

Total No. of Questions : 8]

SEAT No. :

P-312

[Total No. of Pages : 3

[6003]-392

T.E. (E & TC)

DIGITAL COMMUNICATION

(2019 Pattern) (Semester - I) (304181)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer any one question out of Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

Q1) a) What is Inter Symbol Interference? Explain the practical solution to control ISI. Explain the concept of roll off factor along with its equation. [8]

b) Explain M-ary FSK transmitter and receiver with suitable block diagram. [6]

c) Compare M-ary PSK and M-ary FSK. [3]

OR

Q2) a) Sketch the waveforms of MSK for the given bit stream 11001001. [8]

b) Explain digital OFDM system implementation for transmitter and receiver. [6]

c) Draw signal space representation for 16-QAM i.e. 16-QASK and write the equation for energy associated with signals in the first quadrant. [3]

Q3) a) Explain in brief : Processing gain, Jamming Margin in DSSS. [4]

b) A BPSK-DSSS system, using coherent detection, is used to transmit data at 3Kbps $N_o = 10^{-10}$ with $N_o = 10^{-10}$. Calculate the processing gain if the system has to work in a hostile jamming environment with minimum error performance of 10^{-6} . The jamming signal is 10 times stronger than the received signal. Given $\text{erf}(3.3) = 0.999998$. [6]

c) List the advantages and disadvantages of CDMA. [8]

P.T.O.

OR

- Q4)** a) Compare slow and fast frequency hopping. [8]
b) Explain in detail DSSS - BPSK transmitter and receiver along with waveforms. [10]

- Q5)** a) Write a short note on : [9]
i) Source coding theorem
ii) Channel Coding theorem
iii) Information Capacity theorem.
b) A discrete memory less source has five symbols X_1, X_2, X_3, X_4 and X_5 with probabilities $P(X_1) = 0.4, P(X_2) = 0.19, P(X_3) = 0.16, P(X_4) = 0.15, P(X_5) = 0.10$. Construct the Shannon Fano code and calculate the code efficiency and redundancy. [8]

OR

- Q6)** a) Consider the five source symbols of discrete memory less source and their probabilities as given in the table below. Follow the Huffman's algorithm to find the code words for each message. Also find the average code word length and average information / message i.e. entropy. [8]

Message	M_1	M_2	M_3	M_4	M_5
Probability	0.4	0.2	0.2	0.1	0.1

- b) What is Mutual Information? Explain the properties of mutual information. [3]
c) Write short note on frequency hop spread spectrum. [6]
- Q7)** a) Generator matrix for (7, 4) linear block code is given below : [9]

1	0	0	0	1	1	0
0	1	0	0	0	1	1
0	0	1	0	1	1	1
0	0	0	1	1	0	1

Construct the syndrome table for single bit error patterns. Using syndromes, find error pattern and code word for each of the following received vectors :

$$r_1 = 0111101, r_2 = 0001010.$$

b) Define and also write mathematical expression for the following terms, [9]

- i) Information rate
- ii) Mutual Information
- iii) Shannon Hartley theorem

Q8) a) Define and Explain following terms, [10]

- i) Hamming distance
- ii) Hamming weight
- iii) Code rate
- iv) Constraint length
- v) Systematic & nonsystematic codes

b) Write short note on : [8]

- i) Turbo Codes
- ii) LDPC Codes
