

Roll No. ....

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**007301****Mar. 2022****B. Tech.(EL) III SEMESTER****Mathematics-III. (Probability and Statistics) (ELBS-321)**

Time : 90 Minutes]

[Max. Marks : 25

*Instructions :*

1. *It is compulsory to answer all the questions (1 mark each) of Part-A in short.*
2. *Answer any three questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) A card is drawn from a well- shuffled pack of playing cards. What is the probability that it is either a spade or an ace? (1)
- (b) If A and B are independent events,  $P(B) = 0.14$  and  $P(A/B) = 0.24$ , then find the value of  $P(A)$ . (1)
- (c) The mean and standard deviation of a Binomial distribution are respectively 4 and  $\sqrt{\frac{8}{3}}$ . Find the values of n and p where n and p are the parameters of the distribution. (1)

- (d) Find the value of  $k$  if  $f(x, y) = k(1-x)(1-y)$  for  $0 < x, y < 1$  is to be joint density function. (1)
- (e) A random variable  $X$  follows exponential distribution with mean 0.5. What is the expected value of  $X^2$ ? (1)
- (f) If  $y = 2x + 5$  is the best fit for 8 pairs of values  $(x, y)$  by the method of least squares and  $\sum y = 120$ . Find the value of  $\sum x$ . (1)
- (g) Let  $X$  and  $Y$  be two random variables such that  $Y = a + bX$  where  $a$  and  $b$  are constants, then  $\text{Var}(Y)$  equals to..... (1)
- (h) If  $\text{var}(x + y) = 81$ ,  $\text{var}(x) = 36$  and  $\text{var}(y) = 25$ , then find the correlation coefficient between  $x$  and  $y$ . (1)
- (i) Which measure of central tendency takes into account the magnitude of scores? (1)
- (j) For the chi-square test to be effective, the expected value for each cell in the contingency table has to be at least ..... (1)

### PART-B

2. (a) An urn contains 10 white and 3 black balls, while another urn contains 3 white and 5 black balls. Two balls are drawn from the first urn and put into the second urn and then a ball is drawn from the latter. What is the probability that it is a white ball? (3)

- (b) In a bolt factory, machines A, B and C manufactured respectively 25%, 35% and 40% of the total. Of their output 5, 4, and 2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by a machine B? (2)

3. (a) The probability that a bomb dropped from a plane will strike the target is  $1/5$ . If six bombs are dropped, find the probability that (i) exactly two will strike the target and (ii) at least two will strike the target. (2)
- (b) Fit a Poisson distribution to the following data:

X	0	1	2	3	4
F	46	38	22	9	1

(Use value of  $e^{-0.974} = 0.3774$ ) (3)

4. The theory predicts the proportion of beans in the four groups  $G_1, G_2, G_3, G_4$  should be in the ratio 9 : 3 : 3 : 1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? Tabulated value of chi-square at 5% level of significance for 3 degree of freedom is 7.815. (5)

5. (a) A two-dimensional r.v.  $(X, Y)$  have a bivariate distribution given by :

$$P(X = x, Y = y) = \frac{x^2 + y}{32}, \text{ for } x = 0, 1, 2, 3 \text{ and } y = 0, 1$$

Find the marginal distribution of  $X$  and  $Y$ . (3)

- (b) The probability density function of a continuous distribution is given by

$$f(x) = \frac{3}{4}x(2-x); \quad 0 < x < 2$$

Find the mean and variance of a random variable.

(2)

6. (a) Find the regression of  $Y$  on  $X$  for the following data :

$$\sum x = \sum y = 15, \sum x^2 = \sum y^2 = 49, \sum xy = 44, n = 5$$

(2)

- (b) The average marks in Mathematics of a sample of 100 students was 51 with standard deviation of 6 marks. Could this have been a random sample from a population with average marks 50? The significant value of  $z$  at 5% level of significance is 1.96. (3)