Discipline Specific Elective Course for B.Sc. (H) Statistics
Semester-VII

DISCIPLINE SPECIFIC CORE COURSE – 5A: FINANCIAL STATISTICS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Financial Statistics	4	3	0	1	Class XII pass with Mathematics.	Basic knowledge of Stochastic processes, Calculus and Probability theory and Financial markets

Learning Objectives

The learning objectives include:

- To study the Financial Statistics which deals primary and secondary financial markets and the mathematical models used by these markets?
- To study the Stochastic Calculus, this is the study of infinitesimal changes in stochastic processes and the methods of dealing with such changes over time.

Learning Outcomes:

After completing this course, students should have developed a clear understanding of:

- Primary financial markets and their products such as equity, bonds and cash deposits
- Secondary financial markets and their products such as futures, forwards and options (American and European)
- Stochastic calculus- Stochastic differentiation and integration
- Stochastic differential equations and methods of solving them
- Applications of stochastic differential equations in formulating models to price various secondary financial markets products.
- Hedging techniques

SYLLABUS OF DSE- 5a

Theory

UNIT I **(15 hours)**

Introduction to investment and markets, Cash flows. Net present value, Future value, Internal rate of return, criteria for project appraisal, Basic theory of interest, different interest rates and their relationships, discount rates, bonds-pricing and yields, yield curves, spot rates, spot rate curves, Zero- coupon bonds, perpetual bonds and discount bonds, Introduction to derivatives, Tools Needed for Option Pricing: Forward contracts, spot price, forward price, future price, Call and put options, binary one period model, Pricing derivatives: Arbitrage relations and perfect financial markets, Pricing futures, Put call parity for European and American options, Relationship between strike price and option price.

UNIT II **(15 hours)**

Discrete Stochastic Processes- Binomial processes, General random walks, Geometric random walks, Binomial models, Trinomial models. Continuous time processes – Brownian motion, Geometric Brownian motion, Wiener process; Introduction to stochastic calculus: stochastic integration, stochastic differential equations and their solutions; Itô's lemma. Black-Scholes differential equation

UNIT III **(15 hours)**

Intrinsic of option markets: Black-Scholes formula for European options, Implied volatility, Binomial Model for European options, Hedging portfolios: Delta, Gamma and Theta hedging. Cox-Ross-Rubinstein approach to option pricing. Discrete dividends, Trinomial model for American options, pricing American options, put call parity for American options, relationship between American and European options.

PRACTICAL/LAB WORK – (30 hours)

List of Practical:

1. Relationship between various interest rates
2. Present value and future value
3. Relationship between interest rates and discount rates
4. To compute NPV and to obtain IRR of the investments.
5. To compute bond price and yields
6. Determination of spot rate curve
7. To verify "no arbitrage" principle.
8. To price future / forward contracts
9. Simulation of continuous time stochastic processes
10. To price options using Black – Scholes formula.
11. Pricing of options using discrete time models.
12. Impact of dividend on option prices.
13. Call-put parity for European options.
14. Application of Greeks to hedge investment portfolios.
15. Pricing of American options
16. Put call parity for American options.

ESSENTIALREADINGS:

- David, G.L. (2015). Investment Science, Oxford University Press(South Asian edition)
- Franke, J., Hardle, W.K. and Hafner, C.M. (2011). Statistics of Financial Markets: An Introduction, 3rd Ed., Springer Publications
- John C. Hull and Sankarshan Basu (2022) Options, Future and other derivatives, 11thedition, Pearson Indian edition.

SUGGESTIVEREADINGS:

- Ovidiu Calin(2022): An informal introduction to stochastic calculus and its applications , second edition World Scientific
- Baxter, M., Rennie, A., & Rennie, A.J. (1996). Financial calculus: An introduction to derivative pricing. Cambridge university press.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE – 5B: ADVANCED DESIGN OF EXPERIMENTS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Advanced Design of Experiments	4	3	0	1	Class XII pass with Mathematics	Basic Knowledge of Design of Experiments

Learning Objectives
The learning objectives include:

- To design and conduct experiments.
- To analyse and interpret data.
- To construct designs.
- To apply experimental design techniques in real world problems.

Learning Outcomes:
After completing this course, students should be able to:

- Apply of ANOVA technique for two – way classification, fixed effect models with unequal number of observations per cell, Random effect models with one observation per cell and the concept of Mixed effects models.
- Design and analysis of incomplete block designs, understand the concepts of orthogonality, connectedness and balancing.
- Understand the concepts of finite fields and finite geometries and apply them in constructing MOLS, balanced incomplete block designs.
- Apply techniques of Response surface methodology and appreciate the concepts of orthogonality, rotatability and blocking.