Sl.No. :

Total No. of Pages : 2

Second Year M.Sc. Degree Examination, May - 2026
(SLM Scheme) (NON CBCS) (Fourth Semester)
MATHEMATICS
Math 4.4 : Mathematical Statistics

Time : 3 Hours **Max. Marks : 80**

Instructions : 1) Answer any five full questions.

2) All questions carry equal marks.

Q1) a) Define conditional probability measure and if $A_1, A_2, \ldots$ be disjoint events in the space $(\Omega, 7c, p)$, then prove that $P\left[\bigcup_j A_j | B\right] = \sum P\left(A_j | B\right)$. **[8]**

b) If X is a random variable, prove that X^2 is also a random variable. **[4]**

c) Define Probability distribution function and probability mass function. **[4]**

Q2) a) State and prove Jordan decomposition theorem. **[8]**

b) Decompose Finite a continuous function and a step function where

$$f(x) = \begin{cases} 0 & \text{if } x < 0 \\ \frac{2x+1}{8} & \text{if } 0 \le x < 1 \\ \frac{x+1}{4} & \text{if } 1 \le x < 2 \\ 1 & \text{if } x \ge 2 \end{cases}$$ **[8]**

Q3) a) State and prove Jensen's Inequality. **[6]**

b) Define Bernoulli distribution and find E(X) and V(X) for Bernoulli distribution. **[10]**

Q4) a) Write a brief short note on : **[8]**

i) The Beta distribution

ii) The Gamma distribution

b) Write a brief short note on : **[8]**

i) The t-distribution

ii) The F-distribution

Q5) a) In a sampling a large number of parts manufacture by a machine, the mean number of defective in a sample 20 is 2. Out of 1000 such sample, how many would be expected to contain atleast 3 defective parts? **[8]**

b) State and prove Chebyshev's weak law of large numbers. **[8]**

Q6) a) State and prove Neymann factorization theorem. **[10]**

b) Write the properties of Maximum likelihood Estimation. **[6]**

Q7) a) State and prove all the four properties of regression co-efficients. **[10]**

b) Define most powerful test and UMP test. State Neyman-Pearson lemma. **[6]**

Q8) a) Fit a regression line y on x for the following data **[8]**

x	10	14	18	22	26	30
y	18	12	24	06	30	36

Validate the estimated regression line and estimate y for $x = 32$.

b) Find confidence interval of $(\mu_2 - \mu_1)$ for large samples. **[8]**