

Code No: RT22042

**R13**
**SET - 1**

**II B. Tech II Semester Supplementary Examinations, April-2018**  
**RANDOM VARIABLES AND STOCHASTIC PROCESSES**  
 (Electronics and Communications Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. Answer **ALL** the question in **Part-A**  
 3. Answer any **THREE** Questions from **Part-B**

**PART -A**

1. a) Write the properties of Density function
- b) Find the characteristic function of Uniform random variable X.
- c) Joint Sample Space has three elements (1, 1), (2, 1), and (3, 3) with probabilities 0.4, 0.3, 0.2 respectively. Draw the Joint Distribution Function.
- d) Define Ergodicity.
- e) Write the properties of cross power density spectrum
- f) How is the autocorrelation function of white noise represented? What is its significance?

**PART -B**

2. a) A random voltage can have any value defined by the set 'S' = {a ≤ s ≤ b}. A quantizer, divides S into 6 equal-sized contiguous subsets and generates random variable X having values {-4, -2, 0, 2, 4, 6}. Each value of X is earned to the midpoint of the subset of 'S' from which it is mapped
  - i) Sketch the sample space and the mapping to the line that defines the values of X
  - ii) Find a and b?
- b) Explain Gaussian random variable with neat sketches?
3. a) A random variable X has a probability density
 
$$f_x(x) = \begin{cases} (1/2) \cos(x) & -\pi/2 < x < \pi/2 \\ 0 & \text{elsewhere in } x. \end{cases}$$
 Find the mean value of the function,  $g(X) = 4X^2$
- b) A random variable X can have -4, -1, 2, 3 and 4 each with probability  $\frac{1}{5}$ . find density function, mean, variance of the random variable  $Y = 3X^3$ .
4. a) Define random variables V and W by  $V = X + aY$ ,  $W = X - aY$ , Where a is real number and X and Y random variables. Determine a in terms of X and Y such V and W are orthogonal?
- b) Two random variables have joint characteristic function
 
$$\phi_{XY}(\omega_1, \omega_2) = \exp(-2\omega_1^2 - 8\omega_2^2)$$
. Find moments  $m_{10}$ ,  $m_{01}$ ,  $m_{11}$ ?

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5. A random process  $X(t)$  has periodic sample functions as show in figure ; where  $B$ ,  $T$  and  $4t_0 \leq T$  are constants but  $\epsilon$  is a random variable uniformly distributed on the interval  $(0, T)$ . Find first order density function and distribution function of  $X(t)$ .

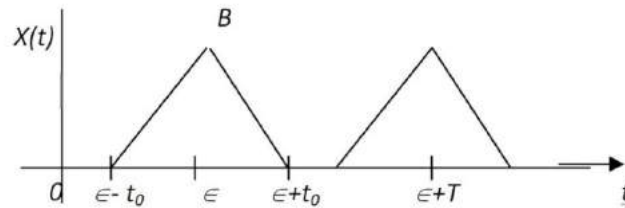


Figure-1

6. a) Assume  $X(t)$  is a wide-sense stationary process with nonzero mean value. Show that  $S_{XX}(\omega) = 2\pi\bar{X}^2\delta(\omega) + \int_{-\infty}^{\infty} C_{XX}(\tau)e^{-j\omega\tau}d\tau$  where  $C_{XX}(\tau)$  is the auto covariance function of  $X(t)$ .
- b) If  $X(t)$  is a stationary process, find the power spectrum of  $Y(t) = A_0 + B_0X(t)$  in term of the power spectrum of  $X(t)$  if  $A_0$  and  $B_0$  are real constants
7. a) Write notes on generalized Nyquist theorem
- b) Prove the output power spectral density equals the input power spectral density multiplied by the squared magnitude of the transfer functions of the filter.