M.Sc (Semester1) ---- 1

MA 5330 Real Analysis

Real number system and its order completeness, sequences and series of real numbers. Metric spaces: Basic concepts, continuous functions, completeness, Baire Category Theorem, Contraction mapping theorem, connectedness, Intermediate Value Theorem, Compactness, Heine-Borel Theorem. Differentiation, Taylor's theorem, Riemann-Stieltjes integral and its properties, Improper integrals. Sequences and series of functions, Uniform convergence, power series and Fourier series, Weierstrass approximation theorem, Equicontinuity, Arzela-Ascoli theorem.

References :

Text Books:
1. W. Rudin, Principles of Mathematical Analysis, Mc-Graw Hill, 1976.
2. C. C. Pugh, Real Mathematical Analysis, Springer, 2002.
References:
1 T. M. Apostol, Mathematical Analysis, Addison-Wesley, 1974.
2. G. F. Simmons, Topology and Modern Analysis, Kreiger, 2003.

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MA5310 Linear Algebra

Systems of Linear Equations, Matrices and Elementary Row Operations, Row-Reduced Echelon Matrices . Vector Spaces, Subspaces, Bases and Dimension, Ordered basis and coordinates. Linear transformations, Rank-Nullity Theorem, The algebra of linear transformations, Isomorphism, Matrix representation of linear transformations, Linear Functionals, Annihilator, Double dual, Transpose of a linear transformation . Characteristic Values and Characteristic Vectors of linear transformations, Diagonalizability, Minimal polynomial of a linear transformation, Cayley-Hamilton Theorem, Invariant Subspaces, Direct-sum decompositions, Invariant Direct sums, The primary decomposition theorem, Cyclic subspaces and annihilators, Cyclic decomposition, rational, Jordan forms. Inner Product Spaces, Orthonormal Basis, Gram-Schmidt Theorem.

References :

Text Books:
1. K. Hoffman and R. Kunze: Linear Algebra, 2nd Edition, Prentice Hall of India, 2005.
2. M. Artin: Algebra, Prentice Hall of India, 2005.
References:
1. I. N. Herstein: Topics in Algebra, 2nd Edition, John-Wiley, 1999.
2. S. Axler: Linear Algebra Done Right, 2nd Edition, Springer UTM, 1997.
3. S. Lang: Linear Algebra, Springer Undergraduate Texts in Mathematics, 1989.
4. S. Kumaresan: Linear Algebra: A Geometric Approach, Prentice-Hall of India, 2004.

MA5370 MULTIVARIABLE CALCULUS

Differential Calculus: Functions of several variables, Open sets, Limits and continuity, Derivatives of a scalar field with respect to a vector, Directional derivatives, Partial derivatives, Total derivative, Gradient of a scalar field, Level sets and tangent planes, Derivatives of vector fields, Chain rules for derivatives, Derivatives of functions defined implicitly, Higher order derivatives, Taylor's theorem.
Applications of Differential Calculus: Maxima, Minima, Saddle points, Stationary points, Lagrange's multipliers, Inverse function theorem, Implicit function theorem.
Line Integrals: Paths and line integrals, Fundamental theorems of calculus for line integrals, Vector fields and gradients.
Multiple Integrals: Double and triple integrals, Iterated integrals, Change of variables formula, Applications to area and volume, Green's theorem, Two-dimensional vector fields and gradients.
Surface Integrals: Parametric representation of a surface, Fundamental vector product and normal to a surface, Stokes' theorem, Curl and divergence of a vector field, Gauss' divergence theorem.

References :

Text Books:
1. T.M.Apostol, Calculus Vol. II, 2nd Ed., John Wiely & Sons, 2003. [Ch. 8, 9, 10, 11, 12.]
2. T.M.Apostol, Mathematical Analysis, 2nd Ed., Narosa Pub. House, 1997. [Sec. 13.2, 13.3, 13.4]
References:
1. D.V.Widder, Advanced Calculus, 2nd Ed., PHI Learning, 1987.
2. M.R.Spiegel, Vector Analysis, Schaum's Outline Series, Mc-Graw Hill, 1959.
3. H.M.Edwards, Advanced Calculus-A Differential Forms Approach, Birkhauser, 1994.

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MA5350 Fundamentals of Discrete Mathematics

Logic: Connectives, quantifiers, validity, satisfiability, consequences, equivalence, logical laws, deductions, conjunctive and disjunctive normal forms of truth functions.
Set Theory: Relations and functions, cardinality, Cantor-Schroder-Bernstein theorem, finite and infinite sets, countable and uncountable sets, continuum hypothesis, axiom of choice, well ordering principle, Zorn's lemma.
Graph Theory: Relations and digraphs, simple graphs, paths and cycles, connectedness, trees, Hamiltonian and Eulerian graphs, planar graphs.

References :

Texts books:
1. R.R. Stoll, Set Theory and Logic, Dover Publications Inc., New York, 1979.
2. J.A.Bondy and U.S.R.Murty, Graph Theory, Springer-Verlag, New York, 2008.
References:
1. A.Singh, Logics for Computer Science, PHI Learning, New Delhi, 2003.
2. J.R.Munkres, Topology, PHI Learning, New Delhi, 2001.
3. P.R.Halmos, Naive set Theory, Springer-Verlag, New York, 1974.
4. J.L.Mutt, A.Kandel, and T.P.Baker, Discrete Mathematics for Computer Science and

Mathematics, PHI Learning, New Delhi, 2003.
5. T.Koshy, Discrete Mathematics with Applications, Elsevier, New York, 2004.
6. D.B.West, Introduction to Graph Theory, 2nd Ed., PHI Learning, New Delhi, 2003.

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MA5390 Ordinary Differential Equations

Existence-Uniqueness: Review of exact solutions of first order, The method of successive approximations, Lipschitz condition, Convergence of successive approximations, Existence and Uniqueness of solutions of initial value problem, Non-local existence of solutions, Existence and uniqueness of solutions to systems, Existence and uniqueness of solutions to linear systems, Equations of order n.
Second Order Equations: General solution of homogeneous equations, Non-homogeneous equations, Wronskian, Method of variation of parameters, Sturm comparison theorem, Sturm separation theorem, Boundary value problems, Green's functions, Sturm-Liouville problems.
Series Solution of Second Order Linear Equations: ordinary points, regular singular points, Legendre polynomials and properties, Bessel functions and properties.
Systems of Differential Equations: Algebraic properties of solutions of linear systems, The eigenvalue-eigenvector method of finding solutions, Complex eigenvalues, Equal eigenvalues, Fundamental matrix solutions, Matrix exponential, Nonhomogeneous equations, Variation of parameters.

References :

Text Books:
1. E.A. Coddington, An Introduction to Ordinary Differential Equations, PHI Learning 1999.
2. G.F. Simmons, Differential Equations with Applications and Historical Notes, 2nd Ed.,McGraw- Hill, 1991.
3. R.P. Agarwal and R.C.Gupta, Essentials of Ordinary Differential Equations, McGraw-Hill, 1993.
4. M. Braun, Differential Equations and Their Applications, 3rd Ed., Springer-Verlag, 1983.
References:
1. P.J. Collins, Differential and Integral Equations, Oxford University Press, 2006.
2. G.F. Simmons and S.G. Krantz, Differential Equations: Theory, technique and practice, Tata McGraw-Hill, 2007.
3. W.E.Boyce and R.C. Di-Prima, Elementary Differential Equations and Boundary Value Problems, John Wiely & Sons, 2001.
4. R.P. Agarwal and D. O'Regan, An Introduction to Ordinary Differential Equations, Springer-Verlag, 2008.