Code No: RT22042 **R13** SET - 1

II B. Tech II Semester Supplementary Examinations, November-2017
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**

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PART –A

1. a) Define Random variable? Write the Conditions for a Function to be a Random Variable.
   b) Prove that expectation of constant is same constant
   c) Write the properties of Joint Distribution Function
   d) What is Strict-Sense Stationary random process?
   e) Determine which of following functions can and cannot be valid power density spectrum. For those are not, explain why.
      i. $\frac{\omega^2}{\omega^6+3\omega^2+3}$ ii. $\frac{\omega^4}{j\omega^6+\omega^2+1}$
   f) Write a short notes on Johnson noise

PART -B

2. a) Let X is Gaussian random variable, show that $\int_{\infty}^{\infty} x f_X(x) = m_x$.
   b) Write properties of Conditional density and distribution function of a random variable

3. a) State and prove Chebychev's Inequality
   b) Find the mean and variance of uniform Random variable

4. a) Define Marginal density function? Find the Marginal density functions of with joint density function.

$$f_{XY} = \frac{1}{12}u(x)u(y)e^{-x/3}e^{-y/4}$$

   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.

5. a) Write the properties of Autocorrelation Function of Random Process.
   b) Define a random process by X(*t*) = A cos (πt), where A is a Gaussian random variable with zero mean and variance σ_A^2. Find the density functions of X(0) and X(1). Is X(*t*) stationary?

6. a) Derive the Wiener- Khintchine relationship.
   b) A random process has the power density spectrum $S_{XX}(\omega) = \frac{6\omega^2}{1+\omega^4}$
   Find the average power in the process.
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7. a) Define the following terms.
   (i)Noise equivalent temperature
   (ii) Noise figure
   (iii) Available power gain
   b) The noise present at the input to a two port network is 1μW. the noise figure F is 0.5dB, the receiver gain $g_a=10^{10}$, calculate:
      i. The available noise power contributed by two port network
      ii. The output available power.