P.G. 2nd Semester

Paper: MTH801C (Core)
Topology
Credits: 4 = 3+1+0 (48 Lectures)

Unit-I

Order relations, dictionary order, well ordered set, minimal uncountable well ordered set $S\Omega$, Definition and examples of topological spaces; basis and sub basis; order topology; product topology on XxY, subspace topology; Closed sets and limit points, Hausdorff space.

[12 Lectures]

Unit - II

Continuity and related concepts; Homeomorphism; Pasting lemma, Product topology and Box topology; Metric topology, Quotient topology. [8Lectures]

Unit - III

Connected spaces, Connected subspace of the real space; component, path component; local connectedness, local path-connectedness. [6Lectures]

Unit - IV

Compact spaces; Tube lemma; Finite product of compact spaces; Compact subspaces of the real space; limit point compact and sequentially compact spaces; locally compact spaces; one point compactification; statement of Tychonoff's theorem.

[10Lectures]

Unit - V

Countability axioms; Lindeloff spaces and separable spaces. Separation axioms; Normal Spaces; Urysohn's lemma; statement of Urysohn's metrization theorem. Tietze's extension theorem.

[12Lectures]

Books Recommended

1. J. R. Munkres, Topology:a first course , Prentice-Hall of India Ltd., New Delhi, 2000
2. J. L. Kelley, General Topology, Springer Verlag, New York, 1990.

Books for Reference

1. K.D. Joshi, An introduction to general topology (2nd edition), Wiley Eastern Ltd., New Delhi, 2002.
2. J. Dugundji, General Topology, Universal Book Stall, New Delhi, 1990.

Paper: MTH802C (Core)
Abstract Algebra
Credits: 4 = 3+1+0 (48 Lectures)

Unit -I

Group action and permutations representations, group acting on themselves by left multiplication- Cayley's theorem, groups acting on themselves by conjugation, class equation, automorphisms, theorems, simplicity of A_n.

[14Lectures]

Unit -II

Direct products, the fundamental theorem of finitely generated abelian group, group of small order, recognising direct products, semi-direct products, p-groups, solvable groups.

[14Lectures]

Unit -III

A brief review of polynomial rings over a field, reducible and irreducible polynomials, primitive polynomials, Gauss theorem for reducibility of$f(x) \in Z[x]$, Eisenstien's criterion for irreducibility of $f(x) \in Z[x]$ over Q, roots of polynomials, Finite fields of order 4,8,9 and 27 using irreducible polynomials over Z_2 and Z_3.

[10Lectures]

Unit -IV

Subfield and prime fields, extensions of fields, algebraic extension, splitting field.

[10Lectures]

Books Recommended

1.D.S.Dummit and R.M.Foote , Abstract Algebra(3rd Edition), Wiley,2011

2. T. W. Hungerford , Abstract Algebra(3rd edition), Brooks/Cole,1996

3. N. Jacobson, Basic Algebra I (3rd edition) , Hindustan Publishing corporation, New Delhi, 2002.

Books for Reference

1. J. B. Fraleigh , A First Course in Abstract Algebra (4th edition), Narosa Publishing House, New Delhi, 2002.

2. J. A. Gallian, Contemporary Abstract Algebra (4th edition), Narosa Publishing House, New Delhi, 1999.

3. I. N. Herstein,Topics in Algebra, Wiley,2006

Paper: MTH803C (Core)
Differential Equations
Credits: 4 = 3+1+0 (48 Lectures)

Unit-I

Initial value problems(IVP) for first order equations; Lipschitz condition, existence and uniqueness theorem for first order equations. Initial value problems for second order equations; existence theorem; uniqueness theorem; linear dependence and independence of solutions; Wronskian.

[10Lectures]

Unit-II

Partial Differential equations reducible to equations with constant coefficients. Second order PDE with variable coefficients. Characteristic curves of second order PDE. Monge's method of solution of non-linear PDE of second order. Reduction to canonical forms. Solutions of PDE of second order by the method of separation of variables.

[10Lectures]

Unit-III

Elliptic differential equations. Occurrence and detailed study of the Laplace and the Poisson equation. Maximum principle and applications, Green's functions and properties.

[8Lectures]

Unit-IV

Parabolic differential equations. Occurrence and detailed study of the heat equation. Maximum principle. Solutions of IVPs for heat conduction equation. Green's function for heat equation, Duhamel's principle.

[10Lectures]

Unit-V

Hyperbolic differential equations. Occurrence and detailed study of the wave equation. Solution of three dimensional wave equation. Method of descent and Duhamel's principle. Solutions of equations in bounded domains and uniqueness of solutions.

[10Lectures]

Books Recommended(s):

1. E. A. Coddington, An Introduction to Ordinary Differential Equations ,Dover Publication, 1989
2. I.N. Sneddon, Partial Differential Equations ,McGraw-Hill, 1957
3. K.S.Rao, Introduction to partial differential equations ,Prentice Hall of India, New Delhi, 2006

Reference Book(s):

1. R. Haberman, Elementary Applied Partial Differential equations, Prentice-Hall, New Jersey, 1987

2.W.E. Willams, Partial Differential Equations ,Oxford University Press, 1980

3. W.A.Strauss, Partial Differential Equations: An Introduction ,John Wiley, 1992

Paper: MTH804C (Core)
Complex Function Theory
Credits: 4 = 3+1+0 (48 Lectures)

Unit-I

Complex form of equations of straight lines, half planes, circles, etc., analytic (holomorphic) function as mappings; conformal maps; Mobius transformation; cross ratio; symmetry and orientation principle; examples of images of regions under elementary analytic function. branch of logarithm, Riemann-Stieltjes integrals.

[12Lectures]

Unit-II

Power series representation of analytic functions, zeros of analytic functions, maximum modulo theorem, Cauchy's theorem and integral formula on open subset of C,

[12Lectures]

Unit-III

Homotopy, homotopic version of Cauchy's theorem, simple connectedness, counting zeros, open mapping theorem, Goursat's theorem, Classification of singularities,extended plane and stereographic projection, Laurent series.

[12Lectures]

Unit-IV

Residues, contour integration, argument principle, Rouche's theorem, maximum principle, Schwarz's lemma. Analytic continuation..

[12Lectures]

Books Recommended

1. J. H. Mathews, and R. W.Howell, Complex Analysis for Mathematics and Engineering,(3rd Edition), Narosa, 1998.

2. J. B.Conway, Functions of One Complex Variable(2nd Edition),Narosa Publishing House, 1994

Books for Reference

1. L. V. Ahlfors, Complex Analysis(3rd Edition) ,McGraw-Hill Publishing Company, New Delhi, 1979).

2. H.A. Priestly, Introduction to Complex Analysis(2nd Edition),Cambridge University Press, 2008

3. T. W. Gamelin, Complex Analysis, Springer, 2003.

4.R. Narasimhan, and Y. Nievergelt, Complex Analysis in One Variable(2nd Edition), Springer (India), New Delhi, 2004.

5. R. V. Churchill, Complex Variables and applications, McGraw-Hill, 1996.

6. S. Ponnusamy, and H. Silverman, Complex Variables and Applications, Birhkäuser, 2006.

Paper: MTH805L (Lab)
Lab 2: Numerical Analysis and Computation
Credits: 4 = 2+0+2 (32 Lectures)

Unit -I

Systems of linear algebraic equations and their solutions: iterative methods; Gauss- Jacobi, Gauss-Seidel, successive over-relaxation iteration methods. Iterative method for matrix inversion; error analysis, rate of convergence.

Unit -II

The algebraic eigen value Problem: Solutions of eigen value problem by Jacobi's method, Given's method, Power method.

Unit -III

Ordinary differential equations: Euler's method, Single step Methods, Taylor series method , Runge-Kutta's method, multi-step methods, Milne-Simpson method; stability and convergence analysis.

Unit -IV

Finite difference methods for 2D and 3D elliptic boundary value problems (BVPs) and error analysis.

Lab work : C program / Matlab / Fortran

Books Recommended

1. C.F.Gerald &P.O.Wheatly, Applied Numerical Analysis(7^{th} Edition), Pearson, 2004

2. W. W. Hager ,Applied Numerical Linear Algebra, Prentice Hall International Editions, 1988

3. J.C. Strickwerda, Finite Difference Schemes & Partial Differential Equations, SIAM publications, 2004.

Reference Books

1.M.K. Jain, S.R.K. Iyengar, R.K. Jain: Numerical Methods for Scientific and Engineering Computation, New Age,2014

2. K. W. Morton, & David Mayers, Numerical solution of partial differential equations, Cambridge University Press, 2005.

3. J.W.Thomas, Numerical Partial Differential Equations: Finite Difference Methods, Springer Verlag, Berlin, 1998.