Code No: 123BT **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, September/October - 2023
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 joint probability.	[2]
b)	Define probability based on axioms.	[3]
c)	What is the significance of standard deviation of a random variable?	[2]
d)	Explain Chebyshev's Inequality.	[3]
e)	Express covariance in terms of correlation and mean values.	[2]
f)	What is joint characteristic function of random variables X and Y?	[3]
g)	Define mean-ergodic process.	[2]
h)	Differentiate time average and statistical averages.	[3]
i)	Is it possible to represent the random signals in frequency domain by using Fourier transform? Justify your answer.	[2]
j)	What is RMS bandwidth of a power spectrum?	[3]

PART - B

(50 Marks)

2. State and prove Bayes theorem. [10]

OR

3. A missile can be accidentally launched if two relays A and B both have failed. The probabilities of A and B failing are 0.03 and 0.02 respectively. It is also known that B is more likely to fail (probability 0.05) if A has failed. a) What is the probability of accidentally 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? [10]

4. Derive the expression for density function of a transformed random variable, if the transformation is monotonic and the random variable is continuous. [10]

OR

5. The characteristic function of a random variable X is given as $\Phi_X(\omega) = \frac{1}{(1-j2\omega)^{\frac{N}{2}}}$, where N is an integer. Find the mean and variance of random variable X. [10]

6. Write and explain the properties of joint density function of random variables X and Y. [10]

OR

7. Statistically independent random variables X and Y have respective densities

$$f_X(x) = \frac{1}{2}u(x-1)e^{-(x-1)/2}$$

$$f_Y(y) = \frac{1}{4}u(y-3)e^{-(y-3)/4}$$

Find the probability density of the sum $W = X + Y$. [10]

8. Define cross – correlation function. State and prove the properties of cross-correlation function. [10]

OR

9. A stationary random process $X(t)$ is applied to the input of a system for which $h(t) = 3u(t)t^2 \exp(-8t)$. If $E[X(t)] = 2$, what is the mean value of the system's response $Y(t)$? [10]

10. Derive the relationship between power spectrum and autocorrelation function. Also list the properties of power spectrum. [10]

OR

11. Explain the power spectrum of response, cross power density spectrum of input and output of the linear system with random inputs. [10]

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