R22 Regulation *Subject code:4E4DA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech IV Semester Regular/Supplementary Examinations, June 2026

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(ECE)

Maximum Marks: 60 Date:08.06.2026 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

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	BTL
1.a)	What is the condition for independent events?	1M	1	L1
b)	State the theorem on total probability.	1M	1	L1
c)	Define random variable?	1M	2	L1
d)	Write the n^{th} moment about origin from Characteristic Function.	1M	2	L2
e)	Define joint moment generating function.	1M	3	L1
f)	State central limit theorem.	1M	3	L2
g)	Distinguish between stationary and non- stationary random processes.	1M	4	L2
h)	Define ergodicity of random process.	1M	4	L1
i)	Define Power Spectral Density of random process.	1M	5	L1
j)	Give the relation between PSD of input and output random process of an LTI system.	1M	5	L2

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) A speaks truth in 75% and B in 80% of the cases. In what percentage of cases are they likely to contradict each other narrating the same incident?	5M	1	L3
	b) If a box contains 75 good diodes and 25 defective diodes and 12 diodes are selected at random, find the probability that at least one diode is defective.	5M		L3
	OR			
3	State and prove the Baye's theorem of probability.	10M	1	L4
4	a) The Pdf of X is, $f_x(x)=\begin{cases} Kx^2(1-x^3); & 0<x<1 \\ 0, & \text{Otherwise} \end{cases}$ is a valid density function. Find the constant 'k' and CDF of X.	5M	2	L3
	b) Define CDF and State & prove the properties of CDF.	5M		L4
	OR			

5	A random variable X has a probability density function $f_X(x)=\begin{cases}\frac{5}{4}(1-x^4); & 0<x\le 1\\ 0; & \text{otherwise}\end{cases}$ Find, a). $E[X]$ b). $E[X^2]$	5M 5M	2	L3
6	a) Describe the joint moments about the origin? b) Statistically independent random variables X and Y have moments $m_{10}=2, m_{20}=14, m_{02}=12$ and $m_{11}=-6$. Find the moment μ_{22}.	5M 5M	3	L2 L3
	OR			
7	Consider random variables Y_1 and Y_2 related to arbitrary random variables X and Y by the coordinate rotation, $Y_1=X Cos\theta+Y Sin\theta$; and $Y_2=-X Sin\theta+Y Cos\theta$. a) Find the covariance of Y_1 and Y_2. b) For what values of θ, the random variables Y_1 and Y_2 are uncorrelated?	5M 5M	3	L4
8	a) Explain the concept of random process and classify the random process with neat sketch? b) A random process is described by $X(t)=At$; where A is continuous random variable, uniformly distributed on (0, 5). Classify the process?	5M 5M	4	L2 L3
	OR			
9	Define auto correlation function of random process. State and prove the properties of Autocorrelation function of random process.	10M	4	L4
10	a) The PSD of random process is given by; $S_{XX}(\omega)=\begin{cases}\pi; & \lvert\omega\rvert<1\\ 0; & \text{otherwise}\end{cases}$. Find its auto correlation function. b) Determine, the following function is valid PSD and why? $S_{XX}(\omega)=\frac{Cos(8\omega)}{2+\omega^4}$	5M 5M	5	L4
	OR			
11	State and prove the any three properties of Power spectral density of random process.	10M	5	L4