R22 Regulation *Subject code:* **4E4DA**

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech IV Semester Supplementary Examinations, December 2024

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(ECE)

Maximum Marks: 60 Date:03.12.2024 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks (10x1M=10 Marks)			
1.a)	Define Demorgans law.	CO1	K1
b)	Define Joint and Conditional Probability.	CO1	K1
c)	Define exponential distribution.	CO2	K1
d)	If X is uniformly is Uniformly distributed in (-2,2), then find the mean and variance.	CO2	K2
e)	In the experiment of tossing a dice, what is the probability of face having 3 dots or 6 dots to appear?	CO3	K2
f)	The joint probability mass function of (X, Y) is given by p(x, y) = k (x+2y) , x =1,2,3, 4; y =0, 1,2 . Find the value of k.	CO3	K2
g)	Give the statement of ergodic theorem.	CO4	K1
h)	State the condition for two random processes X(t) & Y(t) to be independent.	CO4	K1
i)	Define Power spectral density.	CO5	K1
j)	Find the mean of random process from auto correlation $R(\tau) = 18 + \frac{2}{6+\tau^2}$.	CO5	K2

Part-B

Answer All the following questions. (5X10M=50Marks)

2 A random variable X has the following probability distribution. (CO1, K3)

x	0	1	2	3	4	5	6	7	8
P(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

Find (i) the value of 'a' (ii)P(x < 3), P(0<X<5) (iii) Cumulative distribution of X. [10M]

OR

3 A random variable X has the following probability distribution. [10M] (CO1, K3)

x	0	1	2	3	4	5	6	7
P(x)	0	β	2β	2β	3β	β^2	$2\beta^2$	$7\beta^2 + \beta$

Find (i) the value of β (ii)P(x < 6), P(x ≥ 6) and P(0 < x < 3)

4	The number of personal computer (pc) sold daily at a computer world is uniformly distributed with a minimum of 2000 pc and a maximum of 5000 pc. Find 1. The probability that daily sales will fall between 2500 and 3000 pc 2. What is the probability that the computer world will sell atleast 4000 pc? 3. What is the probability that the computer world will sell exactly 2500 pc? [10M]	CO2	K3
	OR		
5	The time (in hours) required to repair a machine is exponentially distributed with parameter 1. What is the probability that the repair time exceeds 2 hrs? 2. What is the conditional probability that a repair takes atleast 11 hrs given that its direction exceeds 8 hrs? [10M]	CO2	K3
6	The random variables X and Y have joint probability density function $f(x,y) = \begin{cases} x^2 + \frac{xy}{3}, 0 \le x \le 1, 0 \le y \le 2 \\ 0, \textit{Otherwise} \end{cases}$ Find i) marginal density functions of X and Y ii) the conditional density function of X given Y iii) Are X and Y independent? [10M]	CO3	K3
	OR		
7	A) Define and explain joint density function of two random variables X and Y. [5M] B) State properties of joint probability distribution function. [5M]	CO3	K3
8	Given a stationary random process $U(t) = X\cos t + Y\sin t \ and \ V(t) = Y\cos t + X\sin t$, where X and Y are independent random variables such that $E[X(t)] = 0 = E[Y(t)], E[X^2] = E[Y^2] = 1$. Check whether U(t) and V(t) are WSS or not? [10M]	CO4	K3
	OR		
9	If $X(t) = \sin(\omega t + Y)$,where Y is uniformly distributed in $(0,2\pi)$, then show that $X(t)$ is wide sense stationary. [10M]	CO4	K3
10	State and prove Wiener-Khintchine relation. [10M]	CO5	K3
	OR		
11	The cross-power spectrum of real random processes X(t) and Y(t) is [10M] $S_{XY}(\omega) = \begin{cases} a + jb\omega\, ; \lvert\omega\rvert < 1 \\ 0; otherwise \end{cases}$ Find Cross correlation function.	CO5	K3