ESSENTIAL READINGS:

- Gibbons, J.D., and Chakraborti, S. (2020): Nonparametric statistical inference. CRC press.
- Siegel, S. (1988). Nonparametric statistics for the behavioral sciences, 2nd ed. McGraw-Hill.

SUGGESTIVE READINGS:

- Kloke, J., and McKean, J. W. (2024): Nonparametric statistical methods using R, 2nd Edition. CRC Press.
- Hollander, M., Wolfe, D. A., and Chicken, E. (2013): Nonparametric statistical methods (Vol. 751). John Wiley & Sons.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE–6B: RELIABILITY THEORY AND LIFE TESTING

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Reliability Theory And Life Testing	4	3	0	1	Class XII pass with Mathematics	Knowledge of Probability Distribution and Statistical Inference

Learning Objectives

The learning objectives include:

- To understand the reliability and their application area.
- To develop the thinking of students so that they can use the concepts of reliability in real life scenario.
- To determine if the performance of components, equipment, and systems, either under closely controlled and known stress conditions in a testing laboratory or under field use conditions.
- To determine the growth in the mean life and/or the reliability of units during their research, engineering and development phase.

Learning Outcomes:

After completing this course, students should have developed a clear understanding of:

- Concept of Reliability and life testing.
- Various estimation procedures of reliability function(s).
- Comparison of various estimates of reliability through simulation study using different software.
- Real data fitting in reliability modelling

SYLLABUSOFDSE-6B

THEORY

UNIT I **(12 hours)**

Reliability and reliability measures

Definition of components and systems, coherent systems, Reliability, Maintainability and Availability; Lifetime distributions, failure rates, MTTF, Bathtub failure rate, reliability of coherent systems in terms of paths and cuts, modular decomposition, reliability importance of components; Parametric families of some common lifetime distributions and their properties (Exponential, Weibull and Gamma).

UNIT II **(10 hours)**

Reliability estimation

Various methods of reliability estimation (Classical and Bayesian); Exponential, Weibull and Gamma lifetime distributions, Reliability estimation under complete, truncated and censored samples, estimates based on components of ordered statistics.

UNIT III **(10 hours)**

Stress-Strength and multicomponent reliability

Stress-Strength reliability: concepts and its estimation for exponential, Weibull and gamma distributions, k-out-of-n (exponential and gamma). Mixture distribution, convolutions and competing risks: introduction, mixture of exponentials, mixture of Weibull, competing risk. Bayesian's Approximation and Reliability: Lindley's expansion, reliability estimation (Normal and Weibull)

UNIT IV **(13 hours)**

Reliability systems and life testing

Reliability of series/parallel systems: introduction, series systems with identical components. Reliability bounds (classical and Bayesian approaches), parallel systems. Different types of redundancy and use of redundancy in reliability improvement. Problems of life testing. Notions of Ageing: IFR, IFRA, NBU, DMRL, NBUE and HNBUE classes, their duals and relationship between them.

PRACTICAL/LABWORK–(30hours)

List of Practical:

1. Calculation of reliability function and its estimates
2. Calculation of hazard rate, MTBF for various systems.
3. Calculation of stress-strength reliability and its estimates.
4. Various reliability and hazard rate plots.
5. Validation of reliability estimates through simulation study.
6. Behavior of reliability estimates corresponding to sample size.
7. Behavior of hazard rates corresponding to different values of parameter(s).
8. Effect of different sample sizes on reliability estimates.
9. Comparison of various methods of estimation of reliability through simulation study.
10. Other relevant problems.

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:

- Balagurusamy (2017): Reliability Engineering; Wiley
- Sinha, S.K(1986): Reliability and Life testing; Wiley Eastern.

SUGGESTIVE READINGS:

- Barlow, R.E. and Proschan F. (1981): Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston. (Reprint)
- Lawless, J.F. (2011): Statistical Models and Methods for Life Time Data, 2nd edition; John Wiley.
- Bain L.J. and Max Engelhardt (1991): Statistical Analysis of Reliability and Life Testing Models; Marcel Dekker.
- Nelson, W (2003): Applied Life Data Analysis; John Wiley.
- Rand M and Hoyland A (2020): System reliability theory, Models, Statistical methods and its applications 3rd edition; Wiley.
- Zacks, S (2011 softcover published and 2012 eBook published): Introdcution to Reliability Analysis, Springer Verlag

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE-6C: GENERALIZED LINEAR MODELS

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course title &code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lectures	tutorials	practical		
Generalized Linear Models	4	3	0	1	Class XII Pass with Mathematics	Knowledge of general linear models

Learning Objectives:
Learning objectives include:

- Provide the ability to learn and use linear and non-linear models for normal data
- Developingabilitytolearngeneralizedlinearmodelsfornormalandnon-normal responses.