Discipline Specific Core (DSC) Course 2b: Design of Experiments

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisite of the course (if any)
		Lecture (45 Hours)	Tutorial (15 Hours)	Practical (00 Hours)		
DSC 2b: Design of Experiments	**4**	**3**	**1**	**0**	**NIL**	**NIL**

Course Objectives:

- To provide students ability to formulate the design and conduct experiments, as well as to analyze and interpret data.

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

- Apply ANOVA for two –way classification, fixed effect models with equal, unequal and proportional number of observations per cell, Random and Mixed effect models with m (>1) observations per cell.
- Design and analyse incomplete block designs, understand the concepts of orthogonality, connectedness and balance.
- Understand the concepts of finite fields and finite geometries and apply them in construction of MOLS, construction of balanced incomplete block designs, confounded factorial experiments.
- Identify the effects of different factors and their interactions and analyse factorial experiments.
- Construct complete and partially confounded factorial designs and perform their analysis.
- Apply Split-plot designs and their analysis in practical situations.
- Understand the effects of independence or dependence of different factor under study.

Unit I (12 Hours)

Review of linear estimation and basic designs. Elimination of heterogeneity in two directions. ANOVA: Fixed effect models (2-way classification with equal, unequal and proportional number of observations per cell), Random and Mixed effect models (2-way classification with m (>1) observations per cell).

Unit II (12 Hours)

Incomplete Block Designs. Concepts of Connectedness, Orthogonality and Balance.

Intrablock analysis of Generic Incomplete Block design. B.I.B designs with and without recovery of interblock information.

Unit III (11 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 (10 Hours)

Symmetrical factorial experiments (sm, where s is a prime or a prime power), Confounding in sm factorial experiments through pencils, sk-p fractional factorial where s is a prime or a prime power. Split-plot experiments.

Tutorial:

Tutorial sessions will include at least one activity such as group discussion/presentation/ problem solving exercise based on the material covered in the lectures along with scholastic work related to the conceptual understanding of the subject.

Essential Readings:

1. Chakrabarti, M.C. (1962). *Mathematics of Design and Analysis of Experiments*, Asia Publishing House.
2. Dey, A. (1986). *Theory of Block Designs*, John Wiley & Sons.
3. Nigam, A.K. Puri, P.D. and Gupta, V.K. (1988). *Characterizations and Analysis of Block Designs*, John Wiley & Sons.
4. Raghavarao, D. (1970). *Construction and Combinatorial Problems in Design of Experiments*, John Wiley & Sons.

Suggested Readings:

1. Das, M.N. and Giri, N.C. (1986). *Design and Analysis of Experiments*, John Wiley & Sons.
2. Dean, A. and Voss, D. (1999). *Design and Analysis of Experiments*, Springer.
3. Dey, A. (2010). *Incomplete Block Designs*, World Scientific.
4. Hinkelmann, K. and Kempthorne, O. (2005). *Design and Analysis of Experiments*, John Wiley & Sons.
5. John, P.W.M. (1971). *Statistical Design and Analysis of Experiments*, Macmillan Publishing Co.
6. Kshirsagar, A.M. (1983). *A Course in Linear Models*, Marcel Dekker, Inc.
7. Montgomery, D.C. (2005). *Design and Analysis of Experiments*, John Wiley & Sons.
8. Raghavarao, D. and Padgett, L.V. (2005). *Block Designs: Analysis, Combinatorics, and Applications*, World Scientific.