2062
B.E. (Electronics and Communication Engineering)
Fourth Semester
EC-407: Probability and Random Processes

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 Section. Use of scientific calculator is allowed.*

x-x-x

I.   (a) Define noise figure of a network.   (1)
        (b) What is binary symmetric channel?   (1)
        (c) Define characteristic function of a random variable.   (1)
        (d) Define channel capacity.   (1)
        (e) Define LTI system.   (1)
        (f) Define CDF of a random variable.   (1)
        (g) Differentiate between ergodic process and stationary processes. (2)
        (h) What is link budgeting?   (2)

Section-A

II.   (a) White Gaussian noise of zero mean and power spectral density $N_0/2$ is applied to the filtering scheme shown in the adjoining figure. The noise at the output of low pass filter is $n(t)$.
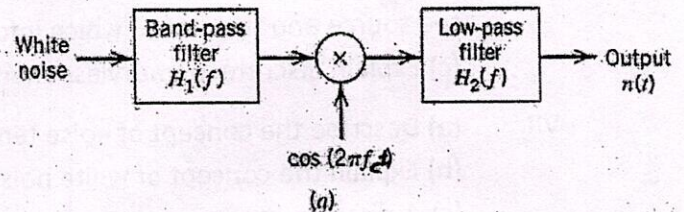
(1) Find the power spectral density and the auto correlation function of $n(t)$.

(2) Find mean and variance of $n(t)$.   (6)
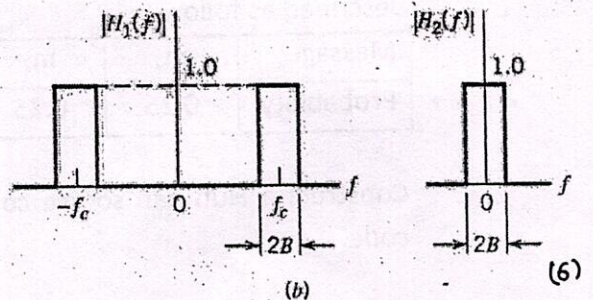
(b) With the help of suitable examples define baseband and bandpass signals. Express a bandpass signal in terms of its in-phase and quadrature components.   (4)

III.   (a) Explain band pass system. Determine the response of a bandpass system to a bandpass signal?   (5)

        (b) Define PSD of a random process. Explain its properties.   (5)

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IV.   (a) Define low-pass and band-pass signals. Express a band-pass signal in terms of its in-phase and quadrature components.   (5)

        (b) What do you mean by AWGN?   (2)
        (c) Define phase delay and group delay.   (3)

Section-B

V.   (a) What is entropy? Prove that the entropy is maximized when all the messages are of equal probability.   (3)
        (b) Define information. How it is measured form engineering viewpoint?   (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 analog signal band-limited to 10 kHz is quantized in 8 levels of a PCM system with probabilities of 1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20 and 1/20 respectively. Find the entropy of the source and the rate at which information is being transmitted.   (3)
        (c) Explain discrete memoryless channels.   (3)

VII.   (a) Describe the concept of noise temperature. What is its significance?   (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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