

U.G. 3rd. Semester Examination-2024**STATISTICS****[MINOR]****Course Code : ST-MI-T-3****(Basic Probability and Probability Distributions)****[NEP-2020]**

Full Marks : 25

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: 1×5=5
- a) Define random experiment and provide an example.
 - b) What is the classical definition of probability?
 - c) State Bayes' theorem.
 - d) What are the key properties of a probability density function?
 - e) If the mean of a binomial distribution is 6 and $n=10$, find the value of p .
 - f) A continuous random variable X has p.d.f.
 $f(x) = 3x^2$ for $0 \leq x \leq 10$. Find $P(x \leq 0.5)$.

[Turn over]

- g) List any two properties of normal distribution.
- h) State Chebyshev's inequality.
2. Answer any two questions: $5 \times 2 = 10$
- a) Two fair coins are tossed simultaneously. Let A be the event of getting at least one head, and B be the event of getting exactly one head. Verify whether A and B are independent.
- b) Explain the properties of the cumulative distribution function (c.d.f.) of a random variable.
- c) Explain the concept of conditional expectation with an example.
- d) Write down the p.d.f. of a gamma distribution and derive its mean and variance.
3. Answer any one question: $10 \times 1 = 10$
- a) Derive the moment generating function of a binomial distribution and use it to find expressions for its mean and variance.
- b) Two continuous random variables X and Y have the joint density:
- $$f(x, y) = \begin{cases} x + y, & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{elsewhere.} \end{cases}$$
- Find the marginal density functions of X and Y and check whether they are independent.