Code No: 154CN **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(Electronics and Computer 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.

PA RT – A

(25 Marks)

1.a) Write the conditions for a function to be a random variable. [2]
b) Define axioms of probability. [3]
c) Discuss joint Gaussian random variable. [2]
d) State central limit theorem for the case of equal distributions. [3]
e) What is a WSS random process? [2]
f) Define the covariance matrix and its properties. [3]
g) State the Periodicity Property of Auto Correlation function of a Stationary Random Process. [2]
h) Verify that the cross spectral density of two uncorrelated stationary random processes is an impulse function. [3]
i) Define SNR and Average Noise figure. [2]
j) Bring out the differences between narrowband and broadband noises. [3]

PART – B

(50 Marks)

2.a) When two dice are thrown, find the probability of getting the sums of 10 or 11?
b) Distinguish between mutually exclusive events and independent events. [5+5]

OR

3.a) A bag contains 4 balls. Two balls are drawn and are found to be white. Find the probability that all balls are white.
b) A Gaussian random variable has a mean value 1 and variance of 4. Find the probability that random variable has value between 1 and 2. [5+5]

4.a) Find the moment generating function about the origin of the Poisson distribution.
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) X and Y are two statistically independent random variables related to W as W= X + Y. Obtain the probability density function of Y in terms of probability density functions of X and Y.
b) What is the difference between random sequence and random process? [5+5]

6.a) Distinguish between deterministic and non-deterministic processes.
b) Obtain the variance of Gaussian random variable. [5+5]

OR

7.a) Define cross covariance and list out its properties.
b) Obtain the characteristic function of Poisson random variable. [5+5]

8.a) Define cross power density spectrum and write its properties.
b) Derive the expression for power density spectrum of a random process given by A cos(2πft). [5+5]

OR

9.a) Determine the cross-correlation function, whose cross PSD is $S_{XY}(\omega) = 8/(\alpha+j\omega)^3$ and also find $S_{YX}(\omega)$, $R_{YX}(\omega)$.
b) Derive the relationship between power spectrum and autocorrelation function. [6+4]

10.a) Discuss about Shannon Fano coding with example.
b) A mixer stage has a noise figure of 20dB, and this is preceded by an amplifier that has a noise figure of 9dB and an available power gain 15dB. Calculate the overall noise figure referred to the input. [5+5]

OR

11.a) What is Quadrature representation of narrow band noise and mention its properties.
b) Discuss about the Shannon-Hartley law. [5+5]

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