



Indraprastha College for Women

University of Delhi

Course Name:	B.Sc (H) Mathematics
Paper Title:	Mathematical Statistics
Unique Paper Code:	
Semester:	5
Faculty(s):	Dr. Suman
Year:	2026

Work Plan			
Period	Unit No.	Learning Objective	Topics to be Covered
	1	The joint behavior of several random variables theoretically and through illustrative practical examples	Joint Distributed Random Variables: Joint probability mass function for two discrete random variables, Marginal probability mass function, Joint probability density function for two continuous random variables, Marginal probability density function, Independent random variables.
	1	The joint behavior of several random variables theoretically and through illustrative practical examples	Expected values, covariance, and correlation
	1	The joint behavior of several random variables theoretically and through illustrative practical examples	Linear combination of random variables and their moment generating functions
	1	The joint behavior of several random variables theoretically and through illustrative practical examples	Conditional distributions and conditional expectation, Laws of total expectation and variance.
	1	Understand joint distributions of random variables including the bivariate normal distribution	Bivariate Normal Distribution.
	2	Estimate model parameters from the statistical inference based on point estimation and hypothesis testing	Distribution of important statistics such as the sample totals, sample means, and sample proportions, Central limit theorem (statement with examples and applications), Law of large numbers.

	2	Estimate model parameters from the statistical inference based on point estimation and hypothesis testing	Chi-squared, t, and F distributions; Distributions based on normal random samples.
	2	Estimate model parameters from the statistical inference based on point estimation and hypothesis testing	Concepts and criteria for point estimation, The methods of moments and MLE.
	2	Apply Rao-Blackwell theorem for improving an estimator, and Cramér-Rao inequality to find lower bound on the variance of unbiased estimators of a parameter	Assessing estimators: Accuracy and precision, Unbiased estimation, Consistency and sufficiency,
	2	Apply Rao-Blackwell theorem for improving an estimator, and Cramér-Rao inequality to find lower bound on the variance of unbiased estimators of a parameter	The Neyman factorization theorem, Rao-Blackwell theorem, Fisher Information, Rao inequality (statement only), Efficiency
	3	Apply Rao-Blackwell theorem for improving an estimator, and Cramér-Rao inequality to find lower bound on the variance of unbiased estimators of a parameter	Interval estimation and basic properties of confidence intervals, One-sample t confidence interval
	3		Confidence intervals for a population proportion and population variance.
	3	Apply Rao-Blackwell theorem for improving an estimator, and Cramér-Rao inequality to find lower bound on the variance of unbiased estimators of a parameter	Statistical hypotheses and test procedures, One-sample tests about a population mean and a population proportion
	3	Understand the theory of linear regression models and contingency tables	P-values for tests; The simple linear regression model and its estimating parameters.
	3	Understand the theory of linear regression models and contingency tables	Chi-squared goodness-of-fit tests
	3	Understand the theory of linear regression models and contingency tables	Two-way contingency tables
			Revision

Unit	TOPICS
I	Joint probability mass function for two discrete random variables, Marginal probability mass function, Joint probability density function for two continuous random variables, Marginal probability density function, Independent random variables; Expected values, covariance, and correlation; Linear combination of random variables and their moment generating functions; Conditional distributions and conditional expectation, Laws of total expectation and variance; Bivariate normal distribution.
II	Distribution of important statistics such as the sample totals, sample means, and sample proportions, Central limit theorem, Law of large numbers; Chi-squared, t, and F distributions; Distributions based on normal random samples; Concepts and criteria for point estimation, The methods of moments and maximum likelihood estimation (MLE); Assessing estimators: Accuracy and precision, Unbiased estimation, Consistency and sufficiency, The Neyman factorization theorem, Rao-Blackwell theorem, Fisher Information, The Cramér-Rao inequality, Efficiency
III	Interval estimation and basic properties of confidence intervals, One-sample t confidence interval, Confidence intervals for a population proportion and population variance. Statistical hypotheses and test procedures, One-sample tests about a population mean and a population proportion, P-values for tests; The simple linear regression model and its estimating parameters; Chi-squared goodness-of-fit tests, Two-way contingency tables.
S. No.	Name of Authors/Books/Publishers
1.	Devore, Jay L., Berk, Kenneth N. & Carlton Matthew A. (2021). Modern Mathematical Statistics with Applications. (3rd ed.). Springer
2.	Hogg, Robert V., McKean, Joseph W., & Craig, Allen T. (2019). Introduction to Mathematical Statistics. Eighth edition, Pearson. Indian Reprint 2020.
3.	Mood, A.M., Graybill, F.A., & Boes, D.C. (1974). Introduction the Theory of Statistics (3rd ed.). Tata McGraw Hill Pub. Co. Ltd. Reprinted 2017
4.	Wackerly, Dennis D., Mendenhall III, William & Scheaffer, Richard L. (2008). Mathematical Statistics with Applications. 7th edition, Cengage Learning.