

Discipline Specific Core (DSC) Course 1b: Statistical Methodology

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 1b: Statistical Methodology	4	3	1	0	NIL	NIL

Course Objective:

- To provide a thorough theoretical grounding in different type of distributions, non-central distributions, censoring, delta method, robust procedures etc.

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

- Formulate the mathematical/statistical models for real data sets arising in various fields in order to analyse in respect of various useful characteristics of the populations.
- Understand how to use non-central distributions in real life problems.
- Understand different types of censoring schemes and their applications.
- Work with incomplete data which is a challenging problem in today's life.

Unit I (10 Hours)

Brief review of basic distribution theory, Symmetric distributions, Truncated distributions, Compound distributions, Mixture of distributions, Generalized power series distributions, Exponential family of distributions.

Unit II (12 Hours)

Characterization of distributions (Geometric, negative exponential, normal, gamma), Non-central Chi-square, t and F distributions and their properties, Concept of censoring. Approximating distributions, Delta method and its applications, Approximating distributions of sample moments, limiting moment generating function, Poisson approximation to negative binomial distribution.

Unit III (12 Hours)

Order statistics-their distributions and properties. Joint and marginal distributions of order statistics. Extreme values and their asymptotic distributions (statement only) with applications. Tolerance intervals, coverage of $(X_{(r)}, X_{(s)})$. Generic theory of regression, fitting of polynomial regression by orthogonal methods, multiple regression, examination of regression equation.

Unit IV (11 Hours)

Robust procedures, Robustness of sample mean, Sample standard deviation, Chi-square test and Student's t-test. Sample size determination for testing and estimation procedures (complete and censored data) for normal, exponential, Weibull and gamma distributions.

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. Biswas, S. (1992). *Topics in Statistical Methodology*, Wiley-Blackwell.
2. David, H.A. and Nagaraja, H.N. (2003). *Order Statistics*, John Wiley & Sons.
3. Mukhopadhyay, P. (2015). *Mathematical Statistics*, New Central Book Agency.
4. Rohatgi, V.K. and Saleh, A.K.Md.E. (2015). *An Introduction to Probability and Statistics*, John Wiley & Sons.

Suggested Readings:

1. Arnold, B.C., Balakrishnan, N. and Nagaraja, H.N. (1992). *A First Course in Order Statistics*, John Wiley & Sons.
2. Dudewicz, E.J. and Mishra, S.N. (1988). *Modern Mathematical Statistics*, John Wiley & Sons.
3. Huber, P.J. (1981). *Robust Statistics*, John Wiley & Sons.
4. Johnson, N.L., Kotz, S. and Balakrishnan, N. (2000). *Discrete Univariate*, John Wiley & Sons.
5. Johnson, N.L., Kotz, S. and Balakrishnan, N. (2000). *Continuous Univariate Distributions*, John Wiley & Sons.
6. Rao, C.R. (1973). *Linear Statistical Inference and Its Applications*, John Wiley & Sons.
7. Rohatgi, V.K. (1984). *Statistical Inference*, John Wiley & Sons.