Total No. of Questions : 8]

SEAT No. :

**P757**

[Total No. of Pages : 3

**[5870]-1061**

**T.E. (Electronics & Telecommunication)**

**DIGITAL COMMUNICATION**

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

*Time : 2½ Hours]* *[Max. Marks : 70*

*Instructions to the candidates:*

1) *Answers Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.*
2) *Figures to the right side indicate full marks.*
3) *Assume suitable data, if necessary.*



*Q1)* a) Explain how eye pattern can be used to study ISI. **[4]**

b) Find the maximum value of error probability Pe for16-PSK, 16-FSK (orthogonal) and 16-QAM if energy per bit duration is 5×10–5 J and double sided power spectral density (PSD) of AWGN is 10-9 W/Hz. **[6]**

Given :

erfc (3.1622) = 0.00000774819

erfc (1.9634375) = 0.00549

erfc (7.0710678) = 1.5239709 $\times 10^{-23}$

c) Describe with the help of block diagram, MSK transmitter along with waveforms. Mention the bandwidth requirement. **[8]**

OR

*Q2)* a) Compare MSK & QPSK. **[4]**

b) With the help neat block diagram explain OFDM transmitter and receiver system. **[8]**

c) Write short note on : Raised cosine function: a solution to Inter Symbol Interference (ISI) and mention its limitations. **[6]**

*P.T.O.*

*Q3)* a) A BPSK-DSSS system using coherent detection is used to transmit data at 250bps & system has to work in a hostile jamming environment with minimum error performance of one error in 20000 bits. Determine the minimum chipping rate if the jamming signal is 300 times stronger than the received signal. **[9]**

b) Write a short note on : **[8]**

i) PN sequence Generator

ii) Frequency hop Spread spectrum

OR

*Q4)* a) Information bit duration of DS-BPSK SS system is 1 MHz. Assuming an average error probability of $10^{-5}$. Calculate jamming margin if $Q(4.25) = 10^{-5}$. **[9]**

b) Explain DSSS based CDMA. **[8]**

*Q5)* a) Given the messages $X_1$, $X_2$, $X_3$, $X_4$, $X_5$ with respective probabilities of 0.4, 0.19, 0.16, 0.15 and 0.1. Construct codeword by minimum variance Huffman code. Compute source entropy, codeword length, efficiency, redundancy and variance. **[10]**

b) Calculate the capacity of an AWGN channel whose bandwidth is 1 MHz and S/N ratio of 40 dB. **[4]**

c) State and explain channel coding theorem. **[4]**

OR

*Q6)* a) Compute Shannon Fano code for following message ensemble. **[10]**

| Symbols | $X_1$ | $X_2$ | $X_3$ | $X_4$ |
|---|---|---|---|---|
| Probabilities | 0.4 | 0.3 | 0.2 | 0.1 |

Compute average codeword length, Entropy and coding efficiency.

b) State and explain Information Capacity theorem. **[4]**

c) Compare between source coding and Channel coding. **[4]**

***Q7)*** a) For a systematic (7, 4) LBC parity matrix is given as : **[9]**

$$P = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

i) Construct a generator matrix.

ii) Find code vectors for messages [1 1 0 0] and [0 0 1 1]

iii) If the received code vector is R = [0 1 1 1 1 0 1], find the corrected codeword

b) Explain the generation of systematic and non systematic cyclic code. **[8]**

OR

***Q8)*** a) Define following terms for LBC **[9]**

i) Code vector

ii) Code rate

iii) Hamming distance

iv) Hamming weight

v) Systematic code

b) What are Turbo codes? Explain its bit error performance for uncoded transmission. **[8]**

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