

Discipline-Specific Elective (DSE) Course- 4f: Statistical Decision Theory

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 (15 Hours)	Practical (00 Hours)		
DSE 4f: Statistical Decision Theory	4	3	1	0	NIL	Basic knowledge of Bayesian Inference

Course Objectives:

- To provide a set of powerful decision-making methods that will help the students to gain critical awareness.
- To develop ability in choosing and using these methods in order to solve various decision-making problems.

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

- Understand the concept of space of randomized decisions, behavioural and optimal decision rules.
- Understand geometric interpretation and applications of Bayes decision rules.
- Discernment and comprehension of notions of admissibility and completeness.
- To handle group decision making in the presence of qualitative variables.
- Formulate solutions of decisions under uncertainty and risks

Unit I (11 Hours)

Decision problem and 2-person game, utility theory, expected loss, decision rules (non-randomized and randomized), decision principles, optimal decision rule.

Unit II (12 Hours)

Concept of admissibility and completeness, Bayes rules, admissibility of Bayes rules. Supporting and separating hyperplane theorems, minimax theorem of finite parameter space, minimax estimators of Normal and Poisson means, admissibility of minimax rules.

Unit III (11 Hours)

Invariant decision rules – location parameter problems, invariance and minimaxity, admissibility of invariant rules, complete class theorem, complete and essentially complete classes in simple estimation and testing situations.

Unit IV (11 Hours)

Sufficient statistics essentially complete classes of rules based on sufficient statistics, complete sufficient statistics.

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. Berger, J.O. (2013). *Statistical Decision Theory and Bayesian Analysis*, Springer.
2. Ferguson, T.S. (2014). *Mathematical Statistics: A Decision Theoretic Approach*, Academic Press.
3. Robert, C.P. (2007). *The Bayesian Choice: A Decision Theoretic Motivation*, Springer.

Suggested Readings:

1. Berger, J.O., Bernardo, J.M. and Sun, D. (2023). *Objective Bayesian Inference*, World Scientific.
2. Bernardo, J.M. and Smith, A.F.M. (2000). *Bayesian Theory*, John Wiley & Sons.
3. Rao, C.R. (2002). *Linear Statistical Inference and its Applications*, Wiley Eastern.
4. Rohatgi, V.K., and Saleh, A.K.Md.E. (2015). *An Introduction to Probability and Mathematical Statistics*, Wiley Eastern.