70
402	Complex Analysis	4	--	4	30	70	--	--	30	70
403	Topology	4	--	4	30	70	--	--	30	70
404	Ordinary Differential Equations	4	--	4	30	70	--	--	30	70
405	Graph Theory	4	--	4	30	70	--	--	30	70
406	Fourier Analysis	4	--	4	30	70	--	--	30	70
	Total	24	--	24	180	420	--	--	180	420

Semester – II

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
501	Differential Geometry	4	--	4	30	70	--	--	30	70
502	Functional Analysis	4	--	4	30	70	--	--	30	70
503	Elements of Partial Differential Equations	4	--	4	30	70	--	--	30	70
504	Discrete Structure	4	--	4	30	70	--	--	30	70
505	Numerical Analysis	4	--	4	30	70	--	--	30	70
506	Functions of Complex Variables	4	--	4	30	70	--	--	30	70
	Total	24	--	24	180	420	--	--	180	420

Semester – III

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
601	Abstract Algebra	4	--	4	30	70	--	--	30	70
602	Advanced Functional Analysis	4	--	4	30	70	--	--	30	70
603	Applied Linear Algebra	4	--	4	30	70	--	--	30	70
600X	Elective Group	4	--	4	30	70	--	--	30	70
600X (*)		4	--	4	30	70	--	--	30	70
600X		4	--	4	30	70	--	--	30	70
	Total	24	--	24	180	420	--	--	180	420

Elective group -1	6001	Mechanics
	6002*	Mathematical Software
	6003	Fluid Dynamics
Elective group -2	6004	Linear programming
	6005	Operation Research
	6006	Optimization Techniques
Elective group -3	6007	Laplace Transform and its Applications
	6008	Fourier Transform and its Applications
	6009	Advanced Integral Transform
Elective group - 4	6010	Elementary Number Theory
	6011	Algebraic Number Theory
	6012	Combinatorics
Elective group - 5	6013	Special Functions - I
	6014	Special Functions - II
	6015	Special Functions - III

Note: (*) paper no – 6002 scheme of teaching L – 4 T – 1 P – 4

Examination scheme for Theory: 18 (internal) 42(external)

Practical: 12 (internal) 28(external)

Total: 30 (internal) 70(external)

Semester – IV

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
701	Advanced Abstract Algebra	4	--	4	30	70	--	--	30	70
702	Theory of Operators	4	--	4	30	70	--	--	30	70
703	Numerical Linear Algebra	4	--	4	30	70	--	--	30	70
700X	Elective Group	4	4	8	18	42	12	28	30	70
700X		4	--	4	30	70	--	--	30	70
700X		4	4	8	18	42	12	28	30	70
	Total	24	8	32	156	364	24	56	180	420

Elective group -1	7001	Computational Fluid Dynamics
	7002	Mathematical Modeling
	7003	Finite Element Method
Elective group -2	7004	Advanced Operational Research
	7005	Non - Linear Programming
	7006	Advanced Optimization
Elective group -3	7007	Wavelet Analysis
	7008	Digital signal processing
	7009	Image processing
Elective group - 4	7010	Advanced Number Theory
	7011	Analytic Number Theory
	7012	Introduction to Modern cryptography
Elective group - 5	7013	Special Functions - IV
	7014	Special Functions - V
	7015	Special Functions - VI

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

Syllabus to be offered at M. Sc. Part-I Semester - I w.e.f. June 2010-11

Paper: 401
Measure Theory

L T P
4-1-0

Pre - Requisite:

Extended Real number. open sets closed sets - sequences of real numbers Continuous Functions

Lebesgue Measure :

Introduction. Borel sets, outer measure, measurable sets. Lebesgue measure, measurable function. Little wood's three principles.

Lebesque Integral :

Riemann Integral, Lebesgue integral of a bounded function over a set of finite measure. The integral of a non-negative functions. The general Lebesgue Integral.

Differentiation & Integration :

Differentiation of monotone functions. Functions of Bounded variation. Differentiation of an Integral. Absolute continuity and convex functions.

Measure and Integration:

Measure space, measurable functions Integration. General convergence theorem, L^P spaces.

Measure & outer measure :

Outer measure and measurability Extension theorem, The Lebesgue-Stieltjes theorem.

References:

1. H. L. Royden : Real Analysis (3rd edition), Prentice - Hall-2009.
2. P. R. Halmos : Measure theory, Springer - 1974.
3. W. Rudin : Real & Complex Analysis 3rd edition McGraw-Hill, 1966.
4. G.de Barra : Measure theory and Integration, Wiley Eastern Ltd., 1985.
5. T. M. Apostol : Mathematical Analysis, Narosa Publication House - 1985.

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Syllabus to be offered at M. Sc. Part-I Semester - I w.e.f. June 2010-11

Paper: 402
Complex Analysis

L T P
4-1-0

Pre - Requisite:

Properties of Complex numbers, polar form of complex numbers. Complex valued functions.

Analytic functions and power series:

Limit and differentiation of complex valued functions. The Cauchy-Riemann Equations. Power Series, convergence of power series. Analytic functions. Differentiation of power series. Local maximum modulus principle.

Cauchy theorem

Holomorphic functions. Integral over paths. Local primitive for Holomorphic functions. Integral along paths. Homotopy form of Cauchy's theorem. Existence of Local primitive. The winding number. The Global Cauchy theorem.

Application of Cauchy Integral Formula

Uniform limits of analytic functions. Laurent series Isolated singularities, Removable Singularities, poles, Essential Singularities.

Calculus of Residues and Harmonic functions

The Residual formula. Residues of differentials. Evaluation of definite integrals. Definition of Harmonic functions and examples. Basic properties of Harmonic functions. The Poisson formulas and construction of Harmonic functions.

References:

1. Serge Lang : Complex Analysis (3rd edition), Springer - 1997
2. S. Ponnuswamy. : Foundation of Complex Analysis Narosa Pub. - 1997.
3. H. A. Priestly : Introduction to Complex Analysis Clarendon Press, Oxford -1990
4. J. B. Conway : Functions of Complex Variable Springer - Narosa Pub.- 1990
5. R. V. Churchill : Introduction to Complex Variables

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Syllabus to be offered at M. Sc. Part-I Semester - I w.e.f. June 2010-11

Paper: 403
Topology

L T P
4-1-0

Topological Spaces :

The definition and some examples, Elementary concepts, Open bases and open sub-bases, Weak topologies, The function algebra *C (X, R)* and *C (X, C)*

Compactness and Separation:

Compact spaces, Product of Spaces, Tychonoff's theorem and locally compact spaces, Compactness for metric spaces, Ascoli's theorem, T_1-spaces and Hausdorff spaces, Completely regular spaces and normal spaces, Urysohn's lemma.

Connectedness and Approximation :

Connected Spaces, The Components of a space, Totally disconnected spaces, Locally Connected spaces, The Weierstrass approximation theorem, The stone-Weierstrass theorems, Locally compact Hausdorff spaces, The extended Stone-Weierstrass theorems.

References:

1. G. F. Simmons: Introductions to Topology and Modern Analysis Tata McGraw-Hill- 2006.
2. J.R. Munkers : Topology - A First Course , PHI, 2000.
3. J. Dugundji : Topology, PHI, 1966.
4. K.D.Joshi : Introduction to general Topology, Willey Eastern, 1963.
5. J.L. Kelley : General Topology, Van Nostrand, 1995.
6. Wiliard S. : General Topology, Addison Wesley, 1970.
7. Crump W & Baker : Introduction to Topology, W.C. Brown, 1991.

Syllabus to be offered at M. Sc. Part-I Semester - I w.e.f. June 2010-11

Paper :404
Ordinary Differential Equations

L T P
4-1-0

Existence, Uniqueness, and Continuation of Solutions:

Introduction, Notation and Definition's, Existence and Uniqueness of Solutions of Scalar Differential Equations, Existence Theorems for Systems of Differential Equations, Differential and Integral Inequalities, Fixed-Point Methods,

Linear Systems:

Introduction, Properties of Linear Homogeneous Systems, Inhomogeneous Linear Systems, Behaviour of Solutions of *n*-th order Linear Homogeneous Equations, Asymptotic Behaviour,

Stability of Linear and Weakly Nonlinear Systems:

Introduction, Continuous Dependence and Stability Properties of Solutions, Linear Systems, Weakly Systems, Weakly Nonlinear Systems, Two-Dimensional Systems.

References:

1. S. Ahmad and M.Rama Mohana Rao : Theory of Ordinary Differential Equations Affiliated East West Press, 1999
2. Coddington E.A. and Levinson N. : Theory of Ordinary Differential Equations, Mc Graw Hill, 1955.
3. Hartmann P. : Ordinary Differential Equations, John Wiley International, 1964.
4. Reid W.T. : Ordinary Differential Equations, John Wiley, 1971.
5. Rose S.L. : Differential Equations, P.H.I.
6. Rai B., Freedmanm H.I., and Chaudhary D.P., : A Course in Ordinary Differential Equations, Narosa, 2002.
7. King A.C., Otto R. and Billingham J. : Differential Equations, Cambridge, 2005
8. Somasundaram D. : Ordinary Differential Equations, Narosa, 2001
9. Mandal C.R. : Ordinary Differential Equations, P.H.I., 2003.

Paper :405
Graph Theory

L T P
4-1-0

Graph-Paths-Circuits

What is Graph?, Application of Graphs, Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendent Vertex, and Null Graph, Isomorphism, Subgraphs, Walks Paths, and Circuits, Connected Graphs, Disconnected Graphs, and Components, Euler Graphs, Operations on Graphs, More on Euler Graphs, Hamiltonian Paths and Circuits, The Traveling Salesman Problems.

Trees and Fundamentals Circuits :

Trees, Some Properties of Trees, Pendant vertices in a tree, Distance and Centers in a tree, Rooted and Binary Trees, On counting trees, Spanning trees, Fundamentals circuits, Finding all spanning Trees of a Graph, Spanning Trees in a Weighted Graph.

Cut-Sets and Cut-Vertices and Planar and Dual Graphs :

Cut-Sets, Some Properties of a Cut-Set, All Cut-Sets in a Graph, Fundamental Circuits and Cut-Sets, Connectivity and Separability, Planar Graphs, Kuratowski's Two Graphs, Different Representations of a Planar Graph, Detection of Planarity.

Matrix Representation of Graphs :

Incidence matrix, Submatrices of *A(G)*, Circuits Matrix, Fundamental Circuit Matrix and Rank of *B*, An Application to a Switching Network, Cut-Set Matrix, Relationships among A_f, B_f, and C_f, Path Matrix, Adjacency Matrix.

References:

1. Narsing Deo : Graph Theory, PHI, 1993.
2. B. Stayanarayan And K.S.Prasad : Discrete Mathematics & Graph Theory, PHI, (2009)
3. R. Manohar & Trembtey J.P. : Discrete Mathematical Structure with application to computer science, TMH, 1999
4. Wilson R.J. : Introduction to G.T. (3rd ed.) Longmann, 1984
5. Gibbons A. : Algorithnmic Graph Thepry, Cambridge University Press, 1984
6. Harry F. : Graph Theory, Narosa Publication, 1995
7. Richard J. : Discrete Mathematics, Pearson Educations, Asia, 2001

Paper :406
Fourier Analysis

L T P
4-1-0

- Periodic Functions. Trigonometric Series.
- Computation of Fourier series, in various Interval.
- Convergence Theorems for Fourier series.
- Uniform Convergence of Fourier series.
- Functions of any Period $p = 2L$.
- Even and Odd Functions. Half-Range Expansions.
- Complex Fourier series.
- Forced Oscillations.
- Approximation by Trigonometric Polynomial.
- Fourier Integrals.
- Fourier cosine and Sine Transforms.
- Modeling: Vibrating String. Wave Equations.
- Separation of Variables. Use of Fourier Series.
- D'Alembert's Solution of the Wave Equations.
- Heat Equation: Solution by Fourier Series.
- Heat Equation: Solution by Fourier Integrals and Transforms.
- Rectangular Membrane. Use of Double Fourier Series.

References:

1. **Kreyszig** : Advanced engineering Mathematics, John Wiley & Sons, 1999
2. **Albert Boggess and Francis j. Narcowich** : A First Course in Wavelets with Fourier Analysis 2nd ed., WileyPublication, 2009.
3. **Jain, Iyenger** : Advanced Engineering mathematics, Wiley India.
4. **Carslaw** : Introduction to Fourier series & Fourier Integrals, CRC Press.

Paper :501
Differential Geometry

L T P
4-1-0

Curves with Torsion:

Tangent, Principal Normal. Curvature, Binormal Torsion Serret-Frenet formulae, Helices, Spherical indicatrix of tangent, etc., Involutes, Evolutes, Bertrand curves,

Envelops Developable Surfaces:

Surfaces, Tangent Plane Normal, Envelope Characteristics, Edge of regression, Developable Surfaces, Osculating developable, Envelope Characteristic points,

Curvilinear Coordinates

Curvilinear coordinates, First order magnitudes, Directions on a surface, The normal, Second order magnitudes, Derivatives of **n**, Curvature of normal section. Meunier's theorem.

Curves on Surface

Principle Directions and curvatures, First and second curvatures, Euler's theorem, Surface of revolution, Conjugate directions, Conjugate systems,

References:

1. Whetherburn C.E. : "Differential Geometry of 3-D", Radha Publishing, Calcutta. 1988
2. Bansilal : "Differential Geometry, 1994 Atma Ram and sons, Allahabad. 1994
3. S.C. Mittal and D. C. Agrawal : Differential Geometry, Krishna Publication, 1976
4. S. Kumaresan : A Course in Differential Geometry and Lie Groups Hindustan Book Agency, 2002
5. Sinha B.B. : An Introduction to Modern Differential geometry, Kalyani Publishers, New Delhi, 1982

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Syllabus to be offered at M. Sc. Part-I Semester - II w.e.f. June 2010-11

Paper :502
Functional Analysis

L T P
4 - 1 - 0

Metric Spaces

Convergence, Cauchy Sequence, Completeness, Examples. Completeness Proofs, Completion of Metric Spaces,

Normed Spaces. Banach Spaces

Vector Space, Normed Space. Banach Space, Further Properties of Normed Spaces, Finite Dimensional Normed Spaces and Subspaces, Compactness and Finite Dimension, Linear Operators, Bounded and Continuous Linear Operators, Linear Functionals, Linear Operators and Functional on Finite Dimensional Spaces, Normed Spaces of Operators. Dual Space,

Inner Product Spaces. Hilbert Spaces

Inner Product Space. Hilbert Space, Further Properties of Inner Product Spaces, Orthogonal Complements and Direct Sums, Orthonormal Sets and Sequences, Series Related to Orthonormal Sequences and Sets, Total Orthonormal Sets and Sequences, Representation of Functionals on Hilbert Spaces, Hilbert-Adjoint Operator, Self -Adjoint, Unitary and Normal Operators,

References:

1. Kreyszig E. : Introductory Functional Analysis with applications, Wiley India, 2006
2. Simmons G. F. : Introduction to Topology and Modern Analysis. McGraw Hill
3. Siddiqui A. H. : Functional Analysis, P.H.I.
4. Sudarshan Nanda : Functional Analysis, Wiley Eastern Pvt. Ltd.
5. Day M.M. : Normed Linear spaces, Springer
6. Limaye B.V. : Functional Analysis, New Age International Pvt. Ltd.

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Syllabus to be offered at M. Sc. Part-I Semester - II w.e.f. June 2010-11

Paper :503
Elements of Partial Differential Equations

L T P

Ordinary Differential Equations in More than Two Variables...

Surfaces and Curves in Three Dimensions, Simultaneous Differential Equations of the First Order and the Degree in Three Variables, Methods of Solutions of $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Orthogonal Trajectories of a Systems of a Curves on a Surface, Pfaffian Differential Forms and Equations, Solution of Pfaffian Differential Equations in Three Variables

Partial Differential Equations of the First Order

Partial Differential Equations, Origins of First-Order Partial Differential Equations, Linear Equations of the First Order, Integral Surfaces Passing through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces, Nonlinear Partial Differential Equations of the First Order, Compatible Systems of First-order Equations, Charpit's Method, Special Types of First-order Equations, Solutions Satisfying Given Conditions, Jacobi's Method,

Partial Differential Equations of the Second Order

The Origin of Second-order Equations, Second-order Equations in Physics, Higher-order Equations in Physics, Linear Partial Differential Equations with Constant Coefficients, Equations with Variable Coefficients, Separation of Variables, Nonlinear Equations of the Second Order Miscellaneous Problems, Elementary Solutions of Laplace's Equations, Families of Equipotential Surfaces.

References:

1. Sneddon I.A. : Elements of Partial Differential Equations, McGraw Hill, Intonation Edition, 1957
2. Zafar Hasan : Differential Equations and their applications, Second Edition, PHI, 2009.
3. Iyengar S.N. :Differential Equations, Anmol Publications, 2000
4. Sharma Gupta : Differential Equations, Krishna Prakashan Media, 1997- 98.
5. Copson E.T. : Partial Differential Equations, S.-Chand & Co. Pvt. Ltd., 1976

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Syllabus to be offered at M. Sc. Part-I Semester - II w.e.f. June 2010-11

Paper :504
Discrete Structure

L T P
4-1-0

Algebraic Structures:

Algebraic systems, Examples and General Properties, Definition and Examples, Some Simple Algebraic Systems and General Properties, Semigroups and Monoids, Definitions and Examples, Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids, Grammars and Languages, Discussion of Grammars, Formal Definition of a Language, Notions of Syntax Analysis, Polish Expression and Their Compilation, Polish Notation, Conversion of Infix Expression to Polish Notation, The Application of Residue Arithmetic to Computers, Introduction to Number Systems, Residue Arithmetic, Group Codes, The Communication Model and Basic Notions Error Correction, Generation of Codes by Using parity Checks, Error Recovery in Group Codes,

Lattices and Boolean Algebra:

Lattices as Partially Ordered Sets, Definition and Examples, Some Properties of Lattices, Lattices as Algebraic Systems, Sublattices, Direct Product, and Homomorphism, Some Special Lattices, Boolean Algebra, Definition and Examples, Subalgebra, Direct Product, and Homomorphism , Boolean Functions, Boolean Forms and Free Boolean Algebras, Values of Boolean Expressions and Boolean Functions, Representation and Minimization of Boolean Functions, , Representation of Boolean Functions, Minimization of Boolean Functions, Design Examples Using Boolean Algebra, Finite-state Machines, Introductory Sequential Circuits, Equivalence of Finite-state Machines.

References:

1. Tremblay and Manohar : Discrete Mathematics Structures with Applications to Computer Science, Tata McGraw-Hill, 2008
2. Abbott J.C. : Sets, Lattices and Boolean Algebras, Allyn and Bacon, inc. Boston, 1969
3. Gibbons A. : Algorithmic Graph Theory, Cambridge Uni. Press, 1984.
4. Harary F. : Graph Theory, Narosa Publication, 1995.
5. Hohn F. : Applied Boolean Algebra (2^{nd} ed.), Macmillan, New York, 1966.
6. Liu C.L. : Elements of Discrete Mathematics, McGraw-Hill Inc., USA, 1985.
7. Richard Johnsonbaugh : Discrete Mathematics, Pearson Edu. Asia, 2001.
8. Rosen K.H. : Handbook of Discrete and Combinatorial Mathematics, CRC Press, 1999.

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Syllabus to be offered at M. Sc. Part-I Semester - II w.e.f. June 2010-11

Paper :505
Numerical Analysis

L T P
4-1-0

Transcendental and Polynomial Equations

Introduction, Bisection Method, Iteration Methods Based on First Degree Equation, Iteration Methods Based on Second Degree Equation, Rate of Convergence, Iteration Methods, Methods for Complex Roots, Polynomial Equations, Model Problems,

System of Linear Algebraic Equations and Eigen value Problems

Introduction, Direct Methods, Iteration Methods, Eigen values and Eigenvectors, Model Problems,

Differentiation and Integration

Introduction, Numerical Differentiation, Partial Differentiation, Numerical Integration, Method based on Interpolation, Method based on Undetermined Coefficients, Composite Integration Method, Romberg Integration, Double Integration,

Ordinary Differential Equations

Numerical Methods, Singlestep Methods, Multistep Methods, Predictor-Corrector Methods, Boundary Value Problems, Initial Value Methods, Finite Difference Methods.

References:

1. Froberg C. E. : Introduction to Numerical Analysis, Addison-Wesley, 1970
2. Jain, Iyenger & Jain : Numerical Methods, for Scientific and Engineering Computation, New-Age International. 1999
3. Philips and Taylor :Theory and Applications of Numerical Analysis Academic Press,1996
4. Gourdin and Boumhart :Applied Numerical Analysis, P.H.I., 1996
5. Householder A. S. :Theory of Matrices in Numerical Analysis, Blarsedell - New York.
6. Jacques and Colin : Numerical Analysis, Chapman & Hall, New-York, 1987

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Syllabus to be offered at M. Sc. Part-I Semester - II w.e.f. June 2010-11

Paper: 506
Functions of Complex Variables

L T P
4-1-0

Conformal Mappings

Schwarz Lemma, Analytic Automorphisms of the Disc, The Upper Half Plane, Other Examples, Fractional Linear Transformations.

Applications of the Maximum Modulus Principle and Jensen's Formula

Jensen's Formula, The Picard-Borel Theorem, Bounds by the Real Part, Borel-Caratheodory Theorem, The Use of Three Circles and the Effect of Small Derivatives Hermite Interpolation Formula, Entire Functions with Rational Values, The Phragmen-Lindelof and Hadamard Theorems.

Entire and Meromorphic Functions

Infinite Products, Weierstrass Products, Functions of Finite Order, Meromorphic Functions, Mittag-Leffler Theorem.

Elliptic Functions

The Liouville Theorem, The Weierstrass Function, The Addition Theorem, The Sigma and Zeta Functions.

The Gamma and Zeta Functions

The Differentiation Lemma, The Gamma Function, Weierstrass Product, The Mellin Transform, Proof of Stirling's Formula, The Lerch Formula, Zeta Functions.

References:

1. Serge Lang : Complex Analysis, Springer, 1993
2. Titchmarsh : Theory of Functions, Oxford University Press.
3. Ponnusamy : Foundation of Complex Analysis, Narosa Publication, 1997.
4. Priestly H. A. : Introduction to Complex Analysis, Clarendon Press, 1990.
5. Conway J.B. : Functions of one Complex Variable, Springer, Narosa, 1980.
6. Sarason D. : Complex Function Theory, Hindustan Book Agency, 1994.

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Syllabus to be offered at M. Sc. Part-II Semester -III w.e.f. June 2011-12

Paper : 601
Abstract Algebra

L T P
4-1-0

Group and Field Theory:

Sylow's Theorem, Direct Products, Finite Abelian Groups, Extension Fields, The Transcendence of *e*, Roots of Polynomials, Construction with Straightedge and Compass, More About Roots, The Elements of Galois Theory, Solvability by Radicals, Galois Groups over the Rationals, Finite Fields,

Linear Transformations:

The Algebra of Linear Transformations, Characteristic Roots, Matrices, Canonical Forms: Triangular Form, Canonical Forms: Nilpotent Transformations, Canonical Forms: A Decomposition of V : Jordan Form, Canonical Forms: Rational Canonical Form, Trace and Transpose, Determinants, Hermitian Unitary, and Normal Transformations, Real Quadratic Forms,

Ring Theory:

Definition and Examples of Rings, Some Special Classes of Rings, Euclidean Rings, A Particular Euclidean Ring, Polynomial Rings, Polynomial Rings over Commutative Rings.

References:

1. I. N. Herstein : Topics in Algebra 2nd Ed., John Wiley Sons, 1999.

2. P.B. Bhattacharya : Basic Abstract Algebra 2nd Ed., Cambridge University. Press, 1995

3. S. Lang : Algebra 3rd Ed., Addition-Wesley, 1993.

4. I. S. Luther and I.B.S. Passi : Algebra Vol. I -Groups, Vol. II Rings, Narosa Publishing House (Vol. I -1996, Vol. II 1999)

5. D. S. Malik, J. N. Mordeson and M. K. Sen : Fundamentals of Abstract Algebra, Mc Graw-Hill, Int. Edition, 1997.

6. S. K. Jain, A. Gunawardena and P. B. Bhattacharya : Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

Syllabus to be offered at M. Sc. Part-II Semester -III w.e.f. June 2011-12

Paper : 602
Advanced Functional Analysis

L T P
4-1-0

Fundamental Theorems for Normed and Banach Spaces:

Zorn's Lemma, Hahn-Banach Theorem, Hahn-Banach Theorem for Complex Vector Spaces and Normed Spaces, Application to Bounded Linear Functionals on C[*a,b,*], Adjoint Operator, Reflaxive Spaces, Category Theorem. Uniform Boundedness Theorem, Strong and Weak Convergence, Convergence of Sequences of Operators and Functionals, Application to Summibality of Sequences, Numerical Integration and Weak* Convergence, Open Mapping Theorem, Closed Linear Operators. Closed Graph Theorem,

Further Applications : Approximation Theory:
Approximation in Normed spaces, Uniqueness, Strict Convexity, Uniform Approximation, Chebyshev Polynomials, Approximation in Hilbert Space, Splines,

Spectral Theory of Linear Operators in Normed Spaces:
Spectral Theory in Finite Dimensional Normed Spaces, Basic Concepts, Spectral Properties of Bounded Linear Operators, Further Properties of Resolvent and Spectrum, Use of Complex Analysis in Spectral Theory, Banach Algebras, Further Properties of Banach Algebras.

References:

1. Kreyszig E. : Introductory Functional Analysis with applications, Wiley India, 2006
2. Simmons G. F. : Introduction to Topology and Modern Analysis. McGraw Hill
3. Siddiqui A. H. : Functional Analysis, P.H.I.
4. Sudarshan Nanda : Functional Analysis, Wiley Eastern Pvt. Ltd.
5. Day M.M. : Normed Linear spaces, Springer
6. Limaye B.V. : Functional Analysis, New Age International Pvt. Ltd.

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Syllabus to be offered at M. Sc. Part-II Semester -III w.e.f. June 2011-12

Paper : 603
Applied Linear Algebra

L T P
4-1-0

Linear Operators:
Functions, Linear operators, Null space and range, Rank and nullity theorem, Operator inverses, Application to matrix theory, Computation of the range ad null space of a matrix, Matrix of an operator, Operator algebra, Change of basis and similar matrices, Applications.

Inner Product Spaces:
Definitions and examples, Norms; angle between vectors, Computational advantages of orthogonal sets, Fourier coefficients and Parseval's identity, Gram-Schmidt process, *QR* factorization, Equivalence of the problems, Computations using orthogonal and nonorthogonal sets, Normal

equations, Projection operators, $M^{\perp}$, Decomposition of the vector space, Applications to approximation and matrix theory, Fredholm alternative, Matrix representation of inner products, Orthogonal change of basis, Rank of a Gram matrix,

Diagonalizable Linear Operators:

Eigenvalues and Eigenvectors, Definitions, Spectrum and eigenspaces of an operator, Theoretical computations using determinants, properties of the characteristic polynomial, Geometric and algebraic multiplicities, Diagonalizable operators and their computational advantages, Similarity to a diagonal matrix, Two competing definitions, Functions of matrices, General properties of functions of diagonalizable operators, Minimal polynomial, Decoupling the differential equations : Two viewpoints for diagonalizable matrices /e^{At} Estimates of Eigenvalues: Gershgorin's Theorems, Applications to Finite Difference Equations, Biological models, finite difference equations.

The Structure of Normal Operators:

Adjoint and Classification of Operators, Definitions, Normal, Hermitian, and unitary operators, Matrix Characterization, Spectral theorem and resolution, Functions of normal operators, Simultaneous diagonalization of normal operators, Functions of normal matrices, Generalized eigenvalue problem, The Rayleigh quotient and its extremal properties, Courant Fischer theorem, Interlacing theorem for bordered matrices.

References:

1. J. T. Scheick : Linear Algebra with Applications, McGraw Hill Int. Edi., 1997.
2. V. Sundarapandian : Numerical Linear Algebra, P.H.I. New Delhi, 2008.
3. Bretscher O. : Linear Algebra with applications Prentice Hall, Englewood Cliffs, New Jersey, 1997.
4. Ciarlet P.G. : Introduction to Numerical Linear Algebra and Optimization, Cambridge University Press, Cambridge,1989.
5. Cullen C.G. : An Introduction to Numerical Linear Algebra, PWS Publishing Company, Boston, 1994.
6. Demmel J.W. : Applied Numerical Linear Algebra, SIAM, Philadelphia, 1997.
7. Hager W.W. : Applied Numerical Linear Algebra, Prentice Hall, Englewood Cliffs, New Jersey, 1988.

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Syllabus to be offered at M. Sc. Part-II Semester -III w.e.f. June 2011-12

Paper - 6001

Mechanics

L - T - P
4 - 1 - 0

FUNDAMENTALS OF PHYSICS

- Measurement
- Motion in one dimension: Displacement, Velocity, Acceleration, Equation of motion with constant acceleration.
- Motion in two dimension and three dimensions: Displacement, Velocity, Acceleration, Projectile Motion, Uniform circular motion, Relative motion in two and three dimension
- Newton Laws of motion (with examples), Friction and centripetal forces

- Kinetic energy and work ,Work done by weight, Work done by variable force, Work-kinetic energy theorem, Work done by spring force, Power, Potential energy and conservation of energy, Electric potential energy, Gravitational potential energy, Conservation of energy

- System of particles: Newton Laws for system of particle, Linear Momentum and Newton's second Law, Conservation of linear momentum, collision, Impulse and linear momentum, Elastic and Inelastic collision in one dimension, Collision in two dimension

- Rotational motion: Angular displacement, Angular velocity and Angular acceleration, Equation of motion for constant angular acceleration, Torque, Newton second law in angular form

- Elasticity

- Planets and satellites: Kepler’s law

- **Oscillations and wave theory**

- Oscillations: Energy, SHM, Energy in SHM, damped simple harmonic motion, forced oscillations and resonance, Simple pendulum

- Waves: Types of waves, wavelength, frequency, period, angular frequency, Superposition of waves

- Sound waves: Doppler effect

- **Heat and Thermodynamics**

- Thermodynamics : Zeroth Law of Thermodynamics

- The Celsius, Kelvin and Fahrenheit scales

- Thermal expansion: Linear expansion and volume expansion

- Specific heat

- First law of Thermodynamics

- Conduction, convection, radiation

- Kinetic theory of Gases and second law of Thermodynamics: Ideal gases, Internal energy, the Adiabatic expansion of an ideal gases, Entropy, Second law of thermodynamics, Entropy in the real world, Engines, Refrigerators

- **Electromagnetism**

- Electric charge, Conductors and insulators, Coulomb’s law.

- Electric field, Electric field due to a point charges, Electric field due to an electric dipole, Gauss law.

- Electric Potential, Equi-potential surfaces, Calculation of Potential from field, Potential due to a point charge

- Capacitors, Capacitance, Capacitors in series and parallel, Capacitor with a Dielectrics.

- Moving charges and electricity, Currents, Semi conductors, Super conductors., Electric current, Current density, Resistance and Resistivity, Ohms law.

- Circuits: Work, energy, emf, power, Ameter and voltmeter, RC circuits, Kirchoff's law

- The Magnetic field, definition of B, Hall effect, Torque on a current loop, Magnetic dipole.
- Magnetic field due to current, Amperes law, solenoids.
- Faraday's law, Lenz's law, Inductance and inductors, self inductance, RL circuits, energy stored in magnetic fields
- Maxwell's equations: magnetic moments, magnates, Paramagnetism, diamagnetism, ferromagnetism, Maxewell's equations
- Geometric optics : Plane mirrors, spherical mirrors, thin lenses
- Wave optics : Interference and diffraction .

Reference Books:

1. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, Sixth edition, John Wiley and Sons, New York, 1998.
2. J.B. Serway, Fundamental of Physics

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Paper - 6002

Mathematical Software

L - T - P
4 - 1 - 0

Introduction

Introduction to Matlab, variable and array, subarrays, displaying output data, data files operation on array, hierarchy of operation on array, built in function in Matlab

Plotting

Introduction to plotting, graph window, two dimensional plot, multiple plot, components of graph(legend, title,),graphical image, commet, 3D graph, additional plotting features Subplots, polar plots,

Branching statement and program design

The if construct, switch construct, The try-catch construct , relational operators, logic operators, logical functions

Loops

The while loop, The for loop, The break and continue statements, Nesting loops.

User defined function

Introduction to Matlab functions, variable passing in Matlab(pass by value), preserving data between calls to functions, sub functions, private function, nested function

Reference books:

1. Chapman Stephen: Matlab programming for engineers, Thompson learning, 2004.
2. Rudra Pratap: getting started with Matlab, oxford university press, 2004

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Paper - 6003

Fluid Dynamics

L - T - P
4 - 1 - 0

- Vectors and Tensors:
- Flow Kinematics
- Flow descriptions (Lagrangian, Eulerian, Material derivative)
- Motion of Fluid particles(rate of dilation, rate of shear, rate of rotation)
- Conservation Laws
- Reynold's transport theorem
- Conservation of mass
- Conservation of momentum
- Conservation of energy
- Navier-stokes equation
- Non dimensionalization of the Navier-stokes equation
- Special form of conservation laws
- Euler equation for inviscid gas dynamics
- Parabolic boundary condition for N S equation
- Vorticity and Circulation
- The vorticity transport equation and Helmholtz's vorticity.
- Kelvin's circulation theorem.
- Potential equation

- Laplace Equation for irrotational flows
- Incompressible inviscid irrotational flows
- Velocity potential and stream function in 2d and 3d
- Complex velocity potential
- Simple planer flows
- Incompressible Viscous flows
- Boundary layer equations

Reference Books:

1. Batchelor G.K.: An Introduction to Fluid Dynamics, Cambridge University Press,1999.
2. Emanuel G: Analytical Fluid Dynamics, CRC Press, Boca Raton, Second Edition, FL, 1999.
3. Panton R.L., Incompressible Flows, Wiley Interscience, 1984
4. Currie I.G.: Fundamental Mechanics of Fluids, McGraw-Hill, New-york, 1993.
5. Chorin: Mathematical introduction to Fluid Mechanics, Springer Verlag, Fourth Edition

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Paper - 6004

Linear Programming

L - T - P
4 - 1 - 0

Linear programming

Introduction, structure of linear programming problem, advantages and limitation of Linear programming, Formulation of Model

The graphical methods of LP problem

The Simplex method

Standard form of LP problem, simplex algorithm for maximum and minimum, simplex mathod, Two – phase method, the Big – M method, types of linear programming solutions

Duality in linear programming

Formulation of Dual LP problem, standard rules on Duality, advantages of Duality

Sensitivity analysis in linear programming

Integer Linear programming

Types of Integer Linear programming Enumeration and cutting plane solution, Gomory's all integer cutting plane mathod, Gomory's mixed – integer cutting plane method, branch and bound method

Books:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.
2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.
3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984
4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm
5. H.A. Taha :Operation research an Introduction
6. Kalyanmoy Deb : Optimization for Engineering Design, Algorithms and
7. Examples Prentice-Hall of New Delhi, India, 2000
8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

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Paper - 6005

Operation Research

L - T - P
4 - 1 - 0

Goal programming

Difference between goal programming and LP programming, Goal programming model formulation, Goal programming application, Graphical method for goal programming, modify simplex method for goal programming, alternative simplex method for goal programming

Transportation method

Mathematical model for Transportation method, north – west corner method, least cost method, vogal's approximation method, test for optimality, variations in transporation problem

Assignment problem

Mathematical model for assignment problem, solution method for assignment problem, variations in assignment problem

Sequencing problem

Processing n jobs through 2 machines, Processing n jobs through 3 machines, Processing n jobs through m machines, Processing 2 jobs through m machines,

Books:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.

2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.

3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984

4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm

5. H.A. Taha :Operation research an Introduction

6. Kalyanmoy Deb : Optimization for Engineering Design, Algorithms and

7. Examples Prentice-Hall of New Delhi, India, 2000

8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

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Syllabus to be offered at M. Sc. Part-II Semester -III w.e.f. June 2011-12

Paper - 6006

Optimization Techniques

L - T - P
4 - 1 - 0

Deterministic inventory control

Inventory Control, functional role of inventory control, reasons of inventory, inventory models building, single item inventory control model without shortages, single item inventory control model with shortages, multi - item inventory models with constraints, single item inventory control models with quantity discounts, information system for inventory controls

Probabilistic inventory control

Introduction, instantaneous demand inventory control models, continuous demand inventory control models without setup cost, instantaneous demand inventory control models with setup cost,

Queuing theory

Introduction, essential features of queuing theory, performance measures of queuing system, probability distribution in queuing systems, calcification of queuing systems, single - server queuing system, multi server queuing system, finite calling population queuing models, multi-phase queuing model, special purpose queuing model

Replacement and Maintenance Models

Introduction, types of failure, replacement if items whose efficiency decrees with time, Replacement of item that fail completely

Books:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.

2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.

3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984

4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm

5. H.A. Taha :Operation research an Introduction

6. Kalyanmoy Deb : Optimization for Engineering Design, Algorithms and

7. Examples Prentice-Hall of New Delhi, India, 2000

8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

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Syllabus to be offered at M. Sc. Part-II Semester - IV w.e.f. June 2011-12

Paper : 6007
Laplace Transform and Applications

L T P
4-1-0

- Definition of the Laplace transform and examples. Existence of the Laplace transform and its Basic properties. The convolution theorem and properties of convolution. Differentiation and Integration of the Laplace transform. The inverse Laplace transform and examples. Tauberian theorem and Watson's lemma Laplace transform of Fractional integral and Fractional derivatives.
- Application of the Laplace transform to solve ordinary differential equations, partial differential equations, Initial and Boundary value problems, Integral equations, Evaluation of definite Integrals Difference and differential - difference equations.
- Definition of Finite Laplace transform and examples Basic operational properties of the finite Laplace transform Application of Finite Laplace transform and Tauberian theorem.

References:

1) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
2) Lokenath Debnath : Integral Transform and their applications, CRC Pub., 1995.
3) B. Davies : Integral Transforms and their applications, Springer - Verlag, 1978.

4) Boss M. L. : Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.
5) Andrews, L. G. & Shivamoggi B. K. : Integral Transforms for Engineers, PHI, 2003.

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Syllabus to be offered at M. Sc. Part-II w.e.f. June 2011-12

Paper : 6008
Fourier Transform and its Applications

L T P
4-1-0

- The Fourier integral formula, Definition of Fourier transforms. Basic properties of Fourier transform. Fourier sine and cosine transforms & properties. Calculation of the Fourier transforms of some simple function and rational functions. Calculation of Fourier sine and cosine transforms. Convolution Integral. Parseval's theorem for Fourier sine and consine transform. Fourier Inversion theorem and examples of some simple functions.

  Applications of Fourier Transform, Fourier sine and cosine transform to various partial differential equations.

  Application of Fourier Transform to solve Integral equation of convolution type. Application of Fourier transform to solve ordinary differential equations and to statistics.

Finite Fourier cosine & sine transform

Definition and Basic properties of finite Fourier sine and cosine transforms and its applications.

References:

1) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
2) Lokenath Debnath : Integral Transform and their applications, CRC Pub., 1995.
3) B. Davies : Integral Transforms and their applications, Springer - Verlag, 1978.
4) Boss M. L. : Mathematical Methods in Physical Sciences,

John Wiley & Sons, 1983.
5) Andrews, L. G. & Shivamoggi B. K. : Integral Transforms for Engineers, PHI, 2003.

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Paper : 6009
Advanced Integral Transform

L T P
4-1-0

Hankel Transforms :

The Hankel Transform and Examples, Operational Properties of the Hankel Transform, Applications of Hankel Transforms to Partial differentia Equation,

Finite Hankel Transform :

Definition of the Finite Hankel Transform and Examples, Basic Operational Properties, Applications of Finite Hankel Transforms.

Mellin Transfroms :

Definition of the Mellin Transform and Examples, Basic Operational Properties, Applications of Mellin Transforms, Mellin Transforms of the Weyl Fractional Integral and the Weyl Fractional Derivative, Application of Mellin Transforms to Summation of Series, Generalized Mellin Transforms.

Z Transforms :

Dynamic Linear Systems and Impulse Response, Definition of the Z Transform and Examples, Basic Operational Properties, The Inverse Z Transform and Examples, Applications of Z Transforms to Finite Difference Equations, Summation of Infinite Series.

References:

1) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
2) Lokenath Debnath : Integral Transform and their applications, CRC Pub., 1995.
3) B. Davies : Integral Transforms and their applications, Springer - Verlag, 1978.

4) Boss M. L. : Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.
5) Andrews, L. G. & Shivamoggi B. K. : Integral Transforms for Engineers, PHI, 2003.

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Paper : 6010
Elementary Number Theory

L T P
4-1-0

Unit – I:

Divisibility in integers, Division algorithm, Greatest Common Divisor (gcd) using the Euclidean Algorithm, property of gcd and lcm of two integers, Fundamental theorem of arithmetic, linear Diophantine equation in two variables.

Unit – II:

Prime and composite numbers, The Fundamental theorem of Arithmetic, Sieve of Eratosthenes, Infinitude of primes, Upper bound for the primes.
Fibonacci numbers and their elementary properties.

Unit –III:

Properties of congruence relation, Modular Arithmetic, Divisibility tests for 3, 9 and 11, CRS(mod n) and RRS(mod n), linear congruence $ax \equiv b \pmod{n}$, Chinese Remainder theorem.

Unit –IV:

Fermat's little theorem, pseudo-primes, Wilson's theorem.
Pythagorean triples, Pythagorean equation $x^2 + y^2 = z^2$.

References:

1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co., N. Delhi, 6th edition, Reprint, 2006.
2. Neville Robbins : Beginning Number Theory, Narosa Pub. House, N.Delhi, 2nd Ed., 2006.
3. I. Niven, S.Zuckerman & L. Montgomery: An Introduction to the Theory of Numbers, 6th edition, John Wiley and Sons, Inc., New York, 2003.
4. George Andrews : Number Theory, The Hindustan Pub. Corp., New Delhi.
5. S.G.Talang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi.

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Syllabus to be offered at M. Sc. Part-II Semester - III w.e.f. June 2011-12

Paper : 6011
Algebraic Number Theory

L T P
4-1-0

Unit – I:

Uniqueness of factorization of integers in rational and Gaussian fields, Polynomials over a field, Eisenstein's irreducibility criterion, Symmetric polynomials, Symmetric function theorem.

Unit – II:

Algebraic and transcendental numbers, algebraic number fields, bases and finite extensions, conjugates of an algebraic number fields, conjugate of an algebraic number in a given algebraic number field.

Unit – III:

Algebraic integers, norm, trace and discriminant of algebraic numbers and algebraic integers, integral basis of an algebraic number field, arithmetic in algebraic number fields

Unit – IV:

Units and primes, the problem of uniqueness of factorization, integral ideals, basic properties of ideals, unique factorization of integral ideals, HCF of two ideals, problem of ramification.

References:

1. Harry Pollard and Harold G. Diamond : The Theory of Algebraic numbers, The Mathematical Association of America (Carns Mathematical Monographs).
2. S. Lang, Algebraic Number Theory, Addison- Wesley, 1970.
3. D.A. Marcus, Number Fields, Springer-Verlag, Berlin, 1977.
4. K. Ireland and M. Rosen, A Classical Introduction to Modern Number Theory, 2nd ed., Springer-Verlag, Berlin, 1990.

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Paper : 6012
Combinatorics

L T P
4-1-0

Unit – I:
Introduction to basic ideas of ordered and unordered selection, The Binomial theorem, Combinatorial approach of the Binomial theorem, Binomial coefficients.

Unit – II:
Pairing problems, perfect matching, system of distinct representative, Optimal assignment problem, Hall's treatment to optimal assignment problem with priorities, marriage theorem.

Unit – III:
Latin squares and rectangles, the maximin theorem, recurrence relation, Fibonacci type relations, generating functions related to recurrence relations.

Unit – IV:
The inclusion-exclusion principle, Rook polynomials, computation of Rook polynomials for various types of board.

References:

1. Jan Anderson : A first course in Combinatorial mathematics,
2. V. Krishnamurty : Combinatorics: Theory and Applications, Affiliated East-West Press Ltd., New Delhi, 1985.
3. Herbert John Ryser : Combinatorial Mathematics, The Mathematical Association of America,USA (Carns Mathematical Monographs No.4).

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Paper : 6013
Special Functions - I

L T P
4-1-0

Infinite Products:

Introduction and definition, Necessary and sufficient condition for convergence, absolute convergence and uniform convergence.

The Gamma and Beta Functions:

The Euler or Mascheroni constant (lemda), The Gamma function, A series for $\Gamma'(z)/\Gamma(z)$, Evaluation of $\Gamma(1)$ and $\Gamma'(1)$, The Euler product for $\Gamma(z)$, The difference equation $\Gamma(z+1) = z\Gamma(z)$, Evaluation of certain infinite products, Euler's integral for $\Gamma(z)$, The Beta function. The value of $\Gamma(z)\,\Gamma(1-z)$, The factorial function, Legendre's duplication formula, Gauss' multiplication theorem.

The Hypergeometric Function:

The function F(a,b; c;z), A simple integral formula, F(a,b;c; 1) as a function of parameters, Evaluation of F(a,b;c;1), The continuous function relation, The Hypergeometric differential equations and their logarithmic solutions, Elementary series manipulations, Simple transformations, Relation between function of z and that of (1 - z), A quadratic transformation, Kummar's theorem, Some additional properties.

References:

[1] Special Functions by Rainville E.D. McMillan, New York, 1960.

[2] Special functions of Mathematical Physics and Chemistry by Sneddon 1. N.Oliver Boyd,1961.

[3] A Treatise on the theory of Bossel's functions by Watson G. N.Cambridge University Press, 193 1.

[4] Special Functions and their Applications by Ledebev N. N. Dover Pub. 1972.

[5] Special Functions by Saxena R. K. and Gokhroo D. C. Khanna Pub.

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Syllabus to be offered at M. Sc. Part-II Semester - IV w.e.f. June 2011-12

Paper : 6014
Special Functions - II

L T P
4-1-0

Generalised Hypergeometric functions:

The function pFq The Exponential and Binomial functions, Differential equation and its various solutions, The continuous function relations with simple integral, pF q with unit argument, Saalschutz' theorem, Whipple's theorem, Dixon's theorem, Contour integrals of Barnes' type, The Barnes integrals and the function pFq with some useful integral.

Generating Functions:

Concept of the generality function, The generating function of the form $G(2xt-t^2)$, Sets generated by $e^t\psi(xt)$, The generating function $A(t)\exp[-xt/(1-t)]$, Another class of generating functions and its extension.

Orthogonal Polynomials:

Simple sets of polynomials, Orthogonality and equivalent condition for orthogonality, Zeros of orthogonal polynomials, Expansion of polynomials, The three - term recurrence formula, The Cristoffel - Darbaux formula, Normalization, Bessel's inequality.

References:

[1] Special Functions by Rainville E.D. McMillan, New York, 1960.

[2] Special functions of Mathematical Physics and Chemistry by Sneddon 1. N.Oliver Boyd,1961.

[3] A Treatise on the theory of Bossel's functions by Watson G. N.Cambridge University Press, 193 1.

[4] Special Functions and their Applications by Ledebev N. N. Dover Pub. 1972.

[5] Special Functions by Saxena R. K. and Gokhroo D. C. Khanna Pub.

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Paper : 6015
Special Functions - III

L T P
4-1-0

Legendre's Polynomials:

The generating function, Differential and pure recurrence relations, Legendre's differential equation, The Rodrigues formula, Batemann generating function, Additional generating functions, Hypergeometric forms of Pn(x), Brafman's generating function, Properties of Pn(x) with more generating functions, Laplace first integral form, Bounds on Pn(x), Orthogonality theorem, Expausition theorem, expansion of Xn and expansion of analytic functions.

Hermite Polynomials:

Definition of Hn(x), Recurrence relations, Rodrigues formula and generating functions, integrals, Hermite polynomial as a ${}_2F_0$, orthogonality, Expansion of polynomials and more about generating functions.

References:

[1] Special Functions by Rainville E.D. McMillan, New York, 1960.

[2] Special functions of Mathematical Physics and Chemistry by Sneddon 1. N.Oliver Boyd,1961.

[3] A Treatise on the theory of Bossel's functions by Watson G. N.Cambridge University Press, 193 1.

[4] Special Functions and their Applications by Ledebev N. N. Dover Pub. 1972.

[5] Special Functions by Saxena R. K. and Gokhroo D. C. Khanna Pub.

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Syllabus to be offered at M. Sc. Part-II Semester -IV w.e.f. June 2011-12

Paper : 701
Advanced Abstract Algebra

L T P
4-1-0

Ideals:
Ideals, Homorphisms, Sum and direct sum of ideals, Maximal and prime ideals, Nilpotent and nil ideals, Zorn's Lemma, Unique factorization domains, Principal ideal domains, Euclidean domains, Polynomials rings over UFD,

Modules:
Definition and examples, Submodules and direct sums, R-homomorphism and quotient modules, Completety reducible modules, Free modules, Representation of linear mappings, Rank of a Linear mapping, Decomposition theorem, Uniqueness of the decomposition, Application to finitely generated abelian groups, Rational canonical form, Generalized Jordan form over any field,

Noetherian and artinial modules and rings:
$\mathrm{Hom}_R\left(\oplus M_{i,} \oplus M_i\right)$, Noetherian and -artinian modules, Wedderburn-Artin theorem, Uniform modules, primary modules, and Noether - Lasker theorem.

Reference:

1. P.B. Bhattacharya : Basic Abstract Algebra 2nd Ed., Cambridge University. Press, 1995
2. I. N. Herstein : Topics in Algebra 2nd Ed., John Wiley Sons, 1999.
3. S. Lang : Algebra 3rd Ed., Addition-Wesley, 1993.
4. I. S. Luther and I.B.S. Passi : Algebra Vol. I -Groups, Vol. II Rings, Narosa Publishing House (Vol. I -1996, Vol. II 1999)
5. D. S. Malik, J. N. Mordeson and M. K. Sen : Fundamentals of Abstract Algebra, Mc Graw-Hill, Int. Edition, 1997.
6. S. K. Jain, A. Gunawardena and P. B. Bhattacharya : Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.

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Paper : 702
Theory of Operators

L T P
4-1-0

Compact Linear operators on Normed spaces and Their Spectrum:
Compact Linear Operators on Normed Spaces, Further Properties of Compact Linear Operators, Spectral Properties of Compact Linear Operators on Normed Spaces, Further Spectral Properties of Compact Linear Operators, Operator Equations Involving Compact Linear Operators, Further Theorems of Fredholm Type, Fredholm Alternative,

Spectral Theory of Bounded Self-Adjoint Linear Operators:
Spectral Properties of Bounded Self-Adjoint Linear Operators, Further Spectral Properties of Bounded Self-Adjoint Linear Operators, Positive Operators, Square Roots of a Positive Operator, Projection Operators, Further Properties of Projections, Spectral Family, Spectral Family of a Bounded Self-Adjoint Linear Operator, Spectral Representation of Bounded Self-Adjoint Linear Operators, Extension of the Spectral Theorem to Continuous Functions, Properties of the Spectral Family of a Bounded Self-Adjoint Linear Operators,

Unbounded Linear Operators in Hilbert Space:
Unbounded Linear Operators and their Hilbert-Adjoint Operators, Hilbert-Adjoint Operators, Symmetric and Self-Adjoint Linear Operators, Closed Linear Operators and Closures, Spectral Properties of Self-Adjoint Linear Operators, Spectral Representation of Unitary Operators, Spectral Representation of Self-Adjoint Linear Operators, Multiplication Operators and Differentiation Operators.

References:

1. Kreyszig E. : Introductory Functional Analysis with applications, Wiley India, 2006
2. Simmons G. F. : Introduction to Topology and Modern Analysis. McGraw Hill
3. Siddiqui A. H. : Functional Analysis, P.H.I.
4. Sudarshan Nanda : Functional Analysis, Wiley Eastern Pvt. Ltd.
5. Day M.M. : Normed Linear spaces, Springer
6. Limaye B.V. : Functional Analysis, New Age International Pvt. Ltd.

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Syllabus to be offered at M. Sc. Part-II Semester -IV w.e.f. June 2011-12

Paper : 703
Numerical Linear Algebra

L T P
4-1-0

Vector and Matrix Norms:
Vector Norms, Matrix Norms, Convergent Matrices, Stability of Nonlinear Systems,

Iterative Methods and Condition Number

Introduction, Gauss-Jacobi Iteration Method, Gauss-Seidel Iteration Method, Convergence of Iteration Methods, Successive Over-Relaxation Iteration Method, Conjugate Gradient Method, Definition and Examples, Elementary Properties of $k(A)$, Sensitivity Analysis of Solutions of Linear Systems, Residual Theorem, Nearness to Singularity, Estimating $k(A)$,

Singular Value Decomposition
SVD Theorem, Algebraic and Geometric Properties of SVD, Determining the Rank of a Matrix Using SVD, Compression Using SVD, Pseudoinverse and the SVD,

Numerical Eigenvalue Problem
Basic Theorem on Eigenvalues and Eigenvectors, Power Method, Power Method Algorithm, Rate of Convergence, Power Method with shift, Simple application of power method with shift, Calculating the least Dominant Eigenpair, Inverse Iteration, Rayleigh Quotient, Householder Deflation, Jacobi's Method, Rotation Matrices, The Outline of Jacobi's Method, The General Step of Jacobi's Method, Zeroing out d_{pq} and d_{qp}, QR Method, Hessenberg QR Method, Rate of Convergence of the hessenberg QR Method, Single Shift Hessenberg QR Method.

References:

1. **V. Sundarapandian :** Numerical Linear Algebra, P.H.I. New Delhi, 2008.
2. **Bretscher O. :** Linear Algebra with applications Prentice Hall, Englewood Cliffs, New Jersey, 1997**.**
3. **Ciarlet P.G. :** Introduction to Numerical Linear Algebra and Optimization, Cambridge University Press, Cambridge,1989.
4. **Cullen C.G.:** An Introduction to Numerical Linear Algebra, PWS Publishing Company, Boston, 1994.
5. **Datta B.N. :** Numerical Liner Algebra, Brooks and Cole, Pacific Grove, 1995.
6. **Demmel J.W. :** Applied Numerical Linear Algebra, SIAM, Philadelphia, 1997.
7. **Hager W.W.:** Applied Numerical Linear Algebra, Prentice Hall, Englewood Cliffs, New Jersey, 1988.
8. **Loan C.F.V.:** Introduction to Scientific Computing, Prentice Hall, Englewood Cliffs, New Jersey, 2000.
9. **Trefethen L.N. and D. Bau :** Numerical Linear Algebra, SIAM, Philadelphia, 1997.

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Paper : 7001
Computational Fluid Dynamics

L T P
4-1-0

- Introduction to CFD, Applications;
- Governing equations and assumptions, Equation types, Model equations, potential flow, Heat conduction, Wave equation, Burgers equation, Euler equations.
- Finite Differences, Algorithms, Errors and Accuracy, Consistency, Stability and Convergence, Finite Volumes, Explicit algorithms, Implicit algorithms, Numerical boundary conditions, Method of lines, Shock Jump Relations, Shock capturing.
- One dimensional Euler equations, Lax – Wendroff Scheme, Mc-Cormack Scheme, Implicit - method, Pseudo One Dimensional Euler Equations, boundary conditions, Flux – Splitting, Artificial viscosity, Flux limiters.
- Multidimensional Euler equations, Lax- Wendroff and Mc-Cormack schemes, stability of multidimensional schemes, Operator splitting Implicit algorithms, Beam - Warming algorithm.
- Practicals : Numerical methods for discretizing fluid flow equations: Finite differences, finite element and finite volume method.

Reference Books:

1. R. J. Leveque: Numerical methods for conservation Laws, Birkhauser Verlag, Basel, 1992.
2. J. D. Anderson: Computation Fluid dynamics, Mc-Graw – Hill, New York, 1995.
3. H. K. Versteeg and W. Malasekera: An Introduction to Computational Fluid Dynamics: The finite volume method, Longman Scinetific and technical Essex, England, 1995.
4. J. Chorin and J. E. Marsden: A Mathematical Introduction to Fluid Mechanics
5. P. D. Lax: hyperbolic systems of conservation laws and mathematical theory of shock waves, 1973.

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Paper : 7002
Mathematical Modeling

L T P
4-1-0

- Needs and Techniques of mathematical modeling: Idea of mathematical modeling, need for mathematical modeling, steps in mathematical modeling, Characteristics of mathematical modeling ,Interpretation
- Models in mechanical vibration :Spring mass system, pendulum problems
- Models in population dynamics:One species model, logistic model, growth model in time delays ,Predator-Prey models,Volterra-Lotka models
- Models of chemical processes, Electrical network and Diffusion processes
- Traffic flow models

COMPUTATIONAL MODELING

- Modeling dynamical systems: differential equations and their numerical solution, linear and non–linear dynamics, stability, convergence, attractors.
- Physical systems: System types and characteristics behaviour, Continuous-time,discrete – time and discrete -event systems, linear and non linear systems
- Exploration of behaviour through simulation:

Developing simulations of dynamical systems using Matlab: representation and visualization of simulation experiments, analyzing behavioural characteristics for a range of classes of physical and computational systems eg. Predictor- prey models, evolutionary systems and cellular systems

Reference Books:

1. J.N.Kapur: Mathematical modelling, Wiley eastern Ltd., 1994.
2. M.M. Gibbons: A concrete approach to Mathematical modeling, John Wiley and sons, 1995.
3. H. Neunzert and A.H. Siddiqui: Topics in Industrial Mathematics, Kluwer Academic Publishers, London, 2000
4. P. E. Wellstead : Introduction to Physical system modeling, Academic Press, 1979.
5. Richard Haberman: Mathematical Models, Practice- Hall Inc., NJ, 1979.
6. Jery Banks, John S., Carson II, Barry Nelson and David M.Nicol,:Discrete – Event system simulation , Prentice hall, 2001

Paper : 7003
Finite Element Method

L T P
4-1-0

- Introduction
- The basic idea about FEM,
- basic features of FEM,
- mathematical model,
- numerical simulations
- Mathematical Preliminaries
- Integral formulations
- Variational methods
- Basic steps of Finite Element Analysis
- Axisymmetic Problems
- Discrete systems

Reference Books:

1. J.N.Reddy: "An introduction to the Finite Element Method" Tata McGraw - Hill Edition, 2005.

2. Baker A. J.: "Finite Element Computational Fluid Mechanics" McGraw Hill Book Company

3. Chung T. J.: "Computation Fluid Dynamics" Cambridge University Press

Paper : 7004
Advanced Operational Research

L T P
4-1-0

Theory of simplex method

Introduction, canonical and standard form of LP problem, slack and surplus variable, reduction of feasible solution to basic solution, improving a basic feasible solution, alterative optimal solution, unbounded solution, optimality condition

Revised simplex method and dual simplex mathod

Introduction, revised simplex method, standard form of revised simplex method, comparison of revised simplex and revised simplex method, algorithm of dual simplex method

Bounded variable LP problem

Introduction, the simplex algorithm

Parametric linear programming

Introduction, the objective function coefficients, variation in availability of resources

Books:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.

2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.

3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984

4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm

5. H.A. Taha :Operation research an Introduction

6. Kalyanmoy Deb: Optimization for Engineering Design, Algorithms and

7. Examples Prentice-Hall of New Delhi, India, 2000

8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

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Paper : 7005
Non - Linear Programming

L T P
4-1-0

One - Dimensional Non- Linear Programming Methods
Unimodal function, exhaustive search, dichotomous search, Fibonacci search, quadratic interpolation , direct search method, interpolation methods

Classical Optimization Methods
Unconstraint optimization, constrain Multi- variable optimization with equality constrains, constrain Multi- variable optimization with inequality constrains,

Non- Linear Programming Methods
Introduction, general non- linear programming problems, graphical solution method, quadratic programming, application of quadratic programming, separable programming, geometric programming, stochastic programming

Books:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.

2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.

3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984

4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm

5. H.A. Taha :Operation research an Introduction

6. Kalyanmoy Deb : Optimization for Engineering Design, Algorithms and

7. Examples Prentice-Hall of New Delhi, India, 2000

8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

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Paper : 7006
Advanced Optimization

L T P

Project Management

Introduction, basic difference between PERT & CPM, phases of Project Management, PERT/CPM network components and precedence relationship, critical path analysis, project scheduling with uncertain activity times, project time - cost trade - off, updating of project progress, resources allocation

Markov chain

Introduction, characteristic of markov chain, application of Markov chain, state and transition problem, multi - period transition problem, steady - state condition

Simulation

Introduction, simulation, types of simulation, steps of simulation process, advantages and disadvantages of simulations, stochastic simulation, random numbers, simulation of inventory problem, simulation of queuing problem, simulation of inventory problems, simulation of PERT/CPM problems, role of computer in simulation

Books:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.

2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.

3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984

4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm

5. H.A. Taha :Operation research an Introduction

6. Kalyanmoy Deb : Optimization for Engineering Design, Algorithms and

7. Examples Prentice-Hall of New Delhi, India, 2000

8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

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Paper : 7007
Wavelet Analysis

L T P
4-1-0

- From Fourier Analysis to Wavelet analysis
- Time Frequency Analysis
- Continuous Wavelet Transform
- Discretizing the Wavelet Transform
- Frames
- Frames of Wavelets
- A necessary condition (Admissibility of the mother wavelet)
- The dual frame
- Examples of Tight frames, The Mexican hat function, a modulated Gaussian
- Frames for the Windowed Fourier transform
- Time-Frequency Density
- Orthonormal Wavelet bases
- Multi Resolution Analysis
- Riesz bases of scaling function
- The Battle-Lemaire waveltes
- Regularity of Orthonormal wavelet bases
- Orthonormal Bases of Compactly Supported Wavelets with Examples
- Regularity of Compactly Supported Wavelets

Books:

1. Ingrid Daubechies :Ten Lectures on Wavelets, OBMS-NSF SIAM, Philadelphia,

1992.

2. Charles K. Chui An introduction to wavelets, Academic Press ,1992

3. G. Kaiser, Friendly Guide to wavelets , Birkhauser Boston 1994.

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Paper : 7008
Digital signal Processing

L T P
4-1-0

INTRODUCTION:

DISCRETE-TIME SIGNALS AND SYSTEMS:

Introduction, Discrete-Time Signals: Sequences, Discrete-Time systems, Linear Time-Invariant Systems, Properties of Linear Time-Invariant Systems, Linear Constant-Coefficient Difference Equations, Frequency-Domain Representation of Discrete-Time Signals and Systems, Representation of Sequences by Fourier Transforms, Symmetry Properties of the Fourier Transform, Fourier Transform Theorems, Discrete-Time Random Signals.

THE Z-TRANSFORM:

Introduction, Z-Transform, Properties of the Region of Convergence for the Z-Transform, The Inverse Z-Transform, Z-Transform Properties.

SAMPLING OF CONTINUOUS - TIME SIGNALS:

Introduction, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of a Bandlimited Signal from its Samples, Discrete-Time Processing of Continuous-Time Signals, Continuous-Time Processing of Discrete-Time Signals, Changing the Sampling Rate Using Discrete-Time Processing, Multirate Signal Processing, Digital Processing of Analog Signals, Oversampling and Noise Shaping in A/D and D/A Conversion.

TRANSFORM ANALYSIS OF LINEAR TIME-INVARIANT SYSTEMS:

Introduction, The Frequency Response of LTI Systems, System Functions for Systems Characterized by Linear constant-coefficient Difference Equations, Frequency Response for Rational System Functions, Relationship between Magnitude and Phase, All-Pass Systems, Minimum Phase Systems, Linear Systems with Generalized Linear Phase.

References:

1. oppenheim A. V., Schafer & Buck "Discrete Time Signal Processing" Pearson education 2006
2. crochiere & rabiner "multirate Digital Signal Processing" Pearson education 2006
3. oppenheim A. V., Schafer, "Digital Signal Processing" Pearson education 2006

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Syllabus to be offered at M. Sc. Part-II Semester -IV w.e.f. June 2011-12

Paper : 7009
Image Processing

L T P
4-1-0

Introduction

Fundamentals of Image Processing, Applications of Image Processing, Automatic Visual Inspection System, Remotely Sensed Scene Interpretation, Biomedical Imaging Techniques,

Defense surveillance, Content-Based Image Retrieval, Moving-Object Tracking, Image and Video Compression, Human Visual Perception, Human Eyes, Neural Aspects of the Visual Sense, Components of an Image Processing System, Digital Camera

Image Formations and Representation

Introduction, Image formation, Illumination, Reflectance Models, Point Spread Function, Sampling and Quantization, Image Sampling, Image Quantization, Binary Image, Geometric Properties, Chain code representation of a binary object, Three-Dimensional Imaging, Stereo Images, Range Image Aquisition, Image file formats

Colors and Color Imagery

Introduction, Perception of Colors, Color Space Quantization and Just Noticeable Difference, Color Space and Transformation, CMYK, NTSC or YIQ Color, YCbCr Color, Perceptually Uniform Color, CIELAB color, Color Interpolation or Demosaicing, Nonadaptive Color Interpolation Algorithms, Adaptive algorithms, A Novel Adaptive Color Interpolation Algorithm,

Image Transformations

Introduction, Fourier Transforms, One-Dimensional Fourier Transform, Two-Dimensional Fourier Transform, Discrete Fourier Transform (DFT), Transformation Kernels, Matrix Form Representation, Properties, Fast Fourier Transform, Discrete Cosine Transform, Walsh-Hadamard Transform (WHT), Karhaunen-Loeve Transform or Principal Component Analysis, Covariance Matrix, Eigenvectors and Eigenvalues, Principal Component Analysis, Singular Value Decomposition

Reference Books:

1. Tinku Acharya & Ajoy K. Ray, 'Image Processing ,Principles and Applications' WILEY- INTERSCIENCE
2. Gonzalez & Woods, "Digital image processing" Pearson Eduction second edition

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Syllabus to be offered at M. Sc. Part-II Semester - IV w.e.f. June 2011-12

Paper : 7010
Advanced Number Theory

L T P
4-1-0

Unit – I:

Introduction of Number theoretic functions $\tau(n)$, $\sigma(n)$, $\mu(n)$, $\phi(n)$ and $[x]$, Multiplicative nature of these functions, Basic properties of these functions, The Mobius Inversion formula, Use of the $[x]$ to compute exponent of highest powers of p that divides n!, Euler's generalization of Fermat's theorem.

Unit – II:
The order of an integer modulo n, Primitive roots for primes, The theory of indices.
Unit – III:
Euler's criterion, The Legendre symbol and its properties, Gauss' Lemma, Quadratic Reciprocity and Quadratic Reciprocity law, Quadratic congruence with composite moduli.
Unit – IV:
Simple continued fractions, finite and infinite continued fractions, uniqueness, representation of rational and irrational numbers as simple continued fractions, rational approximation to irrational numbers, Hurwitz theorem, basic facts of periodic continued fractions and their illustrations (without proofs).

References:

1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co., N. Delhi, 6th edition, Reprint, 2006.
2. Neville Robbins : Beginning Number Theory, Narosa Pub. House, N.Delhi, 2nd Ed., 2006.
3. I. Niven, S.Zuckerman & L. Montgomery: An Introduction to the Theory of Numbers, 6th edition, John Wiley and Sons, Inc., New York, 2003.
4. George Andrews : Number Theory, The Hindustan Pub. Corp., New Delhi.
5. S.G.Talang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi.

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Paper : 7011
Analytic Number Theory

L T P
4-1-0

Unit – I:
The Dirichlet product of two arithmetical functions (a.f.) and group structure w.r.t. this product, The Mangoldt function, Multiplicative a.f., the inverse of a completely multiplicative a.f., Liouville's function $\lambda(n)$, the divisor functions $d(n)$ and $\sigma_\alpha(n)$.

Unit – II:
Generalized convolution, the Bell series of a.f., the Selberg's identity, the big oh notation, Euler's summation formula, the average order of divisor functions $d(n)$ and $\sigma_\alpha(n)$.

Unit – III:
The average order of functions $\varphi(n), \mu(n), \Lambda(n)$, Lattice points visible from the origin, the partial sums of a Dirichlet product, applications to $\mu(n)$ and $\Lambda(n)$.

Unit – IV:
Chebyshev's functions $\psi(x)$ and $\vartheta(x)$, Abel's identity, relation between $\vartheta(x)$, $\pi(x)$, and $\psi(x)$, equivalent forms of prime number theorem, lower and upper bounds for $\pi(n)$ and p_n.

References:

1. T.M.Apostol : Introduction to Analytic Number Theory, Narosa Pub. House, New Delhi, 1998 Ed.
2. Mc Carthy P.J. : Introduction to Arithmetical function, Springer-Verlag, New York, 1986.
3. K. Chandrashekharan : Introduction to Analytic Number Theory, Springer-Verlag, New York, 1968.
4. Hua L.K. : Introduction to Number Theory, Springer-Verlag, New York, 1982.

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Paper : 7012
Introduction To Modern Cryptography

L T P
4-1-0

Unit – I:
Mathematical Basics: Divisibility, primes, primality testing and induction, an introduction to congruences, Euler, Fermat, and Wilson Theorems, primitive roots, the index calculus and power residues, Legendre, Jacobi, & Quadratic Reciprocity, Complexity.

Unit – II:
Cryptographic Basics: The objectives of Cryptography, classic Ciphers, stream Ciphers, linear feedback shift registers, Cryptographic protocols, provable security, attacks.

Unit –III:
Symmetric-Key Encryption: Stream Ciphers, symmetric block Ciphers, Data Encryption Standard (DES), Hash function, message digest and message authentication code, DES-like message digest computation (DMAC), secure Hash algorithm.

Unit –IV:
Public-Key Cryptography: The Concept of public-key Cryptography, Diffie–Hellman exponential key exchange, RSA, Schnorr's public-key Cryptosystem, Digital Signature Algorithm.

References:

1. Richard A. Mollin : An introduction to Cryptograpy, Chapman & Hall/CRC, USA, 2001.
2. Hans Delfs, Helmut Knebl: Introduction to Cryptography: Principles and Applications, Springer, Berlin, 2002.
3. N. Koblitz, A Course in Number and Theory and Cryptography, Graduate Texts in Mathematics, No.114, Springer-Verlag, New York/Berlin/Heidelberg, 1987.

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Paper : 7013
Special Functions - IV

L T P
4-1-0

Leguerre Polynomials:

A Polynomial $L_n^{(\alpha)}(X)$,Generating functions and recurrence relations, Rodrigues formula, The differential equation, Orthogonality, Expansion of polynomial and special properties, Other generating functions, The simple Leguerre polynomial.

Jacobi Polynomials:

The Jacobi polynomials, Bateman's generating function, The Rodrogues formula and orthogonality, Differential and pure recurrence relations, Mixed relations, Appell's functions

of two variables, Elementary generating functions, Brafman's generating functions, Expansion in series of polynomials.

References:

[1] Special Functions by Rainville E.D. McMillan, New York, 1960.

[2] Special functions of Mathematical Physics and Chemistry by Sneddon 1. N.Oliver Boyd,1961.

[3] A Treatise on the theory of Bossel's functions by Watson G. N.Cambridge University Press, 193 1.

[4] Special Functions and their Applications by Ledebev N. N. Dover Pub. 1972.

[5] Special Functions by Saxena R. K. and Gokhroo D. C. Khanna Pub.

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Paper : 7014
Special Functions - V

LTP

4-1-0

CONFLUENT HYPERGEOMETRIC FUNCTIONS

Confluent Hypergeometric Functions, Relations among the Consecutive Functions, Whittaker Equation and Whittaker Functions $M_{k,m}(z)$, Integral Representations, Whittaker Functions $M_{,k,m}(z)$ Asymptotic Expansion of when $W_{k,m}(z)\ z\to\infty$, Barnes' Integral Representation of $M_{k,m}(z)$, Relations between $W_{\pm k,m}(\pm z)$ and $M_{\pm k,m}(\pm z)$, Asymptotic Expansion of $F(\alpha,\gamma,z)$. Stokes Phenomenon, The Case when γ (or 2m)is an Integral, The Asymptotic Expansions of $F(\alpha,\gamma,z)$ for Large $|\alpha|,|\gamma|$, Differential Equations Reducible to the Confluent Hypergeometric Equation, Weber Equation. Parabolic Cylinder Functions $D_n(z)$, Hermite Functions and Hermite Polynomials, Laguerre Polynomials, Other Special Functions Expressible by Whittaker Functions.

BESSEL FUNCTIONS:

Bessel equation, Its relation to the Confluent Hypergeometric equation, Bessel Functions of the first kind: $J_{\pm\nu}(z)$, $2\nu \neq$ integer, Bessel functions of order half an odd integer, Integral representations of $J_\nu(z)$, Bessel functions of integral order $J_n(z)$, (n = 0, 1, 2, …), Bessel functions of the second kind $Y_\nu(z)$, Bessel functions of the third Kind $H_\nu^{(1)}(z), H_\nu^{(2)}(z)$,. Modified Bessel functions $I_\nu(z)$ *and* $K_\nu(z)$, Thomson functions, Spherical Bessel Functions, $j_l(z)$, $n_i(z)$..., Asymptotic expansions for the class $|z| \to \infty$, The method of Steepest Descent, Asymptotic expansions of Bessel functions of order V for large $|v|$ *and* $|z|$, Addition formulae, Integrals containing Bessel functions (1) Finite Integrals (2) Infinite Integrals, Neumann expansion, Kapteyn expansion, The zeros of Bessel functions, Fourier-Bessel expansion.

References :

[1] Special Functions by Wang Z. X. and Guo D. R, World Scientific Pub. Co. Pte. Ltd.,Singapore, 1989.
[2] Special functions of Mathematical Physics and Chemistry by Sneddon 1. N.Oliver Boyd,1961.
[3] A Treatise on the theory of Bossel's functions by Watson G. N.Cambridge University Press, 193 1.
[4] Special Functions and their Applications by Ledebev N. N. Dover Pub. 1972.
[5] Special Functions by Saxena R. K. and Gokhroo D. C. Khanna Pub.

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Paper : 7015
Special Functions -VI

LTP

4-1-0

WEIERSTRASS ELLIPTIC FUNCTIONS :

Elliptic Integrals and Elliptic Functions, The periods of Elliptic Integrals, The General Properties of doubly-periodic functions and Elliptic Functions, The function $\wp(z)$, Algebraic relation between $\wp(z)$ and $\wp'(z)$, the function $\xi(z)$, the function $\sigma(z)$, homogeneity of the Weierstrass elliptic function, Representation of a general elliptic function, Addition formulae, Expressing the coordinates of a cubic curve by Elliptic functions, The problem of a Quartic polynomial, Curves of Genus 1.

THETA FUNCTIONS :

The Theta function $\theta(v)$, The function $\nu_k(v)$, Elliptic function represented by Theta function, Relations among the squares of $\nu_k(v)$, Addition formulae, Differential equation satisfied by Theta functions, The values of some constants, Legendre's Elliptic integral of the first kind, Jacobi's Imaginary transformation, Transformation of Landen-Type, Representation of Theta functions by infinite product, Fourier Expansion of the Logaruthmic Derivatives of Theta functions, The function $\Theta(u)$ *and* $H(u)$

References :

[1] Special Functions by Wang Z. X. and Guo D. R, World Scientific Pub. Co. Pte. Ltd.,Singapore, 1989.

[2] Special functions of Mathematical Physics and Chemistry by Sneddon 1. N.Oliver Boyd,1961.

[3] A Treatise on the theory of Bossel's functions by Watson G. N.Cambridge University Press, 1931.

[4] Special Functions and their Applications by Ledebev N. N. Dover Pub. 1972.

[5] Special Functions by Saxena R. K. and Gokhroo D. C. Khanna Pub.