

Department of Mathematics
Faculty of Mathematics & Computer Science
PhD, Mathematics

Course Code	AM 507
Course Title	Computational Finance
Course Credits	02

Course Objectives:

To provide an experience of formulating financial problems into mathematical models and computational illustrations. Role of differential equations in computational finance such as barrier option pricing, black-scholes equations etc. Introduce various numerical techniques for valuation, pricing and hedging of financial investment instruments such as options.

Minimum Pre-requisites:

Elementary Ordinary and Partial Differential Equations

Course structure:

Introduction to computational finance, Exotic options, Single and double barrier, plain vanilla and capped power call options, Time dependent volatility,

Barrier and lookback option modelling: Discrete and continuous monitoring, lookback options and jumps, continuity corrections for discrete barrier options, Complex barrier options.

Meshless method in financial engineering: Radial basis functions, Application of the one factor Black-Scholes equation.

Black-Scholes Model: Jump-diffusion process, Numerical solution of partial integro-differential equations and financial applications,

Asian options: Finite difference methods and operator splitting methods for Asian options and mixed problems, Cheyette interest models.

Multi-Asset Options: Exchange, Rainbow, Basket, Quotient, Foreign equity, Quanto, spread and Dual-strike options. Numerical solution of multi asset Black-Scholes equations.

Fixed Income Problems: Interest rate modelling, Single factor model, Stochastic models: Merton, Vasicek, CIR, Longnormal models.

Lab Practical: Symbolic and numerical solution of Black-Scholes equations. Graphical solutions to various mathematical models in finance.

Reading suggestions:

- Finite Difference Methods in Financial Engineering: A Partial Differential Approach-Daniel J. Duffy (Wiley) 2006

- Computational Financial Mathematics Using Mathematica: Optimal Trading -Srdjan Stojanovi (Birkhäuser) 2003

Evaluation and Weightage:

- Mid-semester Test (40%)
- End-semester Test (40%)
- Quiz & assignments (20%)