Roll No:
Date: __/__/____

St. Claret College

Autonomous, Bengaluru

UG END SEMESTER EXAMINATION-MAY 2026

B.SC. II SEMESTER

ST224: PROBABILITY AND PROBABILITY DISTRIBUTIONS

TIME: 3 hours. 13 **MAX. MARKS: 80**

This paper contains 2 printed pages and 4 parts

Instructions:

1. **Verify and ensure that the question paper is completely printed.**
2. **Any discrepancies or questions about the exam paper must be reported to the COE within 1 hour after the examination.**
3. **Students must check the course title and course code before answering the questions.**

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PART-A

Answer ALL questions. Each answer carries ONE mark. **[1x10=10]**

1. A random experiment is one in which:
   a) Outcome cannot be predicted with certainty b) Outcome is fixed
   c) Outcome is always known d) None
2. The set of all possible outcomes is called:
   a) Event b) Trail c) Sample space d) Outcome
3. If A and B are independent events, then:
   a) $P(A \cap B) = P(A) + P(B)$ b) $P(A \cap B) = P(A) * P(B)$
   c) $P(A|B) = 0$ d) None
4. A random variable that takes countable values is:
   a) Continuous b) Discrete c) Mixed d) None
5. The function that gives probabilities of a discrete random variable is called:
   a) pdf b) mgf c) cdf d) pmf
6. The expectation of a random variable is also called:
   a) Mean b) Median c) Mode d) Variance
7. If X and Y are independent, then $Cov(X,Y) =$
   a) 1 b) -1 c) 0 d) ∞
8. The binomial distribution is based on:
   a) Discrete variable b) Infinite trails c) Continuous variable d) None
9. The Poisson distribution is a limiting case of:
   a) Normal b) Binomial c) Uniform d) Gamma
10. The normal distribution is:
    a) Positively Skewed b) Negatively Skewed c) Discrete d) Symmetric

PART-B

Answer any TEN questions. Each answer carries TWO marks. **[2x10= 20]**

11. Define probability. Mention its applications.
12. What is a sample space? Give an example.
13. Distinguish between mutually exclusive and independent events.
14. State the addition theorem of probability.
15. Define conditional probability.
16. Write the formula of Bayes' theorem.
17. Define random variable. Give one example.
18. What is a probability mass function (pmf)?
19. Define expectation of a random variable.
20. What is Moment Generating Function (MGF)?
21. Define joint probability distribution.
22. What are marginal distributions?

PART-C

Answer any FOUR questions. Each answer carries FIVE marks. **[5x4= 20]**

23. Explain different approaches to probability with examples.
24. State and prove the multiplication theorem of probability.
25. Define discrete and continuous random variables. Explain with examples.
26. Derive the mean and variance of a binomial distribution.
27. Define two dimensional random variables and formulate the joint probability function of X & Y layout.
28. Define and discuss the properties of normal distribution.

PART-D

Answer any THREE questions. Each answer carries TEN marks. **[10x3= 30]**

29. a) Define conditional probability and state and prove Bayes' theorem.
    b) A box contains 3 red and 2 blue balls. Two balls are drawn successively with replacement. Find the probability that both are red. (5 + 5)
30. a) Define expectation and variance of a random variable.
    b) State and prove addition theorem of expectation. (5 + 5)
31. a) Explain marginal distribution functions and joint density functions.
    b) X_1 and X_2 are independent random variables with a common probability function: $p(x)=\frac{x}{6}$, x=1, 2, 3. Find the probability distribution of X_1+X_2. (5 + 5)
32. a) Define Poisson distribution and obtain its mean and variance.
    b) Derive the mean and variance of geometric distribution. (7 + 3)
33. a) Derive the moment generating function (m.g.f.) of Normal Distribution.
    b) Define beta distribution of 1st kind and derive its mean and variance. (5 + 5)