Code No: 113BT

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, February/March - 2016
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(Common to ECE, ETM)

Time: 3 Hours **Max. M: 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 a random variable. [2]
b) State theorem of total probability. [3]
c) Write the expression for pdf of a Poisson random variable. [2]
d) Define Moment generating function and present generation of moments using it. [3]
e) State central limit theorem for the case of unequal distributions. [2]
f) Write short notes on jointly Gaussian random variables for 2 variable case. [3]
g) What is an ergodic random process? [2]
h) Write short notes on Poisson random process. [3]
i) Define cross power spectral density. [2]
j) Write the properties of power spectral density. [3]

PART - B [50 Marks]

2.a) Consider an experiment of drawing two cards at random from a bag containing four cards marked with the integers 1 through 4.
(i) Find the sample space S_1 of the experiment if the first card is replaced before the second is drawn.
(ii) Find the sample space S_2 of the experiment if the first card is not replaced.
b) Explain relative frequency approach of probability. [5+5]

OR

3. A Company producing electric relays has three manufacturing plants producing 50, 30, and 20 percent, respectively, of its product. Suppose that the probabilities that a relay manufactured by these plants is defective are 0.02, 0.06, and 0.015, respectively.
a) If a relay is selected at random from the output of the company, what is the probability that it is defective?
b) If a relay selected at random is found to be defective, what is the probability that it was manufactured by plant 3? [5+5]

4.a) Obtain the characteristic function of a uniformly distributed random variable.
b) Obtain the variance of Poisson random variable. [5+5]

OR

5.a) A random variable X uniformly distributed in the interval $(0,\pi/2)$. Consider the transformation Y= Cos X, obtain the pdf of Y.
b) Obtain the characteristic function of Poisson random variable. [5+5]

6.a) Consider the linear transformations given by $Y_1 = X_1 - 3X_2$, $Y_2 = -2X_1+3X_2$ where X1 and X2 are independent random variables. Obtain the joint density of Y_1, Y_2 in terms of joint density of X_1, X_2.

b) Prove the joint characteristic function of two independent random variables is equal to the product of marginal characteristic functions. [5+5]

OR

7.a) Write the properties of joint density function.

b) Define covariance of random variables X, Y and derive the relationship between covariance and correlation of X and Y. [5+5]

8. Define cross-correlation function of a random processes, Write properties processes and prove any three of them. [10]

OR

9.a) Explain the properties of covariance.

b) Check whether the random process $X(t) = A\cos(\omega_o t+\theta)$ is WSS or not? Given θ is uniformly distributed in the interval $(0, 3\pi/2)$. [5+5]

10. State and prove Wiener- Khinchine realations. [10]

OR

11.a) The power spectral density of a WSS random process is $\pi[\delta(\omega - \omega_o) + \delta(\omega + \omega_o)]$. Find its autocorrelation function.

b) Obtain the average power in the random process $X(t) = A\cos(\omega_o t+\theta)$ where A, ω_o are real constants and θ is a random variable uniformly distributed in the range $(0, \pi/2)$. [5+5]

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