

Dr. Babasaheb Ambedkar Open University
Term End Examination January – 2026

Course	: MSCDS	Date	: 22/02/2026
Subject Code	: MSCDS-105	Time	: 11:30am to 01:45pm
Subject Name	: Probability and Distribution Theory	Duration	: 02.15 Hours
		Max. Marks	: 70

Section A

Answer the following (Attempt any three) (30)

1. Explain expectation, variance, covariance, and correlation of two random variables.
2. Discuss various applications of probability and distribution theory.
3. Explain uniform, normal, and exponential distributions.
4. Explain mathematical expectation, moments, central moments, and moment generating functions.
5. Explain permutations and combinations in detail.

Section B

Answer the following (Attempt any four) (20)

1. Define sample space and event. Explain mutually exclusive and independent events with suitable examples.
2. Explain transformation of a single random variable using distribution function method.
3. State and explain the Law of Large Numbers and Central Limit Theorem.
4. Explain probability density function (PDF) and cumulative distribution function (CDF) for continuous random variables.
5. Define conditional probability and derive Bayes' Theorem.
6. Define binomial coefficient and explain its role in calculating probabilities in binomial experiments.

Section C

Part – A (Multiple Choice Questions) (10)

- 1 Which of the following represents mutually exclusive events?
A Two coin tosses B Drawing a card and tossing a coin
C Getting 3 and 5 on a single die roll D Tossing two coins together
- 2 Bayes' theorem is used to
A Find union of events B Test independence
C Calculate permutations D Update probabilities using new information
- 3 Combination $C(n,r)$ is used when
A Order matters B Order does not matter
C Repetition is allowed D Probability is zero
- 4 The sum of all probabilities in a PMF is
A 0 B Less than 1
C Greater than 1 D Equal to 1

- 5 Probability for continuous variables is calculated using
A PMF B PDF
C Frequency table D Sample space
- 6 Mathematical expectation represents
A Maximum value B Minimum value
C Average value D Random value
- 7 Bernoulli distribution has how many outcomes?
A Two B Three
C Four D Infinite
- 8 Normal distribution is
A Symmetrical B Discrete
C Skewed D Uniform
- 9 Marginal distribution is obtained by
A Multiplication B Differentiation
C Integration or summation D Division
- 10 If covariance is zero, variables are
A Always independent B Always dependent
C Identical D Uncorrelated

Part – B (Do as Directed)

(10)

State whether the following statements are true or false

- 1 The probability of an impossible event is equal to zero.
- 2 If $P(A \cap B) = P(A) + P(B)$, then events A and B are independent.
- 3 Binomial distribution assumes a fixed number of trials.
- 4 The expected value of a discrete random variable represents its long-run average.
- 5 The probability that a continuous random variable takes an exact value is non-zero.
- 6 Poisson distribution is suitable when events occur at a constant average rate.
- 7 Exponential distribution is used to model the number of successes in fixed trials.
- 8 Jacobian method is used only for discrete random variables.
- 9 Covariance indicates the direction of linear relationship between variables.
- 10 Central Limit Theorem requires the population to be normally distributed.
