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Code No: R1621045 **R16** SET - 1

II B. Tech I Semester Supplementary Examinations, May - 2019
RANDOM VARIABLES & STOCHASTIC PROCESSES
(Electronics and Communication 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 **FOUR** Questions from **Part-B**

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PART –A

1. a) A jar contains two white and three black balls. A sample of size 4 is made. What is the probability that the sample is in the order white, black,white,black? (2M)
   b) Define characteristic function of a random variable X. (2M)
   c) Define marginal density function. (2M)
   d) Define random process. (3M)
   e) Determine whether the power density spectrum shown below is valid or not? (3M)
   $\frac{\cos 3\omega}{\omega^2+1}$
   f) Write the expression for average noise figure of cascaded networks. (2M)

PART -B

2. a) Discuss the significance of a Gaussian random variable using its probability density and distribution functions. (5M)
   b) Define conditional distribution function and write its properties. (4M)
   c) The life time of a system expressed in weeks is a Rayleigh random variable X with its distribution function $F_X(x) = e^{-x^2/400}$. What is the probability that a system lifetime will exceed one year. (5M)

3. a) Find the variance of a random variable with uniform density function. (7M)
   b) A random variable X has pdf $f_X(x) = (1/b)e^{-(x-a)/b}$. Find its moment function and use it to generate first order moment about origin. (7M)

4. a) X and Y are two independent random variables related to W as W= X+Y. Find $f_W(w)$ in terms of $f_X(x)$ and $f_Y(y)$. (7M)
   b) Two random variables X and Y have the joint density (7M)
   $f_{XY}(x,y) = \begin{cases} \frac{xy}{9} & 0 < x < 2, 0 < y < 3 \\ 0 & else\ where \end{cases}$. Show that X and Y are uncorrelated and also statistically independent.

5. a) Define autocorrelation function of a random process. Also write the properties of autocorrelation of a WSS process. (7M)
   b) A random process is defined as X(t) = 4cos(t + Θ), where Θ is uniformly distributed random variable in (0,2π). Check whether X(t) is WSS or not? (7M)

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6. State and prove Wiener-Khintchine relations. (14M)

7. a) Derive the relation between input and output PSDs of an LTI system. (8M)

   b) Write short notes on thermal noise. (6M)

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