Syllabus:
Normed linear space; Banach spaces and basic properties; Heine-Borel theorem, Riesz lemma and best approximation property; Inner product space and projection theorem; Orthonormal bases; Bessel inequality and Parseval's formula; Riesz-Fischer theorem.

Bounded operators and basic properties; Space of bounded operators and dual space; Riesz representation theorem; Adjoint of operators on a Hilbert space; Self adjoint, Normal and Unitary Operators; Examples of unbounded operators; Convergence of sequence of operators.

Hahn-Banach Extension theorem; Uniform boundedness principle; Closed graph theorem and open mapping theorem. Some applications. Invertibility of operators; Spectrum of an operator. Spectral theory of self adjoint compact operators.

Text books:
1. B.V. Limaye, Functional Analysis, Second Edition, New Age International,
1996. 2. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1966.

References:
1. M. Thamban Nair, Functional Analysis: A First Course, Prentice-Hall of India, 2004. 2. B. Bollabas, Linear Analysis, Cambridge University Press, Indian Edition, 1999. 3. Martin Schechter, Principles of Functional Analysis, 2nd Edition, American Mathematical Society, 2001
4. G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 1963. 5. E. Kreyzig, Introduction to Functional Analysis with Applications, Wiley India Private Limited, 2007.
6. A. E. Taylor and D.C. Lay, Introduction to Functional Analysis, 2nd Edition, Wiley, New York, 1980.

Code:MAT5302: Partial Differential Equations Prerequisites: Basic knowledge Calculus, linear algebra, complex analysis, ordinary differential equations	L	T	P	Credit
	4	1	0	4

Course Category	Core

Course Type	Theory
Course Objective	Introduce the concepts of existence and uniqueness of solution of differential equations. Develop analytical techniques to solve differential equations Understand the properties of solution of differential equations. Explore decomposition of continuous functions with Fourier Series. Appreciate the complexities and varied techniques for PDEs
Course Outcome(s)	Use knowledge of partial differential equations (PDEs), modelling, the general structure of solutions, and analytic and numerical methods for solutions. Formulate physical problems as PDEs using conservation laws. understand analogies between mathematical descriptions of different (wave) phenomena in physics and engineering. Classify PDEs, apply analytical methods, and physically interpret the solutions. Demonstrate accurate and efficient use of Fourier analysis techniques and their applications in the theory of PDE's. Apply problem-solving using concepts and techniques from PDE's and Fourier analysis applied to diverse situations in physics, engineering, financial mathematics and in other mathematical contexts.

Syllabus:

Partial Differential Equations - First Order Partial Differential Equations - Linear equations of first order. Nonlinear Partial Differential Equations of the first order - Cauchy's method of characteristics - Compatible systems of first order equations - Charpit's method - Special types of First order equations - Jacobis method. Partial Differential Equations of Second order - The origin of Second order Equations, Canonical forms - Linear Partial Differential Equations with constant coefficients - Equations with variable coefficients - Characteristics curves of second order equations - Characteristics of equations in three variables.

The Solution of Linear Hyperbolic Equations - Separation of variables - The Method of Integral

Transforms - Nonlinear Equations of the second order. Elliptic Equation - Occurrence of Laplace Equations in Physics - Elementary solution of Laplace equations - Families of equipotential surfaces, Boundary value problems - Separation of variables - Problems with axial symmetry. Properties of Harmonic functions, Spherical mean - Maximum-minimum principles.

The wave equation - Occurrence of wave equation in Physics - Elementary solutions of one dimensional wave equation - D'Alembert solution - Vibrating Membranes: Applications of the calculus of variations, Duhamel's principle - Three dimensional problems. The Diffusion Equations: Elementary solutions of the Diffusion Equation - Separation of variables - Maximum minimum principles - The use of Integral transforms.

Text books:

1. N. Sneddon, Elements of Partial Differential Equations, Dover, 2006.
2. Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, Birkhauser, Boston, 2007.

References:

1. Fritz John, Partial Differential Equations, Springer, 1991 .
2. Walter A. Strauss, Partial Differential Equations: An Introduction, John Wiley & Sons Inc., 2008.
3. Sandro Salsa, Partial Differential Equations in Action: From Modelling to Theory, Springer, 2nd Edition. 2015.
4. Gerald B. Folland, Introduction to Partial Differential Equations. Second Edition, Princeton University Press, 2nd Edition, 1995.
5. Garabedian P. R., Partial Differential Equations, John Wiley and Sons, 1964. 6. Prasad P and Ravindran R., Partial Differential Equations, Wiley Eastern, 1985. 7. Renardy M. and Rogers R. C., An Introduction to Partial Differential Equations, Springer- Verlag, 1992.

Code:MAT5303: Numerical Analysis Prerequisites: Basic knowledge Calculus, linear algebra, complex analysis, ordinary differential equations	L	T	P	Credit
	4	1	0	**4**

Course Category	Core
Course Type	Theory