

## **MA654 Financial Engineering**

---

Credit: 2-1-0-3

Students intended for: Ph.D.

**Prerequisites:** Good knowledge of multivariable calculus, probability, statistics and random process and at least one of C/C++/MATLAB/R/Spread sheets Packages.

Elective or Core: Elective

Semester: Odd

### **Course objective:**

The course provides an introduction to financial markets. Some basic concepts related with derivative instruments and arbitrage shall be discussed. The course also covers Options theory and various model of option pricing with their application in hedging and risk management. The course concepts would be covered with the help of real market data. After completing this course, students are expected to be able to build investment strategies and do risk management using derivatives. Students are expected to work and submit a project report on a project on Indian/Foreign Market Data.

### **Course content:**

- Some Basic Definitions and Terminology [2 hrs]
- Forward and Future contracts, Definition and pricing, dividends and transaction costs. [3 hrs]
- Efficient Market Hypothesis, Discrete and continuous random variable, Concept of Arbitrage, Duality theorem in LP and Fundamental theorem. [3 hrs]
- Asset Price Moment, Introduction to Option Markets, Options Valuations, Basic Option Theory, The Binomial Model, Black-Scholes Model and solution, Time dependency and change of variable, The Greeks and their properties. [10 hrs]
- Bullish, Bearish and Neutral options strategies. [6 hrs]
- General principle of Hedging, Different types of Hedging, Delta Hedging, Delta Neutral Portfolio, Gamma Neutral Portfolio. [6 hrs]

### **Text books:**

Options, Futures and Other Derivatives, J.C. Hull, 7<sup>th</sup> Edition, Prentice Hall of India / Pearson Education, 2006.

Mathematics for Finance: An Introduction to Financial Engineering, M. Capinski and T. Zastawniak, Springer, 2005.

Introduction to the Mathematics of Finance: From Risk Management to Options Pricing, S. Roman, Springer, 2004.

**Reference Books:**

N. H. Bingham and R. Kiesel, Risk Neutral Valuation, 2nd Edition, Springer, 2004.

Financial Modeling, Simon Benninga, 3rd edition, MIT Press, 2008.

Option Pricing and Portfolio Optimization, Ralf Korn, ElkeKorn, American Mathematical Society, 2000.