

Discipline Specific Elective (DSE) Courses

Discipline Specific Elective (DSE) Course 4a: Statistics in Finance

Structure 1: PG Curricular Structure with only Course Work
 Structure 2: PG Curricular Structure with Course Work + Research
 Structure 3: PG Curricular Structure with Research only

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisite of the course (if any)
		Lecture (45 Hours)	Tutorial (00 Hours)	Practical (30 Hours)		
DSE 4a: Statistics in Finance	04	03	00	01	NIL	Basic knowledge of Probability Theory

Course Objectives:

- To introduce students to a range of various market-related financial instruments.
- Learn selected statistical models used to analyze and interpret market behavior.

Course Learning Outcomes: After completion of this course, student will be able to:

- Understand mean behavior, fluctuations and cycles of financial markets.
- Understand concept of derivatives in markets.
- To model price of an asset that exhibits random changes as new market information arrives.
- To understand and differentiate between mean square calculus and it calculus.
- To conduct analytic and predictive study on market data.

Unit I (11 Hours)

Derivatives: Forward Contract, Call Option, Put Option, Zero Coupon bond, Discount bond, No arbitrage, Binomial tree model, Binary one-period Model, Arbitrage relations for option management.

Unit II (11 Hours)

Random walk, Geometric random walk, Brownian motion with examples for each from financial markets. Stochastic integrals and differential equations.

Unit III (11 Hours)

Stock price as a stochastic process. Itô's lemma. Black-Scholes option pricing model.

Expectations and efficient markets. Volatility. Value at Risk.

Unit IV (12 Hours)

Econometric models for stock price, exchange rate, term structure and options. Market price of risk. ARCH (q) and GARCH (p, q) models, their estimation and applications.

Essential Readings:

1. Franke J., Hardle W.K. and Hafner C.M. (2011) Statistics of Financial Markets: An Introduction, 3rd ed, Springer.
2. Hull, J. C., and Basu, S. (2021). Options, futures, and other derivatives. Pearson Education India.
3. Tankov, P. (2010). Financial Modeling with Lévy Processes, e-Book.

Suggested Readings:

1. Lamberton, D. and Lepeyre, B. (2008). Introduction to Stochastic Calculus Applied to Finance, 2nd ed., Chapman and Hall/CRC Press.
2. Privault, N. (2014). Stochastic Finance –An Introduction with Market Examples, Chapman and Hall/CRC. Financial Mathematics Series, CRC Press.

List of Practicals:

1. Payoff graph under given call strategies with varying exercise prices and option transaction.
2. Simulation of (i) a group of parallel straight lines, whose points form a lattice (ii) Fibonacci generators.
3. Generate a pair of standard normal variate by using (i) Box-Muller method (ii) Marsaglia method.
4. Verify (i) whether prices of options are consistent under portfolio change (ii) arbitrage opportunities' existence and /or occurrence.
5. Study impact of stock price on insured and non-insured portfolio values and returns.
6. To determine number of stocks and/or options for investing and their delivery price.
7. Calculation of option price for binary one-period model.
8. Problems based on real-market situations which follow Brownian motion.
9. Estimation and fitting of ARCH (q) and GARCH (p, q) model.