[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6621 **L**

Unique Paper Code : 2374001201

Name of the Paper : GE: Introductory Probability (NEP)

Name of the Course : **B.Sc. (Hons.) / B.A. (P) / B.Sc. (P)**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is Compulsory.
3. Attempt any five questions from **Section B**.
4. Use of non-programmable scientific calculator is allowed.

Section – A

1. Answer the following: (5×1, 5×2)

   (a) If $P(A) = p_1$, $P(B) = p_2$ and $P(A \cap B) = p_3$, Obtain $P(\bar{A} \cap \bar{B})$.

   (b) State the conditions under which Poisson distribution can be obtained as limiting case of Binomial distribution.

   (c) If X is the number of points rolled with a balanced die, find the expected value of X.

   (d) Name the distribution whose mean and variance are equal.

   (e) Given a random variable X with pdf f(x), which measure of central tendency is determined by E(1/X)?

   (f) State all the axioms of probability.

   (g) If $\mu_X = 1$, $\mu_Y = 6$, $\sigma_X = 1$ and $\sigma_Y = 2$, then find $E(2X + 3Y^2)$.

   (h) State the central limit theorem.

   (i) Given that a random variable X has mean 3 and standard deviation 5, find the variance of Y=2X−5?

   (j) If X is a variate with $M_x(t) = e^{2(e^t-1)}$, Identify the distribution and obtain P(X=3)?

Section – B

2. (a) The contents of urns I, II, III are 1 white, 2 black, 3 red balls; 2 white, 1 black, 1red ball; 4 white, 5 black, 3 red balls respectively. One urn is chosen at random and 2 balls drawn. They happen to be white and red. What is the probability that they come from urn I?

   (b) Four cards are drawn at random from a pack of 52 cards. Find the probability that
   (i) Two cards are kings and two cards are queens;
   (ii) Two cards are black and two cards are red;
   (iii) Two cards are hearts and two cards are diamonds. (8, 7)

3. (a) A variable X is distributed at random between the value 0 and 4 and its probability density function is given by

$$f(x) = kx^3(4-x)^2$$

Find the value of k, the mean and standard deviation of the distribution.

(b) What is a random variable? Explain briefly. Also, distinguish between discrete and continuous random variables with examples. (8, 7)

4. (a) Given the following table:

x	-1	0	2	3
$p(x)$	0.27	0.12	0.26	0.35

Compute $E(X), E(X^2)$ and $E(X+1)^2$.

(b) Find the moment generating function of the random variable X having the p.d.f.

$$f(x) = \begin{cases} e^{-x}, & for\ x > 0 \\ 0, & elsewhere \end{cases}$$

and use it to find an expression for μ'_r. (8, 7)

5. (a) A manufacturer, who produces medicine bottles, find that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer of bottles. Find how many boxes will contain

(i) no defective and (ii) at least two defectives [Given $e^{-0.5} = 0.6065$]

(b) Obtain the moment generating function of Binomial distribution. Derive the result that the sum of two independent binomial variate is a binomial variate stating clearly the assumptions made. (8, 7)

6. (a) Define Geometric distribution with example. Also, find its mean and variance.

(b) If X and Y are independent Poisson variates with parameters λ and μ respectively such that P(X = 1) = P (X = 2) and P(Y = 2) = P(Y = 3) Find the variance of X - 2Y. (8, 7)

7. (a) Define the Hypergeometric Distribution. Find its mean and variance.

(b) Mention five chief characteristic of the normal probability distribution. Also write its probability density function. (8, 7)

8. (a) Assuming the mean height of students is an exactly normal distribution be 68.22 inches and variance of 10.8 inches squares. How many students in a college of 1000 students would you expect to be: (i) over six feet tall (ii) below 65 inches?

(b) Define Beta Distribution of first kind. Also, obtain its mean and variance. (8, 7)