H.T.No. | | | | | | | | | | |

Code No: EC1518 **GEC-R14**

II B. Tech I Semester Regular Examinations, November 2016

PROBABILITY THEORY AND RANDOM VARIABLES

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. A communication source emits binary symbols 1 and 0 with probability 0.6 and 0.4 respectively. What is the probability that there will be 5 1's in a message of 20 symbols?
2. Find characteristic function of the random variable X with

   $f_X(x) = \lambda e^{-\lambda x} \qquad \lambda > 0, x > 0.$
3. Consider two jointly distributed random variables X and Y with the joint CDF

   $$F_{X,Y}(x,y) = \begin{cases} (1-e^{-2x})(1-e^{-y}) & x \geq 0, y \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

   Find the marginal CDFs.
4. Define cross correlation function of two random processes X(t) and Y(t).
5. Define random process. Discuss classification of random process.
6. What is the relationship between power spectral densities of input and output random process of an LTI system?

PART-B

4 × 12 = 48M

1. a) Show that conditional probability satisfies three axioms of probability. (5M)

   b) A lot consists of ten good articles, four with minor defects and two with major defects. Two articles are chosen from the lot at random (without replacement). Find probability that 1. Both are good 2. Both have major defects. 3. At least one is good 4. At most one is good 5. Neither have majority defects. (7M)
2. a) Explain the concept of a transformation of a random variable X. (5M)

   b) X is a uniformly distributed random variable in the interval (-π, π), under goes the transformation Y= cos(X). Find density function of Y. (7M)

3. a) With neat sketch explain the following:

   i) Gaussian Random variable & Normalised Gaussian random variable

   ii) Find the probability of event $\{X \leq 5.5\}$ for a Gaussian Random variable having mean is 3 and variance as two. (6M)

   b) Show that two random variables X1 and X2 with joint pdf. $f_{X1X2}(X1, X2) = 1/16$; $|X1| < 4$, $2 < X2 < 4$ are independent and orthogonal. (6M)

4. a) Derive the conditions for random process to be Ergodic Process In terms of mean. (6M)

   b) Prove that the random process $X(t)=A \cos(Wt+\phi)$ is wide sense Stationary where A, ϕ are constants and W is uniformly distributed random variable in the interval $(0\ 2\pi)$. (6M)

5. a) A random process $Y(t) = X(t) - X(t + \zeta)$ is defined in terms of a process X(t) that is at least wide sense stationary. Show that mean value of Y(t) is 0 even if X(t) has a non Zero mean value. (6M)

   b) Show that variance of $Y(t) = 2[R_{XX}(0) - R_{XX}(\zeta)]$ (6M)

6. a) A signal $x(t)=u(t)e^{-\alpha t}$ is applied to a network having an impulse response $h(t)=W u(t)e^{-Wt}$. Here α *and* W are real positive constants and u (.) is a unit step function. Find the system response. (7M)

   b) The input X(t) of the RC low pass filter is a white noise. Find the mean square value of Y(t). (5M)

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