

**Second Year of Two Year M.Sc. Statistics Programme**

**or**

**One Year M.Sc. Statistics Programme**

**Semester- III /Semester - I**

**Discipline Specific Core (DSC) Course**

**Discipline Specific Core (DSC) Course 3a: Advanced Statistical Inference**

Structure 1: PG Curricular Structure with only Course Work  
Structure 2: PG Curricular Structure with Course Work + Research

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)		
<b>DSC 3a: Advanced Statistical Inference</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>NIL</b>	<b>NIL</b>

**Course Objectives:**

- Understand the principles of parametric, non-parametric, and sequential estimation methods.
- Learn to compute point estimates and interval estimates using different estimation techniques.
- Develop skills in hypothesis testing for both simple and composite hypotheses.

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

- Understand consistency, CAN estimator and MLE.
- Understand UMPU tests, SPRT, OC and ASN.
- Understand non-parametric methods.

- Demonstrate proficiency in various parametric, non-parametric and sequential estimation techniques and testing procedures to deal with real-life problems.

### **Unit I (12 Hours)**

Consistency and asymptotic relative efficiency of estimators, Consistent asymptotic normal (CAN) estimator, CAN estimator for one-parameter Cramer family, Cramer-Huzurbazar theorem, Method of maximum likelihood estimation, Method of scoring, Fisher lower bound to asymptotic variance.

### **Unit II (12 Hours)**

Similar tests, Neyman structure, UMPU tests for composite hypotheses, Likelihood ratio test (LRT), Asymptotic distribution of LRT statistic, Consistency of large sample test.

### **Unit III (10 Hours)**

Sequential tests-SPRT and its properties, Wald's fundamental identity, OC and ASN functions. Sequential estimation.

### **Unit IV (11 Hours)**

Non-parametric methods-estimation and confidence interval, U-statistics and their asymptotic properties, nonparametric tests-single sample location, location-cum-symmetry, randomness and goodness of fit problems.

### **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. Casella, G. and Berger, R.L. (2013). *Statistical Inference*, Cengage Learning.
2. Gibbons, J.D. and Chakraborti, S. (2021). *Nonparametric Statistical Inference*, Chapman and Hall/CRC Press.
3. Kale, B.K. (2005). *A First Course on Parametric Inference*, Alpha Science International.
4. Rohatgi, V. K. and Saleh, A.K.Md.E. (2015). *An Introduction to Probability and Statistics*, John Wiley & Sons.
5. Wald, A. (2004). *Sequential Analysis*, Dover Publications.

**Suggested Readings:**

1. Ferguson, T.S. (1967). *Mathematical Statistics*, Academic Press.
2. Lehmann, E.L. and Casella, G. (1998). *Theory of Point Estimation*, Springer.
3. Lehmann, E.L. and Romano, J.P. (2022). *Testing Statistical Hypotheses*, Springer.
4. Randles, R.H. and Wolfe, D.S. (1979). *Introduction to the Theory of Non-parametric Statistics*, John Wiley & Sons.
5. Rao, C.R. (1973). *Linear Statistical Inference and Its Applications*, Wiley Eastern Ltd.
6. Sinha, S. K. (1986). *Probability and Life Testing*, Wiley Eastern Ltd.
7. Zacks, S. (1971). *Theory of Statistical Inference*, John Wiley & Sons.