Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ECE)/SEM-5/EC-502/2011-12

2011

DIGITAL COMMUNICATION

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Eye pattern is used to study

a) Bit Error Rate

b) Error Vector Magnitude

c) Quantization Noise

d) Inter Symbol Interference.

ii) The bit rate of a digital communication system using QPSK modulation is 30 Mbps. The baud rate of the system will be

a) 60 Mbps b) 15 Mbps

c) 30 Mbps d) 7·5 Mbps.

iii) The number of bits required to represent a 256 level quantization in PCM is

a) 7 b) 8

c) 5 d) 6.

iv) In PCM, the amplitude levels are transmitted in a 7 unit channel code. The sampling is done at the rate of 10 Hz. The bandwidth preferred minimum should be

a) 5 kHz b) 35 kHz

c) 70 kHz d) 85 kHz.

v) Hamming distance between two code vectors x = (10101101) and y = (11011001) is

a) 2 b) 3

c) 5 d) 4.

vi) Adaptive delta modulation is preferred over delta modulation as

a) it gives better noise performance

b) it uses lesser bits for encoding the signal

c) it does not suffer from slope overload and threshold effects

d) It has simpler circuitry.

vii) If the maximum instantaneous phase transition of a digital modulation technique is 90°, the modulation will be recognised as

a) DPSK b) QPSK

c) OQPSK d) BPSK.

viii) For (7, 4) linear block code, the length of check bits is given by

a) 1 b) 4

c) 3 d) 7.

ix) Spread spectrum technique is used to increase

a) Power efficiency b) Processing gain

c) Spectral efficiency d) Transmission gain.

x) Alternate Mark Inversion (AMI) signaling is known as

a) Bipolar signaling b) Polar signaling

c) Machester signaling d) Unipolar signaling.

xi) Regenerative repeaters can be used in

a) Analog communication system only

b) Digital communication system only

c) Both analog and digital communication systems

d) Wireless communication only.

xii) For encoding the binary data, the Differential encoding uses

a) signal transitions

b) signal frequency

c) signal amplitude

d) signal phase.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Draw the line codes corresponding to the binary data "1101001" for the following : $1\frac{1}{2} + 1\frac{1}{2} + 2$

a) Unipolar Nonreturn to zero

b) Palar Nonreturn to zero

c) Manchester coding.

3. Generate the *pn*-sequence "1110010" using a three-stage Linear Feedback Shift Register (LFSR). 5

4. Draw the block diagram of a QPSK modulator and explain its principle of operation. 5

5. A discrete memoryless source X has five symbols x_1 , (I = 1, ... , 5) with p (x_1) = 0.4, p (x_2) = 0.19, p (x_3) = 0.13, p (x_4) = 0.16, p (x_5) = 0.12. Construct the Huffman code for x and calculate the efficiency of the code. 5

6. Draw an "Eye diagram" and mention the significance of its different parts. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) State Nyquist's criterion for zero Inter Symbol Interference (ISI). 4

   b) Mention the limitations of the above criterion. 3

   c) How can the above problems be solved by using a Raised cosine function. 4

   d) A communication channel of bandwidth 50 khz is required to transmit binary data at the rate of 500 kbps using Raised cosine pulse. Determine the corresponding roll-off factor. 4

8. a) What are the salient features of spread spectrum ? 2

b) With a neat block diagram, explain the principle of Direct Sequence Spread Spectrum (DSSS) transmitter and receiver. 8

c) Define processing gain. 2

d) A spread spectrum system has the following parameters:

Message bit rate = 3 kbps

pn-sequence chip rate = $3{\cdot}072 \times 10^{6}$

Find processing gain. 3

9. a) Compare QPSK and OQPSK systems with respect to the following factors : 3×4

i) Timing diagram

ii) I - Q diagram

iii) Non-linearity handling capability.

b) Compare the bandwidth efficiency of a BPSK system and a QPSK system. 3

10. a) What do you mean by an optimum filter ? When is it called matched filter ? 3 + 3

b) Find the probability of error of the matched filter. 9

11. a) A source produces three symbols A, B and C with probabilities $P(A) = \frac{1}{2}$; $P(B) = \frac{1}{4}$; $P(c) = \frac{1}{4}$.

Calculate source entropy. 5

b) i) Find the transmitted code word for the data "101". The generator matrix is given below :

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

ii) Find the correct code word if the receiver receives 101101. (Consider same generator matrix) 5 + 5

12. Write short notes on any *three* of the following : 3 × 5

a) Shannon's channel capacity

b) Adaptive delta modulation

c) Tapped delay equalizer

d) Companding

e) Differential encoding.