Approval: 8th Senate Meeting

Course Name: Mathematical Foundations of Financial Engineering

Course Number: MA553

Credit: 2-1-0-3

Prerequisites: IC 110, IC 111, IC 210

Intended for: 3rd and 4th Year UG/PG

Distribution: Elective

Semester: Odd /Even

Course Preamble: The course covers the essential tools to understand the theory behind the financial derivatives. It is designed especially for undergraduate students who are planning to do advanced applied courses related to Mathematical and Computational Finance.

Course Outline:

The course covers basic mathematical analysis related with sequence and series of functions, convex analysis and results used in portfolio theory, introduction to Lebesgue integration, stochastic analysis and B-S model and its numerical solution. At the end of the course, students are expected to be familiar and able to understand advanced mathematical models used in the area of computational finance used financial industry.

Modules:

[3 Lectures]

Convex Analysis, constraint qualifications for convex optimization. Numerical Solution of QPP.

[15 Lectures]

Riemann Integration, Measurable space and function, Lebesgue Integration, Wiener process and properties, Martingales and stopping times, Strong Markov property, stochastic integrals, Ito processes.

[12 Lectures]

Introduction to PDE, Diffusion equation and its numerical solution, Diffusion process, connecting stochastic and partial differential equations, Black-Scholes Equation, numerical solution of Black-Scholes Equation.

Text Books:

1. Elementary stochastic Calculus with Finance in View, Thomas Mikosch, World Scientific, 1999.

2. Mathematics for finance: an introduction to financial engineering, M. Capinski and T. Zastawniak, Springer, 2010.
3. Pricing financial instruments: The finite difference method. Tavella, Domingo, and Curt Randall. Vol. 13. John Wiley & Sons, 2000.

Reference Books:

1. Financial Calculus, M. Baxter and A. Rennie, Cambridge University Press, 1996.
2. Nonlinear Programming, Olvi L. Mangasarian, Society for Industrial and Applied Mathematics (SIAM), 1994.
3. Principles of Mathematical Analysis, Walter Rudin, McGraw-Hill, 3rd Edition., 1976.
4. Principles of financial engineering, S. N. Neftci. Academic Press/ Elsevier, 2009.