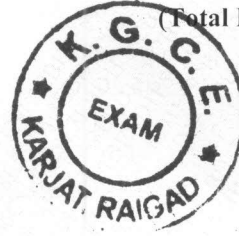


(3 Hours)

(Total Marks : 80)



- N.B. 1. Question No 1 is compulsory.**
2. Attempt any three questions out of remaining five.
3. All questions carry equal marks
4. Assume Suitable data, if required and state it clearly.

- 1** Attempt any **FOUR** [20]
- 1** With a relevant block diagram, explain duobinary signalling scheme. Why is it called correlative coding? Write the output for bitstream 001100.
 - 2** What is DBPSK? What advantage does it have over conventional PSK?
 - 3** Show the entropy is maximum when all the symbols of a discrete memoryless source are equiprobable.
 - 4** Why are line codes necessary? What are the different parameters which need to be examined before choosing a PCM waveform for a particular application?
 - 5** Contrast and Compare systematic and non-systematic block codes.
- 2** **a** Consider an alphabet of a discrete memoryless source having following source symbols with their respective probabilities as 0.40, 0.20, 0.12, 0.08, 0.08, 0.08, and 0.04. [10]
- i) Create a Huffman Tree following the standard algorithm for the Huffman encoding, and compute the codeword and respective length of the codewords for each of the given sources symbols.
 - ii) Determine the average codeword length.
 - iii) Determine entropy of the specified discrete memoryless source.
 - iv) Determine the Coding efficiency
- b** Consider (3,1,2) convolution code with $g^{(1)}=100$, $g^{(2)} = 101$ and $g^{(3)} = 111$ [10]
- i. Draw the encoder for this code
 - ii. Draw the state transition diagram
 - iii. Using state transition diagram, find the codeword for the sequence 1101.
 - iv. Derive the code transfer function.
- 3** **a** Explain 16-ary PSK with respect to the following terms:- [10]
1. Modulator and Demodulator
 2. Power spectral density and Bandwidth.
- b** Consider a (7, 4) cyclic code generated by $g(x) = 1 + x^2 + x^3$. [10]
- i) Design an encoder for systematic cyclic code generation using shift registers
 - ii) Using encoder implemented in (i) and not otherwise, find the code word for message (1001).
 - iii) Suppose the received vector is $R = (0\ 0\ 1\ 0\ 1\ 1\ 0)$, find the syndrome using syndrome circuit.
 - iv) Find out the generator matrix for the above cyclic code.
- 4** **a** Draw the block diagram of QPSK Transmitter and receiver and Sketch the waveform and explain. [10]
- b** Explain Direct sequence spread spectrum (DS-SS) with neat diagram. Explain processing gain and Jamming Margin with necessary expressions. [10]

TURN OVER

- 5 a Consider a Systematic block code whose Parity check equations are: [10]

$$P_1 = m_1 + m_2 + m_3$$

$$P_2 = m_1 + m_2 + m_4$$

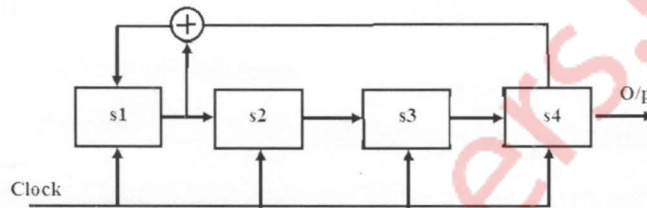
$$P_3 = m_1 + m_3 + m_4$$

$$P_4 = m_2 + m_3 + m_4$$

Where m_i are message bits and P_i are parity check bits. In a codeword parity bits appear before message bits.

- Find Generator matrix (G) and Parity check matrix (H)
- Find the code words for the message vectors: 1001, 1101
- How many errors can the code correct and detect?
- If the received code word is 10011101, decode the message.

- b The following circuitry is used to generate PN sequence with initial content (Seed) as 1011. [10]



- Write down the PN sequence.
 - Verify the balance property of PN Sequence.
 - Verify the Auto-correlation property of the PN sequence.
- 6 a What do you mean by eye diagram? What is its purpose? Mention the four parameters observed from the eye pattern. Explain it with help of suitable illustration. [10]
- b Justify that the probability of error in matched filter does not depend on the shape of input signal. Derive the relevant expression. [10]