Minor in Mathematical Analysis

1. Real Analysis
2. Introduction to Topology
3. Differential Geometry of Curves and Surfaces
4. Functional Analysis

Real Analysis

LTP structure: 3-0-0

Course Objective: To discuss in detail the concepts of sequence, series, limit, continuity, derivative, and integration for single and multiple variables along with their applications.

Course Contents:

Real number system, definitions of sequence and convergence, bounded sequences, Cauchy sequence, infinite series, absolute and conditional convergence

Limit, continuity, uniform continuity, differentiability, mean value theorems, Taylor's theorem, Taylor's series, power series, maxima and minima.

Functions of several variables, limit, continuity, differentiability, gradient, directional derivatives, chain rule, Taylor's theorem, Maxima and minima, and method of Lagrange multipliers.

Riemann integral, fundamental theorems of calculus, improper integrals, Multiple integrals.

Text books and references:

1. K. A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2nd Edition, 2013.
2. Walter Rudin, Principles of Mathematical Analysis, 3rd edition, Mc Graw Hill 2023.
3. S. R. Ghorpade and B. V. Limaye, A course in Calculus and Real Analysis, Springer, 2006.
4. S. R. Ghorpade and B. V. Limaye, A course in Multivariable Calculus and Analysis, Springer, 2010.

Introduction to Topology

LTP structure: 3-0-0

Course Objective: To introduce the student to elementary properties of topological spaces and structures defined on them such as open and closed sets, interiors and boundaries of sets, homeomorphisms, connectedness, compactness.

Course Contents:

Topological spaces, Basis for a topology, Open and closed sets, Continuous functions, Homeomorphism.

Subspace topology, Product topology, Quotient topology.

Connectedness and path-connectedness, Compactness.

Countability axioms, Separation axioms.

Text books and references:

1. C. Adams and R. Franzosa, Introduction to Topology: Pure and Applied, Pearson-Prentice Hall, 2009.
2. M.A. Armstrong, Basic Topology, M.A. Armstrong, Springer, 2004.
3. J. R. Munkres, Topology, Prentice-Hall, 2000.

Differential Geometry of Curves and Surfaces

LTP structure: 3-0-0

Course objective: To provide a systematic exposition of the essential concepts of modern differential geometry primarily focussing in two and three dimensional Euclidean space.

Course Contents:

Curves in R^2 and R^3: Parametrized curves, Plan and space curves, curvature and torsion, Frenet-Serret formula.

Surfaces: Smooth surfaces, Tangent planes, First fundamental form.

Curvature and Geodesics: Normal curvature, Second fundamental form, Euler's theorem, Definition and examples of Geodesics.

Text Books and references:

1. M. P. Do Carmo, Differential Geometry of Curves and Surfaces, 2nd edition, Dover Publications, 2016.
2. Kristopher Tapp, Differential Geometry of Curves and Surfaces, Springer, 2016.
3. S. Montiel and A. Ros, Curves and Surfaces, 2nd edition, American Mathematical Society, 2009.
4. Andrew Pressley, Elementary Differential Geometry, Springer, 2010.

Functional Analysis

L**TP structure of the course:** 3-1-0

Course Objective: To study linear mappings defined on Banach spaces and Hilbert spaces, especially linear functionals on L_p and C[0,1] and some sequence spaces. In particular, the four big theorems in functional analysis, namely, Hahn-Banach theorem, uniform boundedness theorem, open mapping theorem and Banach-Steinhaus theorem will be covered.

Course Contents:

Banach Spaces, Dimensionality, The Hahn-Banach Theorem, The Uniform Boundedness Principle

The Open Mapping Theorem, Dual Spaces, The Weak Topology, The Second Dual.

Weak* Topology, Hilbert Spaces, Orthonormal Bases, Linear Operators, Adjoint Operators

The Resolvent and the Spectrum, Compact Operators, The Spectral Theorem.

Text Books and references:

1. Functional Analysis, Walter Rudin, Tata McGraw-Hill Education, 2006.
2. A course in functional analysis, J. B. Conway, Springer.
3. Linear functional analysis, Bryan P. Rynne and Martin A. Youngson, Springer.