



**MANGALORE UNIVERSITY**

**DEPARTMENT OF MATHEMATICS**

**MSC MATHEMATICS**

<b>MTH 553</b>	<b>Functional Analysis</b>	<b>4 Credits (48 hours)</b>
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**Course Outcome:** Students will have the knowledge and skills to explain and apply the concepts: Baire's theorem, Banach spaces, Continuous linear transformations, the Hahn Banach theorem, the open mapping theorem, Uniform boundedness principle, Hilbert spaces, and Normal and unitary operators. These concepts are useful in Fourier analysis, wavelet and curvelet theories and also in Quantum mechanics.

**Course Specific Outcome:** At the end of the course Students will have the knowledge and skills to understand, explain in depth and apply in various situations the concepts-

- To develop basic understanding of the theory of Banach spaces, continuous linear transformations, Hahn Banach Theorem etc.
- To study the basics of Hilbert spaces, orthonormal sets, The conjugate of a Hilbert space etc.
- To understand the theory of adjoint operators, Normal operators, Finite dimensional spectral theorem etc.

**Unit I**

**Review of metric spaces:** Convergence, Completeness and Baire's theorem.

**Banach spaces:** Definition and some examples, Continuous linear transformations, The Hahn Banach theorem, The natural embedding of  $N$  in  $N^{**}$ , The open mapping theorem, Uniform boundedness principle.

**(26 Hours)**

## Unit II- Hilbert spaces:

Definition and examples, Orthogonal complements, Orthonormal sets, The conjugate of a Hilbert space, The adjoint operator, Self-adjoint operators, Normal and unitary operators, Projections, Finite dimensional spectral theorem.

(22 Hours)

## References

- [1] G. F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw Hill, 2004.
- [2] A. E. Taylor, David Lay, *Introduction to Functional Analysis*, John Wiley and Sons, 1980.
- [3] Ward Cheney, *Analysis for Applied Mathematics*, Graduate Texts in Mathematics, Springer, 2001.
- [4] Walter Rudin, *Real and Complex Analysis*, 3rd Ed., McGraw Hill, 1986.
- [5] M. Thamban Nair, *Functional Analysis - A First Course*, Prentice-Hall, 2002.

