Total No. of Questions : 8]

SEAT No. :

PE-2569

[Total No. of Pages : 3

[6583]-99
T.E. (E&TC)
DIGITAL COMMUNICATION
(2019 Pattern) (Semester - V) (304181)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer any one Question out of Q. No. 1 or Q.2, Q. No. 3 or Q.4, Q.No.5 or Q.6 and Q. No.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) Explain M array QAM in following terms. **[8]**

i) Draw signal space diagram of 16 - QAM

ii) Comment on Euclidean distance for 16 QAM

b) Calculate bandwidth requirement and minimum separation (Euclidean distance) of signal points in signal space for

i) 16-PSK

ii) 16-FSK

iii) 16-QAM.

Given that input bit rate is 8kbps and bit energy is 1×10^{-4} J. **[9]**

OR

Q2) a) Compare M-ary PSK and M-ary FSK. **[8]**

b) What is OFDM? Draw and Explain block diagram of generation and reception of the OFDM. **[9]**

Q3) a) Draw the block diagram of spread spectrum digital communication and explain the various blocks. **[9]**

b) A spread spectrum communication system has the following parameters. Information bit duration Tb = 4.095 ms, PN chip duration , Tc = 1 microsecond. Find the processing gain. What is the number of shift registers required? Also find the jamming margin if Eb/N0 = 10 for BPSK Scheme. **[9]**

OR

P.T.O.

Q4) a) Draw and explain FHSS spread spectrum system with transmitter and reciever section. **[9]**

b) Design a three stage feedback shift register with proper taps to generate N=7 PN sequence. Draw the generator block and if the initial state of shift register is 100 (from left to right). Find the output sequence. **[9]**

Q5) a) Define all five Types of Entropies and Mutual Information in communication system. **[8]**

b) Apply Shannon-Fano code for following message ensemble and find coding efficiency **[9]**

$X = [x_1\ x_2\ x_3\ x_4\ x_5\ x_6\ x_7\ x_8]$

P = [1/4 1/8 1/16 1/16 1/16 ¼ 1/16 1/8]

OR

Q6) a) An analog signal is band-limited to 4 kHz. It is sampled at the Nyquist rate and samples are quantized into 4 levels. The quantization levels Q_1, Q_2, Q_3, and Q_4 are independent messages and have the probabilities $P_1=P_2=1/8$ and $P_3=P_4=3/8$, Find the information rate of the source.**[8]**

b) A discrete memory less source has an alphabet of five symbols with their probabilites shown. Construct Huffman code and calculate code efficiency redundancy of the code. **[9]**

Symbol	M_1	M_2	M_3	M_4	M_5
Probability	0.4	0.19	0.16	0.15	0.10

Q7) a) For a systematic linear block code, the three parity check digits, are given by **[9]**

$$C_4 = d_1 \oplus d_2 \oplus d_3$$

$$C_5 = d_1 \oplus d_2$$

$$C_6 = d_1 \oplus d_3$$

i) Construct Generator Matrix

ii) Construct All Code generated by this matrix

iii) Determine error correcting capability

iv) Prepare suitable decoding table

v) Decode the received words 0 0 0 1 1 0

b) Define and Explain following terms : **[9]**

i) Hamming distance

ii) Hamming weight

iii) Code rate

iv) Constraint length

v) Generator polynomial

OR

Q8) a) A (7,4) cyclic code is described by a generator polynomial $g(x) = 1 + x^2 + x^3$ **[9]**

i) Find the codeword using polynomial division method for m = 1010

ii) Design an encoder for systematic code generation and explain its working

b) Explain Properties of Linear Block code and Cyclic Code with example **[9]**