CBCS SCHEME

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21EC51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Digital Communication

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive the expression for error probability of binary phase shift keying using coherent detection. **(08 Marks)**

b. An FSK system transmits binary data at the rate of 2×10^6 bit per sec. During the source of transmission, AWGN of zero mean and two sided power spectral density 10^{-20}W/Hz is added to the signal. The amplitude of received wave for digit 1 or 0 is 1 microvolt. Determine the average probability of symbol error assuming non-coherent detection. **(06 Marks)**

c. Explain the concept of M-ary PSK. **(06 Marks)**

OR

2 a. With a neat block diagram, explain non-coherent detection of binary FSK technique. **(08 Marks)**

b. Binary data is transmitted over AWGN channel using BPSK at a rate of 1Mbps. It is desired to have average probability of error $p_e \leq 10^{-4}$. Noise PSD = 10^{-12}W/Hz. Determine the average carrier power required at receiver input if the detector is of coherent type. [Assume erfc (3.5) = 0.00025]. **(06 Marks)**

c. Explain the generation and detection of DPSK with neat block diagram. **(06 Marks)**

Module-2

3 a. Explain the geometric representation of set of in energy signals as combination of N orthonormal basis function. Illustrate the case of N = 2 and M = 3 with necessary diagrams and expressions. **(08 Marks)**

b. Explain the correlation receiver using coherent detection. **(06 Marks)**

c. Explain the design of band limited signals with controller ISI-partial response signal. **(06 Marks)**

OR

4 a. Using Gram-Schmidt orthogonalization procedure find the set of orthonormal basis function to represent the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q.4(a). Also express each of these signals interms of set of basis function.

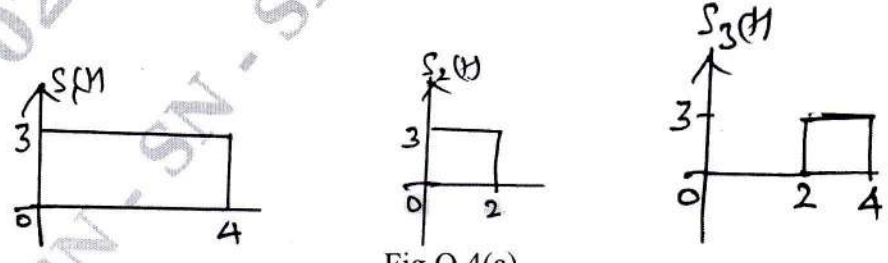

Fig.Q.4(a)

(10 Marks)

b. State and prove Nyquist condition for zero ISI. **(10 Marks)**

Module-3

5 a. Explain the model of spread spectrum digital communication system. **(10 Marks)**

b. With a neat block diagram, explain the CDMA system band on IS-95. **(10 Marks)**

OR

6 a. Explain the frequency hopped spread spectrum technique with neat transmitter and receiver block diagram. **(08 Marks)**

b. The SNR required at the detector to achieve reliable communication in a DSSS communication system is 13dB. If the interference to signal power at the receiver is 20dB. Determine the processing gain required. **(04 Marks)**

c. Write a note on application of DS spread spectrum systems. **(08 Marks)**

Module-4

7 a. Define the following with respect to information theory :

i) Self information
ii) Entropy
iii) Source efficiency
iv) Rate of information. **(08 Marks)**

b. Construct binary code for the following source using Shannon's binary encoding procedure. $s = \{s_1, s_2, s_3, s_4, s_5\}$ $p = \{0.4, 0.25, 0.15, 0.12, 0.08\}$. **(08 Marks)**

c. Explain the types of methods of controlling error. **(04 Marks)**

OR

8 a. Six messages symbols with probability of 0.4, 0.2, 0.2, 0.1, 0.07, 0.03, construct a binary code by using Shannon's Fano encoding procedure. Also determine code efficiency and redundancy. **(10 Marks)**

b. A source produces 5 symbols with probabilities of 0.1, 0.3, 0.4, 0.12 and 0.08.

i) Construct a binary Huffman code
ii) Determine efficiency and redundancy of the code
iii) Draw code-tree. **(10 Marks)**

Module-5

9 a. A (7, 4) linear block code having partly matrix $P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

i) Find all possible code vector
ii) Draw the encoding circuit
iii) Draw the syndrome circuit. **(10 Marks)**

b. A (3, 1, 2) convolutional code with $g^{(1)} = (110)$, $g^{(2)} = (101)$ and $g^{(3)} = (111)$.

i) Draw the encoder block diagram.
ii) Find the generator matrix.
iii) Find the code word for information sequence (11101) using transform domain approach. **(10 Marks)**

OR

10 a. For a (2, 1, 4) convolutional encoder as shown in Fig.Q.10(a). (10 Marks)

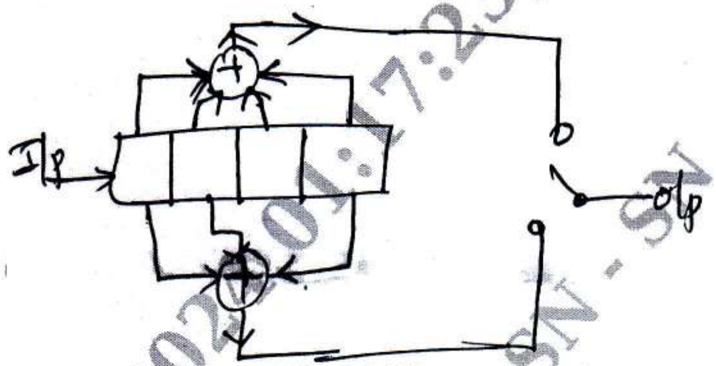

Fig.Q.10(a)

Find the codeward corresponding to the information source (10111). Using time domain and transform domain approach. (10 Marks)

b. A, (2, 1, 2) binary convolutional encoder as shown in Fig.Q.10(b). Draw the state table, state transition table, state diagram and corresponding code tree, for the message 10111. Find the encoded sequence.

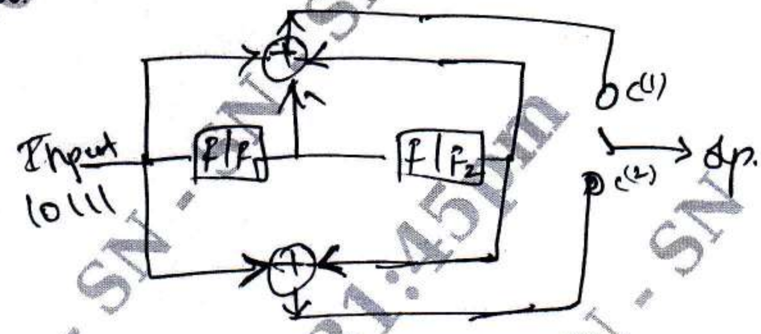

Fig.Q.10(b)

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