GONDWANA UNIVERSITY,
GADCHIROLI.

STUDY COMMITTEE IN MATHEMATICS
M.SC. I & II (MATHEMATICS)
SEMESTER WISE SYLLABUS

WITH EFFECT FROM
2012-13 Subsequently

GONDWANA UNIVERSITY, GADCHIROLI.

STUDY COMMITTEE IN MATHEMATICS

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Total Marks : 2500

Each Paper : 100 marks theory + 25 marks sessional

Periods Allotted per week per paper : 05 Hrs.

M. Sc. Semester-I

Compulsory Papers

1. Paper I Algebra-I
2. Paper II Real Analysis-I
3. Paper III Topology-I
4. Paper IV Linear Algebra and differential equations

Optional Papers (Any One)

5. Paper V Numerical Analysis
6. Paper VI Integral Equations
7. Paper VII Fuzzy Mathematics-I

M. Sc. Semester-II

Compulsory Papers

1. Paper I Algebra-II
2. Paper II Real Analysis-II
3. Paper III Topology-II
4. Paper-IV Differential geometry

Optional Papers (Any One)

5. Paper-V Classical Mechanics
6. Paper VI Mathematical Methods
7. Paper VII Fuzzy Mathematics-II

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M. Sc. Semester-III

Compulsory Papers

1. Paper I Complex Analysis
2. Paper II Functional Analysis

Optional Papers (Any three)

3. Paper-III Fluid Dynamics-I
4. Paper- IV General Relativity
5. Paper-V Operations Research-I
6. Paper VI Algebraic Topology-I
7. Paper- VII Operator Theory
8. Paper –VIII Non-linear programming
9. Paper IX MATLAB Programming

M. Sc. Semester-IV

Compulsory Papers

1. Paper-I Dynamical Systems
2. Paper-II Partial Differential Equations

Optional Papers (Any three)

3. Paper-III Fluid Mechanics-II
4. Paper-IV Cosmology
5. Paper V Operations Research-II
6. Paper VI Advanced Algebra
7. Paper VII Algebraic Topology-II
8. Paper- VIII Banach Algebras
9. Paper – IX Computational Fluid Dynamics

Semester-III

Paper- I

Complex Analysis

Unit1: Impossibility of ordering Complex numbers. Extended complex plane and stereographic projection. Elementary properties and examples of analytic Functions: Power series, analytic functions.

Unit2: Analytic functions as mappings, Mobius transformations.Power series representation of analytic functions, zeros of an analytic function, index of a closed curve.

Unit3: Cauchy's theorem and integral formula, the homotopic version of cauchy's theorem and simple connectivity, counting zeros; the open mapping theorem, Goursat's theorem, Classification of singularities, residues, the argument principle.

Unit4: The maximum principle. Schwarz's lemma. convex functions and Hadamards three circles theorem. Phragmen-Lindelof theorem.

Text Book: Functions of one complex variable: John B. Conway, Second edition, Springer international Student Edition.

Reference Book: Complex Analysis, L.V. Ahlfors. Mc-Graw Hill, 1966.

Paper- II

Functional Analysis

Unit 1 : Normed spaces, Banach spaces, Further properties of normed spaces. Finite dimensional normed spaces and subspaces. Compactness and finite dimension. Bounded and continuous linear operators.

Unit 2 : Linear functionals. Normed spaces of operators. Dual spaces. Inner product space. Hilbert space. Further properties of inner product spaces. Orthogonal complements and direct sums. Orthonormal sets and sequences. Total orthonormal sets and sequences.

Unit 3 : Representation of functionals on Hilbert spaces. Hilbert adjoint operators, self adjoint, unitary and normal operators. Hahn-Banach Theorem, Hahn-Banach Theorem for complex vector spaces and normed spaces. Adjoint operator. Reflexive spaces.

Unit 4 : Category theorem, Uniform boundedness theorem, strong and weak convergence, Convergence of sequences of operators and functionals. Open mapping theorem, Closed linear operators and closed graph theorem.

Text Book:

Introductory Functional Analysis with Applications by E. Kreyszig, John Wiley and Sons. 12

Reference Books :

1.Introduction to Functional Analysis by A.E.Taylor and D.C.Lay, John Wiley and Sons.
2. Introduction to Topology and Modern Analysis: G.F. Simmons, Mc Graw Hill

Paper- III

Fluid Dynamics-I

(Optional)

Unit1: Real fluids and ideal fluids. Velocity of a fluid at a point. Stream lines and path lines. Steady and unsteady flows. Velocity potential. Velocity vector. Local and particle rate of change. Equation of continuity. Acceleration of a fluid. Condition at a rigid boundary. General analysis of fluid motion. Euler's equation of motion. Bernoulli's equation. Worked examples. Discussion of the case of steady motion under conservative body forces. Some further aspects of vortex motion.

Unit2: Sources, sinks and doublets. Images in a rigid infinite plane. Images in solid spheres. Axisymmetric flows. Stokes' stream function. The complex potential for two-dimensional irrotational, incompressible flow. Complex velocity potential for standard two dimensional flow. Uniform stream. Line source and line sink. Line doublets. Line vortices. Two dimensional image systems. The Milne- Thomson circle theorem. Circle Theorem. Some applications of circle theorem. Extension of circle theorem. The theorem of Blasius

Unit3: The equations of state of a substance, the first law of thermodynamics, internal energy of a gas, functions of state, entropy, Maxwell's thermodynamic relation, Isothermal Adiabatic and Isentropic processes.Compressibility effects in real fluids, the elements of wave motion. One dimensional wave equation, wave equation in two and three dimensions, spherical waves, progressive and stationary waves.

Unit4: The speed of sound in a gas, equation of motion of a gas. Sonic, subsonic, supersonic flows; isentropic gas flow. Reservoir discharge through a channel of varying section, investigation of maximum mass flow through a nozzle, shock waves, formation of shock waves, elementary analysis of normal shock waves.

Text Book :

F. Chorlton, Text book of Fluid Dynamics, CBS Publishers, Delhi 1985.

Reference Books :

1.G.K. Batchelor , An Introduction to fluid Mechanics, Foundation Books, New Delhi 1994.

2.M.D. Raisinghania, fluid Mechanics, S. Chand and Company , Delhi

Paper-IV

General Relativity

(Optional) 13

Unit 1: Tensor Algebra, Riemannian geometry, Curvature Tensor: Covariant Curvature tensor, Ricci tensor, Einstein Tensor, The Bianchi identity.

Unit 2:The principle of covariance, The principle of equivalence, Geodesic principle, Newton's equations of motion as an approximation of geodesic equations, Poisson's equations as an approximation to Einstein field equations.

Unit 3: Gravitational field equations in free space, Exterior Schwarzchild's solution and its isotropic form, Birkhoff's theorem, Schwarzchild singularity, planetary orbit, Advance of Perihelion of a planet, Bending of light rays in the gravitational filed, Gravitational Red shift in the spectral lines.

Unit 4: Gravitational field equations for non empty space, Linearization of the field equations, The Weyl's solution of linearized Field equations, Interior Schwarzchild's solution.

Text Book :

Introduction to General Relativity: Ronald Adler, Maurice Bezin and Manamen Schiffer, McGraw-Hill

Kogakusha Ltd.

References Books:

1.Introduction to theory of relativity , Rosser W.G.V., ELBS(1972).

2.Relativity Special, General and Cosmology, Rindler W., Pub. Oxford University Press(2003).

3.The Classical Theory of Fields By Landau I.D. and Lifshitz E.M., Pub. Pergamon Press(1978).

Paper-V

Operational Research–I

(Optional)

Unit1: Simplex method, Theory of Simplex method, duality, dual simplex method.

Unit2: Transportation and Assignment problems.

Unit3: Two–person Zero – sum games. Games with mixed strategies, graphical solution, solution by linear programming.

Unit4: Dynamic programming

Text book:

Operations Research :Kanti-Swarup P.K. Gupta and Man Mohan: Sultan Chand and Sons New Delhi.

Reference books :

1.Linear programming: G. Hadley, Narosa Publishing House1995.

2. Introduction to operations Research: F.S. Hillier and G.J.Lieberman (Sixth Edition), Mc Graw Hill

International Edition 1995.

3.Operations Research – In Introduction: H.A Taha, Macmillan publishing company inc, New York 14

Paper- VI

Algebraic Topology- I

(Optional)

Unit1: Geometric complexes and polyhedra. Simplicial homology groups.

Unit2: Simplicial approximation.

Unit3: The Fundamental group.

Unit4: Covering spaces.

Text Book :

Basic Concepts of Algebraic Topology: Fred H.Croom, Springer-Verlag.

Reference Books :

1. Topology : J.R.Munkres, Prentice Hall, Second Edition, 2000

2.Topology : J.G. Hocking and G.S. Young : Addison Wesley, 1961

Paper- VII

Operator Theory

(Optional)

Unit 1: Basic concepts about spectrum. Spactral properties of bounded linear operators. Further properties of resolvent and spectrum. Use of complex analysis in spectral theory.

Unit 2: Banach Algebras. Further properties of Banach Algebras. Compact linear operators on normed spaces. Further properties of Compact linear operators. Spectral properties of compact linear operators.

Unit 3: Further spectral properties of Compact linear operators. Operator equations involving compact linear operators. Further theorems of Fredholm type. Fredholm alternative.

Unit 4: 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 operator. Further properties of projections. Spectral family. Statement of spectral representation theorem.

Text Book:

Introductory Functional Analysis with Applications by E. Kreyszig, John Wiley and Sons

Reference book :

Introduction to Functional Analysis by A.E.Taylor and D.C.Lay, John Wiley and Sons 15

Paper- VIII

Non-linear Programming

(Optional)

Unit1: The non-linear programming problem and its fundamental ingredients. Linear inequalities and the theorem of the alternative. The optimality criteria of linear programming. Tucker's lemma and existence theorems. Theorems of the alternative Convex sets – Separation theorems.

Unit2: Convex and concave functions - basic properties and some fundamental theorems for convex functions. Generalised Gordan theorem. Bohnenblust – Karlin – Shapley theorem.

Unit3: Saddle point optimality criteria without differentiability – The minimization and the local minimization problems and some basic results. Sufficient optimality theorem. Fritz John Saddle point necessary optimality theorem. Slater's and Karlin's constraint qualifications and their equivalence. The strict constraint qualification. Kuhn – Tucker saddle point optimality theorems.

Unit4: Differentiable concave and convex functions - Some basic properties. Twice differentiable convex and concave functions. Theorems in cases of strict convexity and concavity of functions.Optimality criteria with differentiability- Optimality theorems, Fritz John stationary point necessary optimality theorem.

Text Book : Non- linear programming: O.L. Mangasarian, Mc Graw Hill, New York.

Reference Book : Non- linear programming-Theory and Algorithms,: Mokhtar S. Bazaraa and C.M.Shetty, John Wiley, New York.

Paper- IX

MATLAB PROGRAMMING

(optional)

Unit1: Input output of data from Matlab command. File types. Creating, saving and executing the script file. Creating and executing functions file. Working with files and directories.

Unit2: Matrix manipulation. Creating vectors. Arithmetic operations. Relational operations. Logical operations. Matrix functions. Determinant of matrix. Eiugen values and Eigen vectors. Programming in Matlab: function files, sub functions, global variations, loops, branches and control flow. Interactive input. Recursion. Publishing a report. Controlling command windows. Command line editing.

Unit3: Linear Algebra and interpolation: Solving the linear equation. Gaussian elimination, matrix factorization, curve fitting, polynomial curve fitting, least squares curve fitting. General non linear fits. Interpolation.

Unit4: Differential equations and graphics: First order and second order ODE. Double integration. Roots of polynomial. Two and three dimensional plots. Matlab plotting tools. Mesh and surface plots.

Text Books: 16

1.Applied numerical Methods using MATLAB: Won Young Yang, Tae-Sang-Chung, John Morris: John Wiley and Sons.

2.Solving ODE's with Matlab: L.F. Shampine, I Gladwell, S. Thompson; Cambridge University Press.

3.Getting Started with MATLAB 7: Rudra Pratap; Oxford Press.