II B. Tech I Semester Supplementary Examinations, July - 2023
RANDAM VARIABLES AND STOCHASTIC PROCESSES
(Com to ECE, ECT)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Define a discrete random variable and discuss the characteristics of Poisson random variable using its probability density and distribution functions. [7M]

b) The number of cars arriving at a certain bank drive-in window during any 10-minute period is a Passion random variable X with b = 2. Find (i) The probability that more than 3 cars will arrive during any 10-minute period.
(ii) The probability that no cars will arrive. [7M]

Or

2 a) Explain about the distribution and density functions of exponential random variable with neat sketches. [7M]

b) A random variable X is Gaussian with $\mu_x = 0$ and $\sigma_x^2 = 1$
(i) what is the probability that $|X| > 2$ (ii) what is the probability that X>2 [7M]

UNIT-II

3 a) Find the Moment generating function of exponential distribution. [7M]

b) X is a uniformly distributed random variable in the interval (a, b). If $Y = \sqrt{X}$, Obtain the density of Y. [7M]

Or

4 a) For the binomial density function. Find the mean and variance. [7M]

b) Joint density function of two random variables is given by $f_{XY}(X, Y) = \frac{18y^2}{X^3}$ for 2<x< ∞ and 0<y<1
find i) E[X] ii) E[Y] and iii) E[XY] [7M]

UNIT-III

5 a) Write the properties of marginal distribution function. [7M]

b) A joint density function is given as [7M]

$$f_{XY}(x,y) = \begin{cases} x(y+1.5), & 0<x<1,\ \ 0<y<1; \\ 0\,, & otherwise \end{cases}$$

Find the first order and second order moments.

Or

6 a) Explain how central limit theorem is used in sum of a number of independent random variables. [7M]

b) Consider the linear transformations $Y_1 = 2X_1+3X_2$, $Y_2 =4X_1-X_2$, find the joint density of Y_1,Y_2 in terms of joint density of X_1,X_2. [7M]
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UNIT-IV

7 a) Define autocorrelation function of a random process and write its properties. [7M]

b) What is random process? Explain Gaussian random process and Poisson random process. [7M]

Or

8 a) The autocorrelation function $R_{XX}(\tau) = 36 + \frac{5}{1+7\tau^2}$. Find the magnitude of the mean value and variance of the process X(t). [7M]

b) A random process $X(t) = A\,Cos(\omega_0 t + \Theta)$ where A, ω_0 are constants and Θ is a uniformly distributed random variable in the interval $(0,2\pi)$. Check whether $X(t)$ is wide sense stationary process or not? [7M]

UNIT-V

9 a) Derive the expression for power spectral density of a random process. [7M]

b) Obtain the expression for mean value of the response of an LTI system excited by a random process $X(t)$. [7M]

Or

10 a) Derive the Wiener-Khinchin relation for power spectra density and autocorrelation function. [7M]

b) Obtain the mean square value of the response of a LTI system excited by a WSS random process $X(t)$. [7M]