Code No: R2021044 **R20** SET - 1

II B. Tech I Semester Regular Examinations, Feb/March - 2022
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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1 a) State and prove the properties of cumulative distribution function (CDF) of X. [7M]

b) If the communicative distribution function of a random variable X is given by [7M]

$$f_X(x) = \begin{cases} \frac{x^2}{3} & -1 \le x, y \le 2 \\ 0 & Else\ w\square ere \end{cases}$$

Find P(0<X<1) and $F_x(x)$?

Or

2 a) Define conditional probability distribution function and write the properties. [7M]

b) Two boxes are selected randomly. The first box contains 2 white balls and 3 black balls. The second box contains 3 white and 4 black balls. What is the probability of drawing a white ball? [7M]

3 a) State and prove the Chebychev's inequality theorem. [7M]

b) A Gaussian random variable with variance 10 and mean 5 is transformed to $y = e^x$. Find the pdf of y. [7M]

Or

4 a) Show that any characteristic function $\Phi_X(\omega)$satisfies $\Phi_X(\omega) \le \Phi_X(0) = 1$. [7M]

b) A random variable X is defined by density function [7M]

$$f_X(x) = \begin{cases} 3x^2 & for\ 0 \le x \le 1 \\ 0 & elsew\square ere \end{cases}$$

Find E[X], E[3X] and E[X^2].

5 a) Explain central limit theorem with equal and unequal distributions. [7M]

b) If X and Y are independent, show that E[XY]=E[X] E[Y]. [7M]

Or

6 a) Two statistically independent random variables X and Y have respective densities $f_X(x) = 5e^{-5x}u(x), f_Y(y) = 2e^{-2y}u(y)$. Find the density of the sum W = X +Y. [7M]

b) Gaussian random variables X and Y have first and second order moments m_{10}=-1.1, m_{20}=1.16, m_{01}=1.5, m_{02} =2.89, R_{XY}=-1.724. Find C_{XY}, ρ. [7M]

7 a) Derive the relation between correlation and covariance of two random variables X and Y. [7M]

b) A random process $X(t) = A\,Cos(\omega_c t + \theta)$ where θ is a random variable uniformly distributed in the range$(0,2\pi)$. Show that the process is ergodic in mean and correlation sense. [7M]

Or
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8 a) The auto correlation function for a stationary ergodic process with no periodic components is $R_{XX}(\tau) = 625 + \frac{16}{1+36\tau^2}$ .Find mean and variance of the random process. [7M]

b) Explain about Poisson random processes. [7M]

9 a) Derive the relationship between cross-power spectral density and cross correlation function. [7M]

b) Define the following systems. [7M]
(i)Band pass process
(ii) Band –Limited process
(iii)Narrow band process
(iv)Band – Limited Band pass process

Or

10 a) Show that $S_{YY}(\omega) = |H(\omega)|^2 S_{XX}(\omega)$. [7M]

b) Find the mean and mean- squave values of output y(t) of an LTI system with input x(t). Assume that x(t) is a WSS process. [7M]