(3 Hours)   **[Total Marks: 80]**

N.B.
1] Question no.**1** is **compulsory**
2] Attempt any **three** questions out of remaining **five** questions
3] Assumptions made should be **clearly** stated
4] Illustrate answers with **sketches** wherever **required**

Q.1   Attempt any **four**

a   Prove that entropy of extremely unlikely messages is zero.   5

b   Compare offset QPSK and non-offset QPSK.   5

c   State two criteria which a spread-spectrum communication system must satisfy.   5
Justify that the spread-spectrum signals are transparent to the interfering signals, and vice-versa.

d   Explain the Coherent and non-coherent digital modulation techniques.   5

e   Prove that syndrome depends on error patterns and not on transmitted code word.   5

Q.2

a   Consider the five source symbols of a discrete memoryless source and their respective probabilities as below.   10

S_i	S_1	S_2	S_3	S_4	S_5
P(si)	0.4	0.2	0.2	0.1	0.1

   i) Create a Huffman Tree for Huffman source coding technique to find the codeword and length of codewords for each source symbol.

   ii) Determine the average codeword length of the specified discrete memoryless source.

   iii) Comment on the results obtained

b   Describe in convolution code, Time domain approach, and Transform-domain approach to determine encoder output.   10

Q.3

a   Justify that the probability of error in matched filter does not depend on the shape of input signal. Derive the relevant expression.   10

b   Explain the working of M-ary PSK Transmitter and receiver and plot spread spectrum and calculate the bandwidth..   10

Q.4

a   Describe coherent detection method of binary FSK signals. Also draw power spectra for BFSK modulated signal.   10

b   In a digital communication system, the bit rate of a bipolar NRZ data sequence is 1 Mbps and carrier frequency of transmission is 100MHz. Determine the symbol rate of transmission and the bandwidth requirement of the communications channel for   10
   i) 8-ary PSK system
   ii) 16-ary PSK system.

TURN OVER

Q.5

a   Design a syndrome calculator for a (7, 4) Hamming code, generated by the generator   10
    polynomial $g(x)=1+X^2+X^3$, if the transmitted code word C=(0111001) and received
    word r = (0110001).

b   A (7, 4) cyclic code is described by a generator polynomial   10

$$g(x) = x^3 + x + 1$$

    i)   Find out the generator matrix
    ii)   Parity checks matrix.
    iii)   Draw the syndromecalculator and explain how received message is
            corrected?

Q.6   **Attempt the following (any two).**

a   Write short note on Intersymbol interference (ISI) and Eye diagram.   10

b   Explain with the help of block diagrams and waveforms, the following   10
    techniques of spread spectrum communication. (a) Direct sequence (b)
    Frequency hopping.

c   What are different decoding methods of convolutional codes? Explain any one in   10
    detail.

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