

Semester II

Discipline Specific Core (DSC) Courses

Discipline Specific Core (DSC) Course 2a: Statistical Inference

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 2a: Statistical Inference	4	3	1	0	NIL	NIL

Course Objectives:

- To make students aware of estimation (both point and interval) and testing (both simple and composite hypotheses) procedures.

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

- Apply various estimation and hypothesis testing procedures to deal with real life problems.
- Demonstrate a comprehensive understanding of Fisher Information, Lower bounds to variance of estimators, Minimum Variance Unbiased Estimator (MVUE).
- Explain and apply the Neyman-Pearson fundamental lemma, develop UMP tests and perform interval estimation, including the construction of confidence intervals.

Unit I (12 Hours)

Minimal sufficiency and ancillarity, Exponential families and Pitman families, Invariance property of Sufficiency under one-one transformations of sample and parameter spaces. Fisher Information for one and several parameters models. Lower bounds to variance of estimators for one and several parameters models, necessary and sufficient conditions for MVUE.

Unit II (12 Hours)

Neyman-Pearson fundamental lemma and its applications, UMP tests for simple null hypothesis against one-sided alternatives and for one-sided null against one-sided alternatives in one parameter exponential family. Extension of these results to Pitman family when only upper or lower end depends on the parameters and to distributions with MLR property.

Unit III (10 Hours)

Non-existence of UMP tests for simple null against two-sided alternatives in one parameter exponential family. Families of distributions with monotone likelihood ratio and UMP tests.

Unit IV (11 Hours)

Interval estimation, confidence level, construction of shortest expected length confidence interval, uniformly most accurate one-sided confidence Interval and its relation to UMP tests for one-sided null against one-sided alternative hypotheses.

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. Bartoszynski, R. and Bugaj, M.N. (2007). *Probability and Statistical Inference*, John Wiley & Sons.
2. Casella, G. and Berger, R.L. (2013). *Statistical Inference*, Cengage Learning.
3. Kale, B.K. (1999). *A First Course on Parametric Inference*, Narosa Publishing House.
4. Rohatgi, V.K. and Saleh, A.K.Md.E. (2005). *An Introduction to Probability and Statistics*, John Wiley & Sons.

Suggested Readings:

1. Ferguson, T.S. (1967). *Mathematical Statistics*, Academic Press.
2. Lehmann, E.L. (1986). *Testing Statistical Hypotheses*, John Wiley & Sons.
3. Lehmann, E.L. (1986). *Theory of Point Estimation*, John Wiley & Sons.
4. Rao, C.R. (1973). *Linear Statistical Inference and Its Applications*, Wiley Eastern Ltd.
5. Zacks, S. (1971). *Theory of Statistical Inference*, John Wiley & Sons.