Code No: 153BQ

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, February -2024
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A
(25 Marks)

1.a)	Define and explain the following: i) Sample space ii) Discrete sample space.	[2]
b)	Write the conditions to be satisfied by a function to be a random variable.	[3]
c)	Write the properties of probability density function.	[2]
d)	Write about the Rayleigh density and distribution function.	[3]
e)	Write two properties of joint distribution function of random variables.	[2]
f)	Write about linear transformations of Gaussian random variables.	[3]
g)	Give an example of a deterministic random process.	[2]
h)	Write short notes on Gaussian random process.	[3]
i)	Write short notes on different types of noises.	[2]
j)	What are the causes of thermal noise?	[3]

PART – B
(50 Marks)

2.a) State and prove Bayes Theorem.
b) Define the terms outcome, event, sample space, mutually exclusive events. Consider the experiment of rolling of two fair dice simultaneously and represent its sample space. Also give examples of terms mentioned above related to this experiment. [5+5]

OR

3. A missile can be accidentally launched if two relays A and B both have failed. Theprobabilities of A and B failing are known to be 0.01 and 0.03, respectively. It is also known that B is more likely to fail (probability 0.06), if A has failed.
a) What is the probability of an accidental missile launch?
b) What is the probability that A will fail, if B has failed?
c) Are the events "A fails" and "B fails" statistically independent? [3+3+4]

4.a) Find the Moment generating function of a uniform random variable distribute over (A, B) and find its first and second moments about origin, from the Moment generating function.
b) A random variable X has a mean of 10 and variance of 9. Find the lower bound on the probability of $(5<X<15)$. [5+5]

OR

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

6.a) Obtain the expression for conditional density $f_x(X/B)$ where event B is defined as $\{y_a \le Y \le y_b\}$.

b) Write short notes on jointly Gaussian random variables. [5+5]

OR

7.a) Explain the significance of auto correlation.

b) Find auto correlation function of a random process whose power spectral density is given by $\frac{4}{1+\frac{\omega^2}{4}}$. [5+5]

8.a) Explain the concept of time average and ergodicity. Write the conditions for a random process to be ergodic in mean and autocorrelation.

b) Define Autocorrelation of a random process. Write its properties and prove any two of them. [5+5]

OR

9.a) A random process X(t) = Acos(ωot) + B sin(ωot) where ωo is a constant and A, B are uncorrelated zero mean random variables with same variances. Check whether X(t) is WSS or not?

b) Classify random processes and explain. [5+5]

10.a) A Gaussian random process X (t) is applied to a stable linear filter. Show that the random process Y(t) developed at the output of the filter is also Gaussian.

b) Discuss about cross correlation between the input X (t) and output Y (t). [5+5]

OR

11. Write short notes on the following:
a) Bandpass random process.
b) Band-limited random process. [5+5]

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