University of Rajasthan
Jaipur

SYLLABUS

M.A./M.Sc. Mathematics

(Annual Scheme)

Previous Examination 2025

Final Examination 2026

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(Academic)
University of Rajasthan
JAIPUR

M.A./M.Sc.(Previous) Mathematics Examination

Scheme of Examination : Annual Scheme
Note: Papers I to V are compulsory

Paper – I: Advanced Abstract Algebra
Teaching : 6 Hours per Week
Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Direct product of groups (External and Internal). Isomorphism theorems – Diamond isomorphism theorem, Butterfly Lemma, Conjugate classes (Excluding p-groups), Commutators, Derived subgroups, Normal series and Solvable groups, Composition series, Refinement theorem and Jordan-Holder theorem for infinite groups.

Unit 2: Sylow's theorems (without proof), Cauchy's theorem for finite abelian groups. Euclidean rings. Polynomial rings and irreducibility criteria. Linear transformation of vector spaces, Dual spaces, Dual basis and their properties, Dual maps, Annihilator.

Unit 3: Field theory – Extension fields, Algebraic and Transcendental extensions, Separable and inseparable extensions, Normal extensions. Splitting fields.
Galois theory – the elements of Galois theory, Automorphism of extensions, Fundamental theorem of Galois theory, Solutions of polynomial equations by radicals and Insolvability of general equation of degree five by radicals.

Unit 4: Matrices of a linear maps, Matrices of composition maps, Matrices of dual map, Eigen values, Eigen vectors, Rank and Nullity of linear maps and matrices, Invertible matrices, Similar matrices, Determinants of matrices and its computations, Characteristic polynomial, minimal polynomial and eigen values.

Unit 5: Real inner product space, Schwartzs inequality, Orthogonality, Bessel's inequality, Adjoint, Self adjoint linear transformations and matrices, Orthogonal linear transformation and matrices, Principal Axis Theorem.

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Reference Books:

1. Deepak Chatterjee, Abstract Algebra, Prentice – Hall of India (PHI), New Delhi, 2004
2. N.S.Gopalkrishnan, University Algebra, New Age International, 1986.
3. Qazi Zameeruddin and Surjeet Singh, Modern Algebra, Vikas Publishing,2006
4. G.C.Sharma, Modern Algebra, Shivlal Agrawal & Co., Agra,1998.
5. Joseph A. Gallian, Contemporary Abstract Algebra (4th Ed.), Narosa Publishing House, 1999.
6. David S. Dummit and Richard M. Foote, Abstract Algebra (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2004.
7. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra (4th Edition), Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
8. I.N. Herstein, Topics in Algebra (2nd edition), John Wiley & Sons, 2006.
9. Michael Artin, Algebra (2nd edition), Pearson Prentice Hall, 2011.

Paper – II: Real Analysis and Topology

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Algebra and algebras of sets, Algebras generated by a class of subsets, Borel sets, Lebesgue measure of sets of real numbers, Measurability and Measure of a set, Existence of Non-measurable sets, Measurable functions, Realization of non-negative measurable function as limit of an increasing sequence of simple functions, Structure of measurable functions, Convergence in measure, Egoroff's theorem.

Unit 2: Weierstrass's theorem on the approximation of continuous function by polynomials, Lebesgue integral of bounded measurable functions, Lebesgue theorem on the passage to the limit under the integral sign for bounded measurable functions. Summable functions, Space of square summable functions. Fourier series and coefficients, Parseval's identity, Riesz-Fisher Theorem.

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Unit 3: Lebesgue integration on R^2, Fubini's theorem. L^p-spaces, Holder-Minkowski inequalities. Completeness of L^p-spaces, Topological spaces, Subspaces, Open sets, Closed sets, Neighbourhood system, Bases and sub-bases.

Unit 4: Continuous mapping and Homeomorphism, Nets, Filters, Separation axioms (To, T_1, T_2, T_3, T_4). Product and Quotient spaces.

Unit 5: Compact and locally compact spaces. One point compactification theorem. Connected and Locally connected spaces, Continuity and Connectedness and Compactness.

Reference Books:

1. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co., N.D., 1995.
2. S.C.Malik and Savita Arora, Mathematical Analysis, New Age International, 1992.
3. T. M. Apostol, Mathematical Anslysis, Narosa Publishing House, New Delhi, 1985.
4. R.R. Goldberg, Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970.
5. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
6. James R. Munkres, Topology, 2nd Edition, Pearson International, 2000.
7. J. Dugundji, Topology, Prentice-Hall of India, 1975.
8. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 1963.
9. Walter Rudin, Real and Complex Analysis, Tata McGraw-Hill Pub. Co. Ltd., 1986.
10. I.N. Natansen, Theory of Functions of a Real Variable, Fredrik Pub. Co., 1964.

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Paper – III: Differential Equations and Special Functions

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Non-linear ordinary differential equations of particular forms. Riccati's equation –General solution and the solution when one, two or three particular solutions are known. Total Differential equations. Partial differential equations of second order with variable co-efficients- Monge's method.

Unit 2: Classification of linear partial differential equation of second order, Canonical forms. Cauchy's problem for first order partial differential equations, Method of separation of variables, Laplace, Wave and diffusion equations, Linear homogeneous boundary value problems. Eigen values and eigen functions. Strum-Liouville boundary value problems. Orthogonality of eigen functions. Reality of eigen values.

Unit 3: Calculus of variation – Functionals, Variation of a functional and its properties, Variational problems with fixed boundaries, Euler's equation, Extremals, Functional dependent on several unknown functions and their first order derivatives, Functionals dependent on higher order derivatives, Functionals dependent on the function of more than one independent variable. Variational problems in parametric form, Series solution of a second order linear differential equation near a regular singular point (Method of Frobenius) for different cases.

Unit 4: Gauss hypergeometric function and its properties, Integral representation, Linear transformation formulas, Contiguous function relations, Differentiation formulae, Linear relation between the solutions of Gauss hypergeometric equation, Kummer's confluent hypergeometric function and its properties, Integral representation, Kummer's first transformation. Legendre polynomials and functions $P_n(x)$ and $Q_n(x)$.

Unit 5: Bessel functions $J_n(x)$, Hermite polynomials $H_n(x)$, Laguerre and Associated Laguerre polynomials.

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Reference Books:

1. J.L.Bansal and H.S.Dhami, Differential Equations Vol-II, JPH, 2004.
2. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co., 2003.
3. L. C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, Vol. 19, AMS, 1999.
4. I.N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, 1988.
5. E.A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
6. Frank Ayres, Theory and Problems of Differential equations, TMH, 1990.
7. D.A. Murray, Introductory Course on Differential Equations, Orient Longman,1902.
8. A.R.Forsyth, A Treatise on Differential Equations, Macmillan & Co. Ltd., London, 1956.

Paper- IV: Differential Geometry and Tensor Analysis

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Space curves, Tangenet, Contact of curve and surface, Osculating plane, Principal normal and Binormal, Curvature, Torsion, Serret-Frenet's formulae, Osculating circle and Osculating sphere, Existence and Uniqueness theorems, Bertrand curves, Involute, Evolutes.

Unit 2: Ruled surface, Developable surface, Tangent plane to a ruled surface. Necessary and sufficient condition that a surface $\zeta = f(\xi,\eta)$ should represent a developable surface. Conoids, Inflexional tangents, Singular points, Indicatrix. Metric of a surface, First, second and third fundamental forms, Weingarten equations. Fundamental magnitudes of some important surfaces, Orthogonal trajectories.

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Unit 3: Normal curvature, Meunier's theorem. Principal directions and Principal curvatures, First curvature, Mean curvature, Gaussian curvature, Umbilics. Radius of curvature of any normal section at an umbilic on z = f(x,y). Radius of curvature of a given section through any point on z = f(x,y). Lines of curvature, Principal radii, Relation between fundamental forms. Asymptotic lines, Differential equation of an asymptotic line, Curvature and Torsion of an asymptotic line. Gauss's formulae, Gauss's characteristic equation, Mainardi-Codazzi equations. Fundamental existence theorem for surfaces, Parallel surfaces, Gaussian and mean curvature for a parallel surface, Bonnet's theorem on parallel surfaces.

Unit 4: Geodesics, Differential equation of a geodesic, Single differential equation of a geodesic, Geodesic on a surface of revolution, Geodesic curvature and Torsion, Normal angle, Gauss-Bonnet Theorem.
Tensor Analysis– Kronecker delta. Contravariant and Covariant tensors, Symmetric tensors, Quotient law of tensors, Relative tensor. Riemannian space. Metric tensor, Indicator, Permutation symbols and Permutation tensors.

Unit 5: Christoffel symbols and their properties, Covariant differentiation of tensors. Ricci's theorem, Intrinsic derivative, Geodesics, Differential equation of geodesic, Geodesic coordinates, Field of parallel vectors, Reimann-Christoffel tensor and its properties. Covariant curvature tensor, Einstein space. Bianchi's identity. Einstein tensor, Flate space, Isotropic point, Schur's theorem.

Reference Books:

1. R.J.T. Bell, Elementary Treatise on Co-ordinate geometry of three dimensions, Macmillan India Ltd., 1994.
2. Mittal and Agarwal, Differential Geometry, Krishna publication, 2014.
3. Barry Spain, Tensor Calculus, Radha Publ. House Calcutta,1988.
4. J.A. Thorpe, Introduction to Differential Geometry, Springer-Verlog , 2013.
5. T.J. Willmore - An Introduction to Differential Geometry. Oxford University Press.1972.
6. Weatherbum, Reimanian Geometry and Tensor Clculus, Cambridge Univ. Press, 2008.
7. Thorpe, Elementary Topics in Differential Geometry, Springer Verlag, N.Y. (1985).
8. R.S. Millman and G.D. Parker, Elements of Differential Geometry, Prentice Hall, 1977.

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Paper – V: Mechanics

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: D'Alembert's Principle. General equations of motion of a rigid body. Motion of the centre of inertia and motion relative to the centre of inertia. Motion about a fixed axis. The compound pendulum, Centre of percussion. Conservation of momentum (linear and angular) and energy for finite as well as impulsive forces.

Unit 2: Motion in three dimensions with reference to Euler's dynamical and geometrical equations. Motion under no forces, Motion under impulsive forces. Motion of a Top.

Unit 3: Lagrange's equations for holonomous dynamical system, Energy equation for conservative field, Small oscillations, Motion under impulsive forces. Hamilton's equations of motion, conservation of energy, Hamilton's Principle and Principle of Least Action.

Unit 4: Kinematics of ideal fluids. Lagrange's and Euler's methods. Equation of continuity in Cartesian, cylindrical and spherical polar coordinates. Boundary surface. Stream-lines, path-lines ,velocity potential, rotational and irrotational motion.

Unit 5: Euler's hydrodynamical equations. Bernoulli's theorem. Helmholtz equations. Cauchy's integrals, Motion due to impulsive forces. Motion in two-dimensions: Stream function, Complex potential. Sources, Sinks, Doublets, Images in two-dimensions.

Reference Books:

1. N. C. Rana and P.S. Joag, Classical Mechanics, Tata McGraw-Hill, 1991.
2. M. Ray and H.S. Sharma, A Text Book of Dynamics of a Rigid Body, Students' Friends & Co., Agra, 1984.
3. M.D. Raisinghania, Hydrodynamics, S. Chand & Co. Ltd., N.D. 1995.
4. M. Ray and G.C. Chadda, A Text Book on Hydrodynamics, Students' Friends & Co., Agra, 1985.
5. H. Goldstein, Classical Mechanics, Narosa, 1990.
6. J. L. Synge and B. A. Griffith, Principles of Mechanics, McGraw-Hill, 1991.
7. L. N. Hand and J. D. Finch, Analytical Mechanics, Cambridge University Press, 1998.

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M.A./M.Sc. (FINAL) MATHEMATICS

Scheme of Examination : Annual Scheme

Note: 1. Papers I and II are compulsory

2. Candidates are required to opt any three papers from Paper III to XIII

COMPULSORY PAPERS

Paper – I: Analysis and Advanced Calculus

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Subspace of a metric space, Product space, Continuous mappings, Sequence in a metric space, Convergent, Cauchy sequence. Complete metric space, Baire's category theorem, compact sets, compact spaces, Separable metric space and connected metric spaces.

Unit 2: Normed linear spaces. Quotient space of normed linear spaces and its completeness. Banach spaces and examples. Bounded linear transformations. Normed linear space of bounded linear transformations. Weak convergence of a sequence of bounded linear transformations.

Unit 3. Equivalent norms, Basic properties of finite dimensional normed linear spaces and compactness. Reisz Lemma. Multilinear mapping. Open mapping theorem. Closed graph theorem. Uniform boundness theorem. Continuous linear functionals. Hahn-Banach theorem and its consequences. Embedding and Reflexivity of normed spaces. Dual spaces with examples.

Unit 4: Inner product spaces. Hilbert space and its properties. Cauchy-Schwartz inequality, Orthogonality and Functionals in Hilbert Spaces. Phythagorean theorem, Projection theorem, Separable Hilbert spaces and Examples, Orthonormal sets, Bessel's inequality, Complete orthonormal sets, Parseval's identity, Structure of a Hilbert space, Riesz representation theorem, Reflexivity of Hilbert spaces.

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Unit 5: Adjoint of an operator on a Hilbert space. Self-adjoint, Positive, Normal and Unitary operators and their properties. Projection on a Hilbert space. Invariance. Reducibility. Orthogonal projections. Eigen values and eigen vectors of an operator. Spectrum of an operator Spectral theorem.

Reference Books:

1. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons., 1978.
2. A. E. Taylor, Introduction to Functional Analysis, John Wiley, 1958.
3. W. Rudin, Functional Analysis, McGraw-Hill, 1973.

Paper II VISCOUS FLUID DYNAMICS

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration Theory Paper Max. Marks 100

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Viscosity , Analysis of stress and rate of strain, Stokes' law of friction, Thermal conductivity and generalized law of heat conduction, Equations of state and continuity , Navier- Stokes' equations of motion , Vorticity and circulation, Dynamical similarity, Inspection and dimensional analysis, Buckingham theorem and its application, Non-dimensional parameters and their physical importance : Reynolds number, Froude number, Mach number, Prandtl number, Eckart number, Grashoff number, Brinkmann number, Non – dimensional coefficients : Lift and drag coefficients, Skin friction , Nusselt number, Recovery factor.

Unit 2 : Exact solutions of Navier – Stokes' equations, Velocity distribution for plane couette flow, Plane Poiseuille flow, Generalized plane Couette flow, Hagen-Poiseuille flow, Flow in tubes of uniform cross-sections, Flow between two concentric rotating cylinders.

Unit 3 : Stagnation point flows : Hiemenz flow, Homann flow. Flow due to rotating disc, Concept of unsteady flow, Flow due to plane wall suddenly set in the motion (Stokes' first problem), Flow due to an oscillating plane wall (Stokes' second problem), Starting flow in plane Couette motion, Suction/injection through porous wall.

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Unit 4 : Equation of energy, Temperature distribution : Between parallel plates, in a pipe, between two concentric rotating cylinders, variable viscosity plane Couette flow, temperature distribution of plane Couette flow with transpiration cooling.

Unit 5 : Theory of very slow motion: Stokes' and Oseen's flows past a sphere, Concept of boundary layer , Derivation of velocity and thermal boundary equations in two-dimensional flow. Boundary layer on flat plate (Balsius-Topfer solution), Simple solution of thermal boundary layer equation for Pr = 1.

Reference Books:

1. J.L. Bansal, Viscous Fluid dynamics, JPH, Jaipur , 2008.
2. M.D.Raisinghania, Fluid Dynamics, S.Chand, 2003.
3. F. Chorlton, A Text Book of Fluid Dynamics, CBC, 1985.
4. S. W. Yuan, Foundations of Fluid Mechanics, Prentice-Hall, 1976.
5. S. I. Pai, Viscous Flow Theory I- Laminar Flow, D. Van Nostrand Co., Ing., Princeton, New Jersey, N.Y., Landon, Toronto, 1956.
6. F.M.White, Viscous Fluid Flow, McGraw-Hill, N.Y., 1974.

OPTIONAL PAPERS

Candidates are required to opt any three papers given below:

Paper – III: Continuum Mechanics

Teaching : 6 Hours per Week

Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Cartesian Tensors, Index notation and transformation laws of Cartesian tensors. Addition, Subtraction and Multiplication of cartesian tensors, Gradient of a scalar function, Divergence of a vector function and Curl of a vector function using the index notation. ε-δ identity. Conservative vector field and concept of a scalar potential function. Stokes', Gauss' and Green's theorems.

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Unit 2: Continuum approach, Classification of continuous media, Body forces and surface forces. Components of stress tensor, Force and Moment equations of equilibrium. Transformation law of stress tensor. Stress quadric. Principal stress and principal axes. Stress invariants and stress deviator. Maximum shearing stress.

Unit 3: Lagrangian and Eulerian description of deformation of flow. Comoving derivative, Velocity and Acceleration. Continuity equation. Strain tensors. Linear rotation tensor and rotation vector, Analysis of relative displacements. Geometrical meaning of the components of the linear strain tensor, Properties of linear strain tensors. Principal axes, Theory of linear strain. Linear strain components. Rate of strain tensors. The vorticity tensor. Rate of rotation vector and vorticity, Properties of the rate of strain tensor, Rate of cubical dilation.

Unit 4: Law of conservation of mass and Eulerian continuity equation. Reynolds transport theorem. Momentum integral theorem and equation of motion. Kinetic equation of state. First and the second law of thermodynamics and dissipation function. Applications (Linear elasticity and Fluids) – Assumptions and basic equations. Generalized Hook's law for an isotropic homogeneous solid.

Unit 5: Compatibility equations (Beltrami-Michell equations). Classification of types of problems in linear elasticity. Principle of superposition, Strain energy function, Uniqueness theorem, p-ρ relationship and work kinetic energy equation, Irrotational flow and Velocity potential, Kinetic equation of state and first law of Thermodynamics. Equation of continuity. Equations of motion. Vorticity-stream surfaces for inviscid flow, Bernoullis equations. Irrotational flow and velocity potential. Similarity parameters of fluid flow.

Reference Books:

1. W. Prager, Introduction to Mechanics of Continua, Lexinton Mass, Ginn, 1961.
2. A.C. Eringen, Mechanics of Continua, Wiley, 1967.
3. T.J. Chung, Continuum Mechanics, Prentice- Hall, 1988.

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Paper- VIII: Integral Transforms and Integral Equations
Teaching : 6 Hours per Week
Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Laplace transform– Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals. Properties of inverse Laplace transform. Convolution theorem. Complex inversion formula.

Unit 2: Fourier transform – Defiition and properties of Fourier sine, cosine and complex transforms. Convolution theorem. Inversion theorems. Fourier transform of derivatives. Mellin transform– Definition and elementary properties. Mellin transforms of derivatives and integrals. Inversion theorem. Convolution theorem.

Unit 3: Infinite Hankel transform– Definition and elementary properties. Hankel transform of derivatives. Inversion theorem. Parseval Theorem.
Solution of ordinary differential equations with constant and variable coefficients by Laplace transform. Application to the solution of Simple boundary value problems by Laplace, Fourier and infinite Hankel transforms.

Unit 4: Linear integral equations– Definition and classifications. Conversion of initial and boundary value problems to an integral equation. Eigen values and Eigen functions. Solution of homogeneous and general Fredholm integral equations of second kind with separable kernels Solution of Fredholm and Volterra integral equations of second kind by methods of successive substitutions and successive approximations. Resolvent kernel and its results. Conditions of uniform convergence and uniqueness of series solution.

Unit 5: Solution of Volterra integral equations of second kind with convolution type kernels by Laplace transform. Solution of singular integral equations by Fourier transform.

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Integral equations with symmetric kernels– Orthogonal system of functions. Fundamental properties of eigen values and eigen functions for symmetric kernels. Expansion in eigen functions and bilinear form. Hilbert-Schmidt theorem. Solution of Fredholm integral equations of second kind by using Hilbert-Schmidt theorem. Classical Fredholm theory– Fredholm theorems. Solution of Fredholm integral equation of second kind by using Fredholm first theorem.

Reference Books:

1. Shanti Swarup, Integral Equations, Krishna Publications, Meerut.
2. M.D.Raisinghania, Integral Equations and Boundary Value Problems, S.Chand, 2010.
3. Lokenath Debnath and Dambaru Bhatta, Integral Transforms and their Applications, Taylor and Francis Group, 2014.
4. Abdul J. Jerry, Introduction to Integral Equations with applications, Marcel Dekkar Inc. NY, 1999.
5. L.G.Chambers, Integral Equations: A short Course, Int. Text Book Company Ltd. 1976.
6. Murry R. Spiegal, Laplace Transform (SCHAUM Outline Series), McGraw-Hill, 1965.

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Paper- XII: Advanced Numerical Analysis
Teaching : 6 Hours per Week
Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Iterative methods – Theory of iteration method, Acceleration of the convergence, Chebyshev method, Muler's method, Methods for multiple and complex roots. Newton-Raphson method for simultaneous equations, Convergence of iteration process in the case of several unknowns.

Unit 2: Solution of polynomial equations – Polynomial equation, Real and complex roots, Synthetic division, the Birge-Vieta, Bairstow and Graeffe's root squaring method. System of simultaneous Equations (Linear)- Direct method, Method of determinant, Gauss-Jordan, LU-Factorizations-Doolitte's, Crout's and Cholesky's. Partition method. Method of successive approximate-conjugate gradient and relaxation methods.

Unit 3: Eigen value problems– Basic properties of eigen values and eigen vector, Power methods, Method for finding all eigen values of a matrix. Jacobi, Givens' and Rutishauser method. Complex eigen values.

Curve Fitting and Function Approximations – Least square error criterion. Linear regression. Polynomial fitting and other curve fittings, Approximation of functions by Taylor series and Chebyshev polynomials.

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Unit 4: Numerical solution of Ordinary differential Equations – Taylor series Mathod, Picard method, Runge-Kutta methods upto fourth order, Multistep method (Predictor-corrector strategies), Stability analysis – Single and Multistep methods.

Unit 5: BVP's of ordinary differential Equations – Boundary value problems (BVP's), Shooting methods, Finite difference methods. Difference schemes for linear boundary value problems of the type $y'' = f(x,y), y'' = f(x,y,y')$ and $y^{iv} = f(x,y)$.

Reference Books:

1. S.S.Sastry, Introductory Methods of Numerical Analysis, PHI, 1979.
2. V.Rajaraman, Computer Oriented Numerical Methods, PHI, 1993.
3. M.K.Jain, S.R.K. Eyenger and R.K. Jain, Numerical Methods for Mathematics and Applied Physicists, Wiley-Eastern Pub., N.Delhi, 2005.
4. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
5. C. F. Gerald and P. O. Wheatley, App;ied Numerical Analysis, Pearson Education, India,7th edition, 2008.
6. C.F. Gerald, P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.
7. S. D. Conte, C de Boor, Elementary Numerical Analysis, McGraw-Hill, 1980.
8. C.E. Froberg, Introduction to Numerical Analysis, (Second Edition), Addition-Wesley, 1979.

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