

U.G. 3rd Semester Examination-2025**STATISTICS****[MINOR]****Course Code : ST-MI-T-3****(Basic Probability and Probability Distributions)****[NEP-2020]**

Full Marks : 35 (25+10)

Time : 2 Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.**Notations and symbols have their usual meaning.*

1. Answer any **five** questions: $1 \times 5 = 5$
 - a) Define mutually exclusive events and exhaustive set of events.
 - b) State the addition law and multiplication law of probability.
 - c) Write 'down the properties of a probability mass function.
 - d) Given $P(A) = 3/8$, $P(B) = 3/5$, $P(A \cup B) = 3/4$, find $P(A|B)$.
 - e) Distinguish between 'pairwise independent' and 'mutually independent' events.
 - f) Write down the probability mass function of hypergeometric distribution.

[Turn over]

- g) A coin tossed repeatedly until a head appears. Write down the sample space corresponding to this random experiment.

2. Answer any two questions: $5 \times 2 = 10$

- a) Find the mean and variance of a Poisson distribution with parameter λ .
- b) i) State the theorem of total probability.
ii) Suppose there are two identical boxes. Box 1 has two white balls and two black balls; box 2 has four white balls and six black balls. One box is chosen at random and from this box one ball is picked. What is the probability that the ball is white?
- c) Derive the m.g.f of a normal distribution with mean μ and variance σ^2 .
- d) Let X and Y be two continuous random variables with the joint p.d.f.

$$f(x, y) = \begin{cases} 1 - \frac{x}{3} - \frac{y}{3} & \text{for } 0 \leq x \leq 2, 0 \leq y \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

Obtain the marginal density of X .

3. Answer any one question: $10 \times 1 = 10$

- a) i) The p.d.f of a certain continuous random variable X is $f(x) = k(x-1)(2-x)$ for $1 \leq x \leq 2$. Find k and $E(X)$.

- ii) Find the mode of binomial distribution.

5+5

- b) i) Define correlation coefficient (ρ_{xy}) of two jointly distributed random variables X and Y . Show that $-1 \leq \rho_{xy} \leq 1$. Interpret the cases when $\rho_{xy} = +1$ and -1 .

- ii) A problem is given to two students A and B whose chances of solving it are $1/2$ and $3/4$ respectively. If they try independently, what is the probability that the problem will be solved?

6+4

[Internal Assessment: 10]