Paper / Subject Code: 32224 / Random Signal Analysis

1T01035 - T.E.(Electronics and Telecommunication)(SEM-V)(Choice Base Credit Grading System) (R-19) (C Scheme) / 32224 - Random Signal Analysis   QP CODE: 10038899   DATE: 1/12/2023

Time: 3 hours   **Max. Marks: 80**

> **N.B. :** 1) **Question no. 1 is compulsory**
> 2) **Answer any 3 questions from remaining five questions**

Q1   Answer any four questions

    a. Define mathematical, statistical, and axiomatic definitions of probability.   **05**
    b. Define PDF and CDF of random variables with properties.   **05**
    c. Define Autocorrelation Function. List the properties.   **05**
    d. Explain the central limit theorem   **05**
    e. Define n^{th} order stationary process. When will it become a WSS process?   **05**

Q2 a. For a certain binary, communication channel, the probability that a transmitted '0' is received as a '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. if the probability that a '0' is transmitted is 0.4, find the probability that   **10**
i) '1' is received ii) a '1' was transmitted given that a '1' was received iii) Error Probability

    b. Find mean and variance of binomial distribution using characteristic function   **10**

Q3 a. If the probability of success is 0.2, how many trials are necessary in order that probability of at least one success is greater than 0.5?   **10**

    b. The joint pdf of the random variables (X, Y) is given by   **10**
$$f(x,y) = kxye^{-(x^2+y^2)}, \text{x>0, y >0}$$
$$= 0 \text{ , elsewhere}$$
Find the value of k and prove that X and Y are independent.

Q4 a. Prove that for a linear time invariant system, if the input is a WSS process, then output is also WSS Process.   **10**

    b. Find the equation of the regression line from the following data. Calculate MSE.   **10**

X	1	3	5	7	9	10
Y	9	8	10	12	11	13

Q5 a. If the WSS process X (t) is given by X (t) = 10 cos (100t+ θ), where θ is uniformly distributed over (-π, π). Prove that X (t) is correlation ergodic.   **10**

    b. If two random variables X and Y are independent, find the pdf of Z=X+Y if f(X)=5e^{-5x} and f(Y)=2e^{-2y} , x > 0 and y > 0   **10**

Q6 a. Find the correlation coefficient for the bivariate random variable (x, y) having the joint probability function.   **10**
$$f(x, y) = \frac{3}{2}(x^2 + y^2) \; ; 0 \le x \le 1; 0 \le y \le 1$$
$$= 0 \qquad ; \text{elsewhere}$$

    b. Write a note on   **10**
       i)   Bayes Theorem   ii) Gaussian process

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