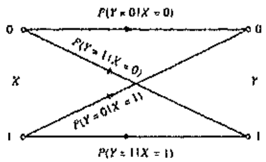
Date : 17.09.2-24 **Roll. No:........................**

III SEMESTER-B.Tech.(ECE& EIOT) MID-SEMESTER EXAM,SEPT., 2024
Course Code:ECECC303/EIECC303 Course Title:Prob. Th. and Random Process
Time: 1:30 Hours Max. Marks: 20

Note: -For Re-registration ie **ECECC06/EIECC06, marks shall be scaled up to 25 marks.** *Attempt all questions in the given order only. Missing data/information (if any), maybe suitably assumed & mentioned in the answer.*

S. No.	Questions	Marks	CO
1. (a)	Let A, B, and C be three events in the sample space S. If it is given that A∪B∪C=S, P[A]=1/2, P[B]=2/3, P[A∪B]=5/6, and P[C∩(A∪B)]=5/12. Find a) P(A∩B). b) Do A, B, and C form a partition of S? c) Using P(C−(A∪B)), find P(C).	2	CO1
(b)	If we roll two dice and observe two numbers X and Y. Find a. P(X=2,Y=6). b. P(X>3|Y=2). c. If Z=X+Y, find the PMF of Z, $P_Z(z)$. d. Find P(X=4|Z=8).	2	CO1
2. (a)	The PDF of a continuous r.v., X, is given by $f_X(x) = \begin{cases} x, & 0 < x \leq 1 \\ 2 - x, & 1 < x \leq 2 \\ 0 & otherwise \end{cases}$ Find the corresponding CDF and sketch $f_X(x)$ and $F_X(x)$.	2	CO1
(b)	Let X be a Poisson r.v. with parameter λ. Derive the mean and variance of this random variable.	2	CO1
3. (a)	Let $X \sim N(0, \sigma^2)$. Determine E[X | X>0] and Var[X | X>0] ?	2	CO1
(b)	What does Moment Generating Function (MGF) signify? How can we obtain moments of a random variable using its MGF?	2	CO1
4. (a)	Consider the binary communication channel shown below  Let (X, Y) be a bivariate r.v., where X is the input to the channel and Y is the output of the channel. Let P(X = 0) = 0.5, P(Y = 1|X = 0)= 0.1, and P(Y = 0|X = 1)= 0.2. Find 1. Joint PMF of (X, Y). 2. Are X and Y independent?	2	CO2
(b)	Let X and Y be jointly continuous random variables with joint PDF $f_{XY}(x,y) = \begin{cases} 6\, e^{-(2x+3y)} & x, y \geq 0 \\ 0 & otherwise \end{cases}$ Find 1. E [Y|X>2]. 2. P[X>Y].	2	CO2
5.(a)	The joint PDF of random variables X and Y is given by $f_{XY}(x,y) = \begin{cases} k & 0 < y \leq x < 1 \\ 0 & otherwise \end{cases}$ Determine 1. the value of k. 2. Are X and Y independent? 3. Are X and Y uncorrelated?	2	CO2
(b)	Suppose the joint PMF of a bivariate r.v. (X, Y) is given by $P_{X,Y}(x_i, y_j) = \begin{cases} \frac{1}{3} & (0,1), (1,0), (2,1) \\ 0 & otherwise \end{cases}$ 1. Compute E[X], E[Y]. 2. Covariance of X and Y.	2	CO2