Reg. No. | | | | | | | | |

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

UG DEGREE END SEMESTER EXAMINATIONS - APRIL 2025.
(For those admitted in June 2023 and later)

PROGRAMME AND BRANCH: B.Sc., STATISTICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
III	PART – III	CORE-5	U23ST305	ESTIMATION THEORY

Date & Session: 24.04.2025/AN **Time: 3 hours** **Maximum: 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	SECTION – A (10 X 1 = 10 Marks) Answer ALL Questions.
CO1	K1	1.	A point estimator is used to: a) Provide a range of possible values for a parameter b) Estimate a population parameter with a single value c) Test hypotheses about a parameter d) Collect sample data
CO1	K2	2.	If an estimator's expected value is equal to the true parameter value, it is said to be: a) Consistent b) Unbiased c) Efficient d) Sufficient
CO2	K1	3.	Which of the following statements is true about a Minimum Variance Unbiased Estimator (MVUE)? a) MVUE always has the lowest possible variance among all estimators. b) MVUE must satisfy both unbiasedness and efficiency. c) MVUE is always unique for all distributions. d) MVUE minimizes variance among all unbiased estimators.
CO2	K2	4.	The Rao-Blackwell Theorem helps in: a) Finding the Maximum Likelihood Estimator (MLE). b) Reducing the variance of an unbiased estimator by conditioning on a sufficient statistic. c) Proving that an estimator is biased. d) Comparing the efficiency of two different biased estimators.
CO3	K1	5.	Which of the following is NOT a method of estimation? a) Method of Moments b) Maximum Likelihood Estimation c) Least Squares Estimation d) Bayes' Theorem
CO3	K2	6.	In the Method of Moments, parameter estimates are obtained by: a) Maximizing the log-likelihood function. b) Minimizing the sum of squared residuals. c) Using Bayesian techniques to compute posterior probabilities. d) Solving equations where sample moments are set equal to population moments.
CO4	K1	7.	The Method of Minimum Chi-Square involves minimizing: a) The sum of squared deviations b) The sum of absolute deviations c) The Chi-Square statistic between observed and expected frequencies d) The likelihood function
CO4	K2	8.	The Method of Least Squares is used primarily in: a) Estimating probabilities of discrete events b) Finding parameters in regression models c) Testing independence in contingency tables d) Analyzing categorical data
CO5	K1	9.	For large samples ($n \geq 30$), the confidence interval for the mean is based on: a) The normal distribution b) The t-distribution c) The binomial distribution d) The F-distribution
CO5	K2	10.	If the sample size increases, the width of a confidence interval: a) Increases b) Decreases c) Remains the same d) Depends on the population size

Course Outcome	Bloom's K-level	Q. No.	**SECTION – B (5 X 5 = 25 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	11a.	Show that the sample mean is an unbiased estimate of the parameterμ. **(OR)**
CO1	K3	11b.	Let $x_1, x_2, \ldots, x_n$ be a random sample from $N(\mu, \sigma^2)$ population. Find the sufficient estimators for μ & σ^2.
CO2	K3	12a.	Show that, a minimum variance unbiased estimator is unique. **(OR)**
CO2	K3	12b.	Let T1 and T2 be unbiased estimators of $\gamma(\theta)$ with efficiencies e1 and e2 respectively and $\rho = \rho_\theta$ be the correlation coefficient between them. Then $\sqrt{e_1 e_2} - \sqrt{(1-e_1)(1-e_2)} \leq \rho \leq \sqrt{e_1 e_2} + \sqrt{(1-e_1)(1-e_2)}$
CO3	K4	13a.	Describe the properties of MLE. **(OR)**
CO3	K4	13b.	Prove that the MLE of the parameter α of a population having density function $\frac{2}{\alpha^2}(\alpha - x)$, 0<x<2,for a sample of a unit size is 2x,x being the sample value.
CO4	K4	14a.	Let $x_1, x_2, \ldots, x_n$ be a random sample of n observations from Bernoulli population with parameter θ .Find the Estimator of θ by method of minimum Chi-square. **(OR)**
CO4	K4	14b.	Illustrate the assumptions of Least Square Estimation.
CO5	K5	15a.	Determine the confidence interval for variance of normal population. **(OR)**
CO5	K5	15b.	How do you calculate a confidence interval using large samples?

Course Outcome	Bloom's K-level	Q. No.	**SECTION – C (5 X 8 = 40 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	16a.	State and prove the sufficient conditions for consistency. **(OR)**
CO1	K3	16b.	State and prove the invariance property of consistent estimation.
CO2	K4	17a.	State and prove the Cramer-Rao inequality. **(OR)**
CO2	K4	17b.	State and prove the Rao Blackwell Theorem.
CO3	K4	18a.	Find the Maximum Likelihood Estimator (MLE) for the parameter λ of a Poisson distribution based on a sample of size n. Also, find its variance. **(OR)**
CO3	K4	18b.	Let $x_1, x_2, \ldots, x_n$ be a random sample of n observations from N(μ, σ^2).Find the estimators of μ *and* σ^2 by the Method of Moments.
CO4	K5	19a.	Briefly explain the properties of least square estimation. **(OR)**
CO4	K5	19b.	Explain the Method of Minimum Chi-Square Estimation.
CO5	K5	20a.	Determine the confidence interval for the difference between the means of two normal populations. **(OR)**
CO5	K5	20b.	Obtain the 100(1 - α)% confidence limits (for a large sample) for the parameter λ of the Poisson distribution, given the probability mass function: $f(x, \lambda) = \frac{e^{-\lambda}\lambda^x}{x!}$; $x = 0,1,2, \ldots$