Subject Code: 24EC11RC16 **R-24** **Reg No:** | | | | | | | | | | | | |

GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN

(Autonomous)

(Affiliated to Andhra University, Visakhapatnam)

II B.Tech. - II Semester Regular Examinations, April – 2026

PROBABILITY THEORY AND RANDOM PROCESS

[Electronics and Communication Engineering]

1. All questions carry equal marks
2. Must answer all parts of the question at one place

Time: 3Hrs. **Max Marks: 70**

UNIT-I

1. a. An experiment consists of observing sum of numbers showing up when two dice are thrown. Find P(A) if A={8<sum<11}, P(B) if B= {sum >10}, P(C) if C= {sum =7}.

   b. State and Prove Total Probability Theorem and Bayes Theorem.

OR

2. a. Define Probability Distribution function. A Continuous random variable X has a probability density function given by $f(x) = 3x^2$; $0 \leq x \leq 1$. Find a, b such that i) $P(X \leq a) = P(X > a)$ and ii) $P(x > b) = 0.05$

   b. A Random variable X has the probabilities as shown in table:

x	-3	-2	-1	0	1	2
P(x)	0.2	0.25	0.15	0.1	0.2	0.1

   Find E[X], E $[X^2]$, $E[(2X+1)^2]$, Var[X],Var[3X+5]

UNIT-II

3. a. State Marginal Distribution and Marginal Density function of Multiple Random Variables.

   b. The joint pdf of two random variables X, Y is $f_{XY}(x,y) = K e^{-(x+y)}$, for $x \geq 0$ and $y \geq 0$. Find the i) K if it is a valid joint density function ii) Joint Distribution function $F_{XY}(x,y)$ iii) Marginal Density functions iv) Are X and Y Statistically independent or not?

OR

4. a. Define Joint Probability Density function. List the properties of Joint Probability Density function.

   b. Explain Central Limit Theorem of Multiple Random Variables.

UNIT-III

5. a. Define Correlation, Covariance and Correlation Coefficient of Multiple Random Variables.

   b. Two random variables X and Y have joint characteristic function $\Phi_{XY}(\omega_1,\omega_2) = \exp(-2\omega_1^2 - 8\omega_2^2)$. Show that X and Y are zero mean random variables and uncorrelated.

OR

6. a. Statistically Independent Random Variables X and Y have moments $m_{10}=2$, $m_{20}=14$, $m_{02}=12$, $m_{11}=-6$. Calculate μ_{11} and check whether X and Y are uncorrelated.

   b. Explain Joint Central Moments and Jointly Gaussian Random Variables of Multiple Random Variables.

UNIT-IV

7. a. Define Random Process. With a neat sketch, discuss the classification of random process with examples.

   b. A random process $X(t)=A\,Cos(\omega_c t+\theta)$, where A, ω_c are constants and θ is uniformly distributed random variable over interval $(0,2\pi)$. Is X(t) a Wide Sense Stationary Process?

OR

8. a. Define Cross Correlation of Random Process and List any 4 properties of Cross Correlation.

   b. If X(t) is a stationary random process having auto correlation function $R_{XX}(\tau) = 4 + 2e^{-|\tau|}$. Find the Mean, Mean Square and Variance.

UNIT-V

9. a. Derive the Mean and Mean Square of a output response of a LTI System.

   b. A random noise X(t) having power spectrum $S_{XX}(\omega) = 3/(49+\omega^2)$ is applied to a network for which $h(t) = u(t)\, t^2 \exp(-7t)$. The network response is denoted by Y(t).
      i) What is the average power of X(t)
      ii) Find the power spectrum of Y(t)
      iii) Find average power of Y(t).

OR

10. a. Derive the Power Density Spectrum of a output response of a LTI System.

    b. Explain the following
    i) Narrow Band Random Process ii) Band Limited Random Process.