Bachelor of Science Examination, 2025

(2nd Year, 1st Semester)

Mathematics

(Statistics II)

Time : 90 *minutes* *Full Marks* : 32

Attempt *any* **two** from [CO1] (Ques 1, 2 and 3) and Q4 and Q5

[CO1]

1. 100 identicall balls are to be distributed into 10 distinct bins numbered 1, 2...10.

(a) In how many ways can you put the above balls into the bins?

(b) Find the probability that in the above distribution bin numbered 1 contains 5 balls and bin numbered 50 contains 10 balls. 4+4=8

[CO1]

2. Consider a three faced prism which is unbiased and the three faces are marked 1, 2 and 3 respectively.
Suppose this prism is rolled independently and repeatedly until both 1 and 2 show. Let X denote the number of rolling required to get both 1 and 2.

(a) Find the probability mass function (PMF) of X.

(b) Had the three faces of the Prism been marked 1, 2 and 3, find the PMF of X. 4+4=8

[CO1]

3. Let a coin having Head probability 3/4 be tossed repeatedly and independently until 4 Tails come up. Let X denote the number of tosses needed to get 4 tails.

(a) Find the PMF of X.

(b) Find the Variance of X. 4+4=8

[CO2]

4. Let X be distributed as a Poisson Random variable with parameter 10.

(a) Write down the PMF of X.

(b) Find the mean and variance of X. 2+(3+3)=8

[CO3]

5. *(a)* Find the moment generating function (MGF) of an exponential random variable with the probability density function (pdf) given by : $f(x) = \begin{cases} 2e^{-2x}, & \text{if } x > 0 \\ 0, & \text{if } x \le 0 \end{cases}$

(b) Let $X_1, X_{2,...,} X_n$ be iid (independent and identically distributed) random variables each with pdf f above. Find the MGF of $\sum_{i=1}^{n} X_i$. Hence find the mean of $\sum_{1}^{n} X_i$.

(c) Can you name the distribution of $\sum_{1}^{n} X_i$? 2+5+1=8

(OR)

[CO3]

Let the pdf of a continuous random variable X be given by :

$f(x) = k.e^{\frac{-x^2}{8}}, -\infty < x < +\infty$ where k is a constant

(a) find k

(b) find $E(X)$

(c) find Var(X). 3+2+3=8

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