Code No: 113BT

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June-2015

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

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) State the conditions for which two events are said to be independent. [2M]
b) Distinguish between joint and conditional probability. [3M]
c) Distinguish between binomial and Poisson distribution. [2M]
d) Derive Mean of Uniform Distribution. [3M]
e) Explain the term "statistical independence" of two random variables. [2M]
f) What are the conditions for two random variables to be jointly Gaussian? [3M]
g) Explain the term Ergodicity. [2M]
h) Explain the term Gaussian random process. [3M]
i) State and explain the relation between power spectrum and Auto-correlation Function. [2M]
j) Explain the term cross power spectral density. [3M]

PART-B (50 Marks)

2.a) An experiment consist of rolling a single die. Two events are defined as A = { a 6 shows up}and B = {a 2 or a 5 shows up}.Find P(A) and P(B).
b) Define Random variable and give the concept of random variable.
c) State and prove Baye's Theorem. [4+3+3]

OR

3.a) The six sides of a fair die are numbered from 1 to 6. The die is rolled 4 times. How many sequences of the four resulting numbers are possible?
b) Define cumulative distribution function of a random variable.
c) State and prove axioms of probability. [4+3+3]

4.a) Derive mean and variance of exponential distribution of a random variable.
b) A random variable X has the following probability distribution:

x	0	1	2	3	4	5	6	7	8
P(X)	A	3a	5a	7a	9a	11a	13a	15a	17a

i) Determine the value of 'a'
ii) Find the distribution function F(x).
c) Distinguish between monotonic and non-monotonic transformation of a continuous random variable. [3+4+3]

OR

5.a) Write about Rayleigh distribution of a random variable.

b) A random variable X has the density function

$$f(x)=\begin{cases}\frac{1}{2x} & 0\le x\le 1\\ 0 & else\ where\end{cases}$$

Obtain the moment generating function.

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

[3+4+3]

6.a) Write about joint distribution function of two random variables. Discuss its properties.

b) Explain conditional distribution function of two random variables.

c) The joint probability density function of two random variables x and y is given as

$$f(x,y)=C(2x+y) \quad 0\le x\le 1, 0\le y\le 2$$
$$=0 \quad elsewhere$$

i) Find the value of C

ii)Find the marginal functions of X and Y. [3+3+4]

OR

7.a) Write about Expected value of a function of random variables.

b) Explain conditional density function of two random variables.

c) The characteristic function for a Gaussian random variable X, having a mean value of 0, is $\Phi_x(\omega)=\exp(-\sigma_x^2\omega^2/2)$

Find all the moments of X. [3+3+4]

8.a) Determine whether the random process $X(t) = A\cos(\omega_0 t + \theta)$ is wide stationary or not where A, ω_0 are constants and θ is a uniformly distributed random variable on the interval $(0, 2\pi)$.

b) What is Erogodic Random Process?

c) State and prove the properties of covariance function of two random process.

[3+3+4]

OR

9.a) Define Auto and cross correlation functions of two random processes.

b) Comment on the term time-Average of random processes.

c) State and prove the properties of cross correlation function of two random process. [3+3+4]

10.a) Derive the relation between power spectrum and auto correlation function of a random process.

b) For a random process X(t) derive the expression for power density spectrum.

c) State and prove any four properties of power spectral density of random process.

[3+3+4]

OR

11.a) Derive the relationship between cross-power spectral density and cross correlation function of a random process.

b) Evaluate the cross power spectral density given the cross correlation of two processes X(t) and Y(t) is $(AB/2)[\sin\omega t+\cos\omega(2t+\tau)]$,where A, B and ω are constant.

c) Is power density spectrum an even function of 'ω' or odd function of 'ω'? Justify.

[3+3+4]

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