

Computational Finance

- 1.1 Course Number: MA 441
- 1.2 Contact Hours: 3-0-0 Credits: 09
- 1.3 Semester-offered: 4th Year-Odd
- 1.4 Prerequisite: Numerical Methods, Financial Engineering-I, Mathematical Finance, Financial Engineering-II.
- 1.5 Syllabus Committee Member: Dr. C. Kundu, and Dr. M. K. Rajpoot, Dr. A. Kumar (Convener), Dr. G. Rakshit.
2. **Objective:** This course aims at providing the knowledge of financial market, finite difference methods, Monte Carlo method, and their implementation to solve option pricing problems.
3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction	Review of financial market models for derivative pricing, interest rate modelling and Black-Scholes PDE.	06
2	Finite difference methods for standard options	Solutions of pricing PDEs using finite difference methods, American option as free boundary problem, computation of price of American options, pricing of exotic options.	09
3	Monte Carlo methods for standard options	Monte-Carlo simulation, generating sample paths, discretization of stochastic differential equations (SDE), Monte-Carlo for option valuation and Greeks, Monte-Carlo for American and exotic options.	12
4	Monte Carlo methods (Continue...)	Variance reduction techniques; Monte-Carlo implementation of short rate models, forward rate models and LIBOR market model, volatility structure and calibration.	12
		Total	39

4. Readings

4.1 Textbook:

1. R. U. Seydel, Tools for Computational Finance, 5th Ed., Springer, 2012.
2. P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer, 2004.

4.2 Reference books:

1. Y.-l. Zhu, X. Wu, I-L. Chern and Z.-z. Sun, Derivative Securities and Difference Methods, 2nd Ed., Springer, 2013.
2. D. Higham, Introduction to Financial Option Valuation: Mathematics, Stochastics and Computation, Cambridge University Press, 2004.
3. P. Wilmott, S. Howison and J. Dewynne, The Mathematics of Financial Derivatives: A Student Introduction, Cambridge University Press, 1997.
4. Y. Lyuu, Financial Engineering and Computation, Cambridge University Press, 2002.

5 Outcome of the Course:

At the end of the course the students will be able to understand the fundamental knowledge of selected financial models for option pricing and their numerical approximations.