Course Outcome(s)	The main contents include: Introduction to probability theory, random variable, probability density, mean, and variance of a random variable. The applications include interest rate, coupon bonds, arbitrage, Brownian

	motion, geometric Brownian motion for mathematical models on stock price, etc.

Syllabus:
Introduction to investment securities and financial derivatives, Random walk, Brownian Motion, Geometric Brownian Motion, Interest rates and Present Value Analysis, Pricing Contracts via Arbitrage, Arbitrage Theorem, Black-Scholes Formula, Valuing by expected utility, Exotic Options, Models for Crude Oil data, Autoregressive Models and Mean reversion.

Text books:
1. S. M. Ross, An Elementary Introduction to Mathematical Finance, 3rd Edition, Cambridge University Press, 2011.

References:
1. John Hull, Options, Futures, and Other Derivatives, 8th Edition, Prentice Hall, 2011. 2. M. Baxter and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 1996.
3. Darrell Duffie, Dynamic Asset Pricing Theory, 3rd Edition, Princeton University Press, 2001. 4. Paul Wilmott, Sam Howison and Jeff Dewynne, The Mathematics of Financial Derivatives: A Student Introduction, Cambridge University Press, 1995.
5. J. P. Fouque, G. Papanicolaou and K. R. Sircar, Derivatives in Financial Markets with Stochastic Volatility,Cambridge University Press, 2000.

Code:MAT5014: Mathematical Methods Prerequisites:	L	T	P	Credit
	3	2	0	**4**

Course Category	Elective
Course Type	Theory

Course Objective	The main aim is to make students familiar with Laplace, Fourier transformations, extrema of functional through calculus of variations and integral equations.
Course Outcome(s)	The course students will be able to recognize difference between Volterra and Fredholm Integral Equations, First kind and Second kind, homogeneous and inhomogeneous etc. They apply different methods to solve Integral Equations. Students will have much better and deeper understanding of the fundamental concepts of the space of admissible variations and concepts of a weak and a strong relative minimum of an integral.

Syllabus:

INTEGRAL TRANSFORMS: Laplace transform: Definition - properties - Laplace transforms of some elementary functions - Convolution Theorem - Inverse Laplace transformation - Applications. Fourier transform: Definition - Properties - Fourier transform of some elementary functions - Convolution theorem - Fourier transform as a limit of Fourier Series - Applications to

PDE.

INTEGRAL EQUATIONS: Volterra Integral Equations: Basic concepts – Relationship between Linear differential equations and Volterra integral equations - Resolvent Kernel of Volterra Integral equation - Solution of Integral equations by Resolvent Kernel- The Method of successive approximations - Convolution type equations, solution of integral differential equations with the aid of Laplace transformation. Fredholm Integral equations: Fredholm equations of the second kind, Fundamentals - Iterated Kernels, Constructing the resolvent Kernel with the aid of iterated Kernels - Integral equations with degenerate Kernels - Characteristic numbers and eigen functions, solution of homogeneous integral equations with degenerate Kernel - non-homogeneous symmetric equations- Fredholm alternative.

CALCULUS OF VARIATIONS: Extrema of Functionals: The variation of a functional and its properties - Euler's equation - Field of extremals - suffcient conditions for the Extremum of a Functional, conditional Extremum, Moving boundary problems - Discontinuous problems - one sided variations - Ritz method.

Text books:

1. I. M. Gelfand and S. V. Fomin, Calculus of Variations, Dover, 2000.
2. Ram P Kanwal, Linear Integral Equations, Academic Press, 1971.

References:

1. I. N. Sneddon, The Use of Integral Transforms, Tata McGraw Hill, 1972. 2. Porter D. and Stirling S. G., Integral Equations, A Practical Treatment, Cambridge University Press, 1990.
3. Gakhov F. D., Boundary Value Problems, Addision Wesley, 1966.
4. Muskhelishvilli N. I., Singular Integral Equations, Noordho_, 1963.
5. M. L. Krasnov, G. K. Makarenko and A. I. Kiselev, Problems and Exercises in Calculus of Variations, Imported Publishers, 1985.
6. Ram P Kanwal, Linear Integral Equations, Academic Press, 1971.
7. A. M. Wazwaz, A First Course in Integral Equations, World Scienti_c, 1997. 8. F. B. Hildebrand, Methods of Applied Mathematics, Prentice Hall, 1965. Introduction, Cambridge University Press, 1995.

Code:MAT5015: Operator Theory Prerequisites: Real analysis, topology and functional analysis	L	T	P	Credit
	3	2	0	4

Course Category	Elective