Exam.Code:0928
Sub. Code: 6908

2071

B.E. (Electronics and Communication Engineering)

Fourth Semester

EC-407: Probability and Random Analysis

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Use of scientific calculator is allowed.*

x-x-x

I. (a) Which part of a typical communication system is most likely to be affected by channel noise and why? (1)
(b) What is a filter? (1)
(c) Define noise figure of a network. (1)
(d) What is binary symmetric channel? (1)
(e) What is link budgeting? (2)
(f) Differentiate between ergodic process and stationary processes. (2)
(g) Describe relation between correlation and covariance functions. (2)

UNIT - I

II. (a) Explain the working of a communication system with the help of its block diagram. (3)
(b) With the help of suitable examples define baseband and bandpass signals. Express a bandpass signal in terms of its in-phase and quadrature components. (4)
(c) Define independent random variables. Prove that the variance of a sum of such random variables is equal to the sum of their variances. (3)

III. (a) Explain Gaussian PDF. What is its importance in communication theory? Determine the Cumulative Distribution Function (CDF) of a Gaussian Random variable. (6)

(b) A probability density function is given by the expression $f(x)=ae^{-b|x|}$. The random variable X takes values from $x=-\infty$ to $x=+\infty$. Determine the following:

1. The relationship between a and b
2. Cumulative distribution function
3. The probability that outcome lies between 1 and 2. (4)

IV. (a) What is a frequency selective channel? Explain phase delay and group delay for this channel. (5)

(b) Describe the concept of autocorrelation function of a random process. What are its properties? (5)

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UNIT - II

V. **(a)** Define information. How it is measured form engineering viewpoint? **(3)**

(b) What is entropy? Prove that the entropy is maximized when all the messages are of equal probability. **(3)**

(c) What do you mean by fixed length and variable length codes? **(4)**

VI. **(a)** Define narrowband noise. Explain its properties. **(4)**

(b) An event has six possible outcomes with the probabilities $P_1 = 1/2$, $P_2 = 1/4$, $P_3 = 1/8$, $P_4 = 1/16$, $P_5 = 1/32$ and $P_6 = 1/32$. Find the entropy of the system. Also find the rate of information, if there are 16 outcomes per second. **(3)**

(c) Describe the concept of noise temperature. What is its significance? **(3)**

VII. **(a)** Explain discrete memoryless channels. **(3)**

(b) Explain the concept of white noise. Why is it called idealized form of noise? **(2)**

(c) A discrete message source generates seven messages whose probability of occurrences are described as follows:

Message	m_1	m_2	m_3	m_4	m_5	m_6	m_7
Probability	0.25	0.25	0.125	0.125	0.125	0.0625	0.0625

Construct a Huffman source code for the message source and calculate the efficiency of the code. **(5)**

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