Approved: 10th Senate Meeting

Course Name	: Topology and Functional Analysis
Course Number	: MA-521
Credit	: 3-1-0-4
Prerequisites	: NA
Students intended for	: M.Sc./M.S./Ph.D./B.Tech 3rd and 4th year
Elective or core	: Core for M.Sc. in applied Mathematics and Elective for other discipline.
Semester	: Odd/Even

Preamble: The objective of this course is to introduce topology and functional analysis. The contents are designed in such a way that it will give foundation of mathematics at a level and depth appropriate for someone aspiring to study higher level mathematics. Many of the concepts and results like Uniform convergence, Hahn Banach, open mapping, closed graph theorems etc are very useful in proving many results in fields like Differential Equations, Numerical Analysis etc.

1. Cartesian Products, Finite Sets, Countable and Uncountable Sets, Infinite Sets and Axiom of Choice, Well Ordered Sets. Topological Spaces, Basis for a topology, Order topology, Subspace Topology, Product topology, closed sets and limit points, Continuous functions, Metric Topology. [Lecture hours: 10]
2. Connected spaces, Components and Local Connectedness, Compact spaces, Countability Axioms, Separation axioms Normal Spaces, Urysohn's Lemma, Titetz Extension Theorem, Tychonoff's Theorem , Metrization Theorem. [Lecture hours: 11]
3. Normed spaces, continuity of linear maps, Hahn - Banach theorems, Banach spaces. Uniform bounded principle, closed graph theorem, Open mapping theorem, bounded inverse theorem, spectrum of Bounded Operator. Duals and transposes, duals of LP [a,b] and C[a,b]. [Lecture hours: 11]
4. Inner product spaces, orthonormal sets, approximation and optimization, projections, Riesz representation theorem. Bounded operators and adjoints on a Hilbert space, normal, unitary and self adjoint operators. [Lecture hours: 10]

Text Books

1. **J. R. Munkres,** Topology, 2nd Edition, Pearson Education (India), 2001**.**
2. **H. L. Royden**, Real Analysis, 3rd edition, Prentice Hall of India, 1995.

Reference Books

1. **G.F. Simmons,** Introduction to Topology and Modern Analysis, McGraw-Hill, New York, 1963.
2. **J. L. Kelley,** General Topology, Van Nostrand, 1955.

3. **B. V. Limaye**, Functional Analysis.
4. **K. Yoshida**, Functional Analysis, Springer.
5. **S. Nanda and B. Choudhari** Functional Analysis With Application, New Age International Ltd.
6. **S. C. Bose,** Introduction to Functional Analysis, Macmillan India Ltd