

(i) Printed Pages : 3 Roll No. ....

(ii) Questions : 8 Sub. Code : 

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**B.A./B.Sc. (General) 5<sup>th</sup> Semester  
(2125)**

**MATHEMATICS**

**Paper-III : Probability Theory**

**Time Allowed : Three Hours] [Maximum Marks : 30**

**Note :—** Attempt **FIVE** questions in all, selecting at least **TWO** questions from each unit. All questions carry equal marks.

**UNIT-I**

1. (a) State & Prove Boole's inequality.
- (b) A bag contains two 1 Re. coins and three 20 paise coins. A person draws two coins. Find the probability density function of the value of coins drawn. 3,3

2. (a) The distribution function for a random variable X is:

$$F(x) = \begin{cases} 0 & , x < 0 \\ 1 - e^{-2x} & , x \geq 0 \end{cases}$$

Find:

- (i) The probability density function of X
- (ii) The probability that  $X > 2$
- (iii) The probability that  $-3 < X \leq 4$

- (b) Two cards are drawn simultaneously (without replacement) from a well-shuffled pack of 52 cards. Find the mean and variance of the number of red cards. 3,3

3. Let  $X$  be a continuous random variable having p.d.f:

$$f(x) = \begin{cases} \frac{3}{4}x(2-x) & , \quad 0 \leq x < 2 \\ 0 & , \quad \text{elsewhere} \end{cases}$$

Find measures of skewness and kurtosis of the distribution.

6

4. (a) If a random variable  $X$  has m.g.f.  $M(t) = \left(\frac{2}{3} + \frac{1}{3}e^t\right)^5$ , then find its p.m.f., mean, and variance.

- (b) If  $X$  has Poisson distribution with parameter  $m$ , then show that  $P(X = \text{even}) = \frac{1}{2}(1 + e^{-2m})$ . 3,3

### UNIT-II

5. (a) If  $X$  is uniformly distributed with mean 1 and variance  $\frac{4}{3}$ , find  $P(X < 0)$ .

- (b) Mean and variance of exponential distribution with parameter  $\lambda$  are  $\frac{1}{\lambda}$  and  $\frac{1}{\lambda^2}$  respectively. 3,3

6. If  $X$  is  $N(\mu, \sigma^2)$ , then find the distribution of  $aX + b$ . 6

7. Let  $X$  and  $Y$  be two random variables having joint probability density function:

$$f(x, y) = \begin{cases} k(6 - x - y) & , \quad 0 < x < 2, 2 < y < 4 \\ 0 & , \quad \text{elsewhere} \end{cases}$$

Find:

- (i) Value of  $k$
- (ii)  $P(X < 1 \mid Y < 3)$
- (iii)  $P(X + Y < 4)$  6
8. (a) The coefficient of correlation is independent of change of scale and origin.
- (b) If the correlation coefficient  $r$  of  $X$  and  $Y$  exists, then  $-1 \leq r \leq 1$ . 3,3