END TERM EXAMINATION

SECOND SEMESTER [B.TECH] JUNE-JULY-2023

Paper Code: BS-110	Subject: Probability and Statistics for Engineers

Time: 3 Hours	Maximum Marks: 50

Note: Attempt five questions in all including Q.no.1 which is compulsory. Select one question from each unit.

Q1
a) Box *A* contains 4 red, 2 white and 6 black balls and box *B* contains 3 red and 5 white balls. A fair die is tossed. If 1 or 6 appears, a ball is chosen from *A*; otherwise a ball is chosen from *B*. If a red ball is chosen, what is the chance that a 6 appeared on the die? **(2.5)**

b) Find the value of k which makes f(x,y)=k(x+y) a joint density function over the region 0<x<1, 0<y<2. **(2.5)**

c) The regression line of X on Y is given as 4x-3.7y+24.7=0, find the regression coefficient. **(2.5)**

d) What is 2^k factorial design? Explain it briefly. **(2.5)**

Unit –I

Q2
a) Four coins were tossed simultaneously. What is the probability of getting. **(5)**
(i) 3 heads   (ii) at least 3 heads

b) If X follows an exponential distribution with $P(X \leq 1) = P(X > 1)$, find the mean and variance. **(5)**

Q3
a) If a boy is throwing stones at a target, what is the probability that his 10th throw is 5th hit, if the probability of hitting the target at any trial is 0.2. **(5)**

b) Find the probability that at most 5 defective fuses will be found in a box of 200 fuses if experience shows that 2% of such fuses are defective. **(5)**

Unit-II

Q4
a) Find the moment generating function of a random variable X having the density function. **(5)**

$$f(x) = \begin{cases} \dfrac{x}{2}, & 0 \leq x \leq 2 \\ 0, & otherwise \end{cases}$$

b) Obtain the conditional distribution of X given Y=0 from the joint distribution of X and Y. **(5)**

Y\X	0	1	2
0	0.02	0.08	0.10
1	0.05	0.20	0.30
2	0.03	0.12	0.15

Q5   a)   What is point estimation? Explain different methods of point estimation. **(5)**

       b)   If $f(x,y) = e^{-(x+y)}$, $x \geq 0, y \geq 0$ is the joint probability density function of X and Y, find $P(X<1)$. **(5)**

Unit-III

Q6   A city health department wishes to determine if the mean bacteria count per unit volume of water at a lake beach is within the safety level of 200. A researcher collected 10 water samples of unit volume and found the bacteria counts to be

       175   190   205   193   184
       207   204   193   196   180

Do the data strongly indicate that there is no cause for concern? Test with $\alpha = .05$. Given $t_{0.05}(9 \text{ df})=1.833$. **(10)**

Q7   The two regression lines are $4x - 5y + 33 = 0$ and $20x - 9y = 107$, and $Var(X) = 25$. Find

       (i) The mean of x and y,

       (ii) The values of correlation coefficient between x and y and σ_y = SD of y, and

       (iii) The angle between the regression lines. **(10)**

Unit-IV

Q8   What is P chart? Find the center line, upper and lower control limits for the P chart of the following data: **(10)**

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. of Defectives	44	48	32	50	29	31	46	52	44	48	36	52	35	41	42	30	46	38	26	30

Q9   What is U chart? Find the center line, upper and lower control limits for the U chart of the following data: **(10)**

Sample	1	2	3	4	5	6	7	8	9	10
No. Defects	6	4	8	10	9	12	16	2	3	10

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