52

Code No: 113BT **R13**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year I Semester Examinations, November - 2015**
**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) What is Total probability and Baye's Theorem? [2M]
b) Define Random Variable. [3M]
c) Explain probability density function with example. [2M]
d) Define expected value of a random variable. [3M]
e) Define joint distribution function with example. [2M]
f) Define joint central moment. [3M]
g) Write about the following with examples. [2M]
i) Discrete time stochastic process ii) Continuous time stochastic process.
h) Discuss Gaussian random process and state its properties. [3M]
i) Define power spectrum. [2M]
j) Discuss cross power density spectrum. [3M]

## PART-B

**[50 Marks]**

2.a) Define and explain the following with an example:
i) Equally likely events
ii) Exhaustive events
iii) Mutually exclusive events.
b) A class contains 9 boys and 3 girls.
i) In how many ways can the teacher choose a committee of 4?
ii) How many of them will contain at least one girl?
iii) How many of them will contain exactly one girl? [5+5]

**OR**

3.a) State the conditions for a function to be random variable
b) In experiment where the pointer on a wheel of chance is spun. The possible outcomes are the numbers from 0 to 12 marked on the wheel. The sample space consists of the numbers in the set $\{0 < S \leq 12\}$ and if the random variable X is defined as $X = X(S) = S^2$, map the elements of random variable on the real line and explain. [5+5]

4.a) Write short notes on the following
i) Binomial ii) Poisson distribution.

b) The random variable X has the discrete variable in the set {-1,-0.5, 0.7, 1.5, 3} the corresponding probabilities are assumed to be {0.1, 0.2, 0.1, 0.4, 0.2}. Plot its distribution function and state is it a discrete or continuous distribution function. [5+5]

**OR**

5.a) Discuss Moment generating function and its properties.

b) Calculate E[X] when X is binomially distributed with parameters n and p. [5+5]

6.a) Discuss the properties of joint density function for two random variables X and Y.

b) A joint probability density function is $f(x, y) = 1/ab$ for $0 < x < a$, $0 < y < b$ and $f(x, y) = 0$ elsewhere. Find the joint probability distribution function. [5+5]

**OR**

7.a) Prove that the mean value of a weighted sum of random variables equals the weighted sum of mean values.

b) Prove that if 'X' and 'Y' are random variables taking real values then $[E(XY)^2] \leq E[X^2].E[Y^2]$. [5+5]

8.a) Discuss in detail about First order stationary random process

b) The auto correlation function of a random process X(t) is $R_{XX}(\tau) = 3+2\exp(-4\tau^2)$. Find the power spectrum of X(t). [5+5]

**OR**

9.a) Prove that autocorrelation function of a random process is even function of $\tau$.

b) Prove that $R_{XX}(\tau) = R_{XX}(0)$. [5+5]

10.a) Discuss the properties of cross power density spectrum?

b) State and prove Wiener – Khintchine relationship. [5+5]

**OR**

11.a) Find the power density spectrum of a random process whose autocorrelation function is $R_{XX}(\tau) = A\cos(\omega_0\tau)$.

b) A random process is defined as $Y(t) = X(t)-X(t-a)$, where $X(t)$ is a WSS process and $a > 0$ is a constant. Find the PSD of $Y(t)$ in terms of the corresponding quantities of $X(t)$. [5+5]

--ooOoo--