

**R15**

Code No: 123BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, March - 2017

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(Common to ECE, ETM)

Time: 3 Hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) Define Random variable. [2]
- b) Write about the continuous and mixed random variables. [3]
- c) Mention the difference between the Variance and Skew. [2]
- d) Write about the Rayleigh density and distribution function. [3]
- e) Explain the equal and unequal distributions. [2]
- f) Write about linear transformations of Gaussian random variables. [3]
- g) Mention the properties covariance. [2]
- h) Show that  $S_{xx}(\omega) = S_{xx}(-\omega)$ . [3]
- i) State wiener-Khinchin relation. [2]
- j) Express the relationship between power spectrum and autocorrelation. [3]

**PART - B****(50 Marks)**

- 2.a) Discuss the mutually exclusive events with an example.
  - b) Define probability, set and sample spaces. [5+5]
- OR**
3. Write the classical and axiomatic definitions of Probability and for a three digit decimal number chosen at random, find the probability that exactly K digits are greater than and equal to 5, for  $0 < K < 3$ . [10]
- 4.a) Obtain the relationship between probability and probability density function.
  - b) Find the moment generating function of the random variable whose moments are  $m_r = (r + 1)!2^r$ . [5+5]
- OR**
- 5.a) Write about Chebychev's inequality and mention about its characteristic function.
  - b) Determine the moment generating function about origin of the Poisson distribution. [5+5]
- 6.a) Differentiate between the marginal distribution functions, conditional distribution functions and densities.
  - b) Given the transformation  $y = \cos x$  where  $x$  be a uniformly distributed random variable in the interval  $(-\pi, \pi)$ . Find  $f_y(y)$  and  $E[y]$ . [5+5]

**OR**

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**PART - B****(50 Marks)**

- 2.a) Discuss the mutually exclusive events with an example.
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**OR**

7. Let  $X$  be a random variable defined, Find  $E[3X]$  and  $E[X^2]$  given the density function as

$$f_x(x) = \begin{cases} (\pi/16)\cos(\pi x/8), & -4 \leq x \leq 4 \\ 0, & \text{elsewhere} \end{cases} \quad [10]$$

8.a) State and prove properties of cross correlation function.

b) If the PSD of  $X(t)$  is  $S_{xx}(\omega)$ , Find the PSD of  $dx(t)/dt$ . [5+5]

**OR**

9. A random process  $Y(t) = X(t) - X(t + \tau)$  is defined in terms of a process  $X(t)$ . That is at least wide sense stationary.

a) Show that mean value of  $Y(t)$  is 0 even if  $X(t)$  has a non Zero mean value.

b) If  $Y(t) = X(t) + X(t + \tau)$  find  $E[Y(t)]$  and  $\sigma Y^2$ . [5+5]

10. The auto correlation function of a random process  $X(t)$  is  $R_{XX}(\tau) = 3 + 2 \exp(-4\tau^2)$ .

a) Evaluate the power spectrum and average power of  $X(t)$ .

b) Calculate the power in the frequency band  $-1/\sqrt{2} \leq \omega \leq 1/\sqrt{2}$  [5+5]

**OR**

11. Derive the relation between PSDs of input and output random process of an LTI system.

[10]

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