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

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

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PART –A

1. a) Write the properties of Distribution function
b) Derive the relationship between variance, first and second moments
c) Joint Sample Space has three elements (0, 0), (1, 1), and (2, 2) with probabilities 0.35, 0.4, 0.25 respectively. Draw the Joint Distribution Function diagram
d) What is Stationarity? Write the conditions for Wide-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. $\frac{\cos(3\omega)}{\omega^2+1}$ ii. $\frac{\omega^2}{\omega^4+1} - \delta(\omega)$
f) What are the causes of thermal noise?

PART -B

2. a) Gaussian random voltages X for which $a_X = 0$ and $\sigma_X = 4.2V$ appears across a 100-Ω resistor with power rating of 0.25W. What is the probability that the voltage will cause an instantaneous power that exceeds the resistor's rating?
b) A Gaussian random variable X has $a_X = 2, and\ \sigma_X = 2$
I. Find $P\{X > 1.0\}$
II. Find $P\{X \le -1.0\}$

3. a) A random variable X is uniformly distributed on the interval $(-\pi/2, \pi/2)$. X is transformed to the new random variable Y = T (X) = *a* tan (X), where *a* > 0. Find the probability density function of Y
b) Prove that mean and variance of Poisson random variable is same

4. a) Write the statement of Central Limit Theorem.
b) Find the density function of W=X+Y, where X and Y are satirical independent random variables and the densities of X and Y are assumed to be:
Fx (x)=0.5[u(x)-u(x-2)]; fy (y)=0.25[u(y)-u(y-4)]

5. a) Write the properties of Cross correlation Function of Random Process
b) A random process is defined by X(*t*) = A, where A is a continuous random variable uniformly distributed on (0, 1). Determine the form of the sample functions, classify the process.

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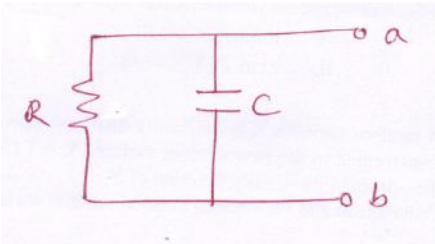
6. a) A random process has the power density spectrum $S_{XX}(\omega) = \frac{6\omega^2}{[1+\omega^2]^3}$
Find the average power in the process.

b) A random process is given by $X(t) = A\cos(\Omega t + \theta)$ where A is a real constant, Ω is a random variable with density function $f_\Omega(\Omega)$ and θ is a random variable uniformly distributed over the interval $(0, 2\pi)$ independent of Ω. Show that the power spectrum of $X(t)$ is

$$S_{XX}(\omega) = \frac{\pi A^2}{2}[f_\Omega(\omega) + f_\Omega(-\omega)]$$

and also find P_{YY}.

7. a) Derive the expression for root mean square value of thermal noise voltage across ab terminals of network shown below:



b) Define the following random processes:
   i. Band pass
   ii. Band limited
   iii. Narrow band

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