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.

- Understand the concept of mixture experiments that are useful in our daily life, food industry, chemical industry, pharmaceutical companies.
- Understand and apply Crossover designs in practical situations.

SYLLABUS OF DSE - 5b
Theory

UNIT I **(6 hours)**
Analysis of Variance
Fixed effect models (2-way classification with unequal number of observations per cell), Random effect models (2-way classification with one observation per cell) and the concept of Mixed effect models.

UNIT II **(12 hours)**
Incomplete Block Designs
Concepts of Connectedness, Orthogonality and Balance. Intra block analysis of General Incomplete Block design. B.I.B designs with and without recovery of inter block information.

UNIT III **(13 hours)**
Finite fields
Finite Geometries- Projective geometry and Euclidean geometry. Construction of complete set of mutually orthogonal Latin squares. Construction of B.I.B.D. using finite Abelian groups, MOLS, finite geometry and method of differences.

UNIT IV **(14 hours)**
Some Useful Designs
Response surface designs for first and second order models, concepts of orthogonality, rotatability and blocking. Mixture Experiments–models and designs, Cross-over designs

PRACTICAL/LAB. WORK (30 HOURS)

List of Practical:
1. Based on ANOVA for 2-way classification with unequal number of observations per cell under fixed effects model
2. Based on ANOVA 2-way classification with one observation per cell under random effects model
3. Based on ANOVA 2-way classification with one observation per cell under mixed effects model
4. Based on Intra block analysis of an IBD
5. Based on analysis of a BIBD with and without inter block analysis.
6. Based on response designs for first and second-order models.
7. Based on mixture designs,
8. Based on Cross-over designs.

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2016). An Outline of Statistical Theory, Vol 2, The world Press Private Limited.
- Das, M.N. and Giri, N.C. (2024). Design and Analysis of Experiments, Wiley Eastern Limited.
- Dey, A. (1986). Theory of Block Designs, John Wiley & Sons.
- Hinkel mann, K. and Kempthorne, O. (2022). Design and Analysis of Experiments, Vol. 2: Advanced Experimental Design,9th edition, John Wiley & Sons.
- Bose, M. and Dey, A. (2009). Optimal Crossover Designs, World Scientific.

- Cornell, John A. (2002). Experiments with Mixtures, John Wiley & Sons.
- Myers, R. H. and Montgomery, D. C. (2016). Response Surface Methodology: Process and Product Optimization using Designed Experiments, 4 th edition John Wiley & Sons.

SUGGESTED READINGS

- Chakrabarti, M.C. (1962). Mathematics of Design and Analysis of Experiments, Asia Publishing House, Bombay.
- Dean, A. and Voss, D. (2017). Design and Analysis of Experiments, Springer 2 nd edition. First Indian Reprint 2006.
- John, P.W.M. (1971). Statistical Design and Analysis of Experiments, Macmillan Co., New York.
- Kshirsagar, A.M. (1983). A Course in Linear Models, Marcel Dekker, Inc., N.Y.
- Montgomery, D. C. (2005). Design and Analysis of Experiments, 6th ed., John Wiley & Sons.
- Raghavarao, D. and Padgett, L. V. (2005). Block Designs: Analysis, Combinatorics, and Applications, World Scientific.
- Raghavarao, D. (1970). Construction and Combinatorial Problems in Design of Experiments, John Wiley & Sons.
- Wu, C. F. J. and Hamada, M. (2011). Experiments: Planning, Analysis and Parameter Design Optimization, John Wiley & Sons.

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

DISCIPLINE SPECIFIC ELECTIVE COURSE –5C : ADVANCED THEORY OF BIOSTATISTICS

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 theory of Biostatistics	**4**	**3**	0	**1**	Studied Biostatistics	Basic knowledge of survival analysis and survival models

Learning objectives:
The learning objectives include:

- Comparison of Survival in two groups
- Epidemiological Study and epidemic models.
- Independent and dependent risks in Competing risk theory.
- Concept of Relative Risk, Odds Ratio and Attributable Risk.
- Concept of Clinical trials.

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