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 2025

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(ECE)

Maximum Marks: 60 Date:16.12.2025 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	BloomTx
1.a)	If X is a continuous random variable with probability density function $f(x) = \begin{cases} c(x-x^2), & 0 < x < 1 \\ 0, & Otherwise \end{cases}$, then find the value of c.	1M	CO1	K3
b)	State Bayes theorem on probability.	1M	CO1	K1
c)	Verify whether the given function $f(x,y) = \frac{2}{5}(2x+3y),\ 0 \le x \le 1$ and $0 \le y \le 1$ is a valid probability density function or not?	1M	CO2	K3
d)	Define moment generating function of a random variable X.	1M	CO2	K1
e)	Mention any two properties of Gaussian Random variables.	1M	CO3	K1
f)	State Central Limit Theorem.	1M	CO3	K1
g)	Check whether the function $R(\tau) = cos\tau + \frac{\lvert\tau\rvert}{T}$ is autocorrelation or not?	1M	CO4	K2
h)	Define wide sense stationary process.	1M	CO4	K1
i)	Find the autocorrelation of a random process if its power spectral density is given by $s(\omega) = \frac{4}{4+\omega^2}$.	1M	CO5	K3
j)	Write the bandwidth of the Power Density Spectrum.	1M	CO5	K1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BloomTx
2	a) A bag contains 4 balls. Two balls are drawn at random without replacement and are found to be blue. What is the probability that all balls in the bag are blue?	5M	CO1	K3
	b) Find the probability that in tossing a fair coin 5 times, there will appear (i) 3 heads (ii) 3 tails and 2 heads (iii) atleast 1 head and (iv) not more than 1 tail.	5M		

	OR			
3	A random variable X has the following probability distribution. X= x: 0, 1, 2, 3, 4, 5, 6, 7, 8 P(x): a, $3a$, $5a$, $7a$, $9a$, $11a$, $13a$, $15a$, $17a$ (i) Find the value of a. (ii) Find the cumulative distribution function of X. (iii) Find mean and variance of X.	10M	CO1	K3
4	The joint probability mass function of (X, Y) is given by $P(x,y) = k(2x+3y),\ x = 0,1,2\ ; y = 1,2,3$. Find i) the marginal distributions of X and Y ii) the probability distribution of $X+Y$ iii) $P(X+Y>3)$.	10M	CO2	K3
	OR			
5	The savings bank account of a customer showed an average balance of Rs.150 and a standard deviation of Rs.50. Assuming that the account balances are normally distributed (i) What percentage of account is over Rs.200? (ii) What percentage of account is between Rs.120 and Rs.170? (iii) What percentage of account is less than Rs.75?	10M	CO2	K3
6	Explain Joint moments about the Origin and Central moments.	10M	CO3	K2
	OR			
7	Two gaussian random variables X_1 and X_2 have zero means and variances $\sigma_{X1}^2 = 4$ and $\sigma_{X2}^2 = 9$. Their covariance C_{X1X2} equals 3. If X_1 and X_2 are linearly transformed to new variables Y_1 and Y_2 according to $Y_1 = X_1 - 2X_2\ ; Y_2 = 3X_1 + 4X_2$ with the above results find the means, variances and covariances of Y_1 and Y_2.	10M	CO3	K3
8	Show that the random process $X(t) = A\cos(\omega t + \theta)$ is wide sense stationary if A and ω are constants and θ is a uniformly distributed random variable in $(-\pi, \pi)$.	10M	CO4	K3
	OR			
9	Find the auto correlation if power spectral density is $\frac{\omega^2+9}{\omega^4+5\omega^2+4}$.	10M	CO4	K3
10	Prove that Auto-correlation function and Power spectral density form a Fourier transform pair.	10M	CO5	K3
	OR			
11	Find the power spectrum of the binary transmission auto correlation $R_{XX}(\tau) = \begin{cases} 1 - \frac{\lvert\tau\rvert}{T}; \lvert\tau\rvert \le T \\ 0 \quad ; \lvert\tau\rvert > T \end{cases}$	10M	CO5	K3