Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(ECE)/SEM-5/EC-502/2009-10

2009

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 : $10 \times 1 = 10$

i) The spectral density of white noise is

a) Exponential b) Uniform

c) Poisson d) Gaussian.

ii) Sampling theorem finds application in

a) Amplitude modulation

b) Frequency modulation

c) PCM

d) none of these.

iii) Measure of information $I(m_k)$ of a message m_k with probability p_k is given by

a) $\log_b(1/p_k)$ b) $\log_b(p_k)$

c) $\log_b(1-p_k)$ d) $\log_b[1/(1-p_k)]$.

iv) What is effective to reduce cumulative error ?

a) PCM

b) DPCM

c) Delta sigma modulation

d) ADM.

v) To avoid aliasing, what is the Nyquist rate of the signal $x(t) = 8 \cos 200 \pi t$?

a) 50 Hz b) 100 Hz

c) 200 Hz d) 400 Hz .

vi) AMI is another name of which process ?

a) Polar b) Bipolar

c) On-off d) None of these.

vii) If no. of quatization levels is 256, then no. of bits for per sample required is

a) 8 b) 10

c) 5 d) none of these.

viii) Which is more immune to noise ?

a) AM b) FM

c) Both (a) & (b) d) none of these.

ix) Two msg m_1 and m_2 of zero memory source channels have probabilities 0·8 and 0·2. Then its entropy is

a) 0·85 b) 0·75

c) 0·72 d) none of these.

x) In above question the efficiency for second arder Huffman coding is

a) 0·923 b) 0·989

c) 0·72 d) none of these.

xi) For a given E_b / N_0 which digital modulation scheme has smaller error probability ?

a) Coherent QPSK b) Coherent FSK

c) Coherent PSK d) DPSK.

xii) PN sequence is used to generate

a) DSSS b) GMSK

c) DPSK d) none of these.

xiii) Equalizer is used to

a) increase the signal to noise ratio at the receiver

b) equalize the distortion introduced by channel

c) decrease the error probability of signal detection

d) none of these.

xiv) For a voice grade signal, the signal to noise ratio of DPCM is

a) worse than standard PCM

b) better than standard PCM

c) same as standard PCM

d) none of these.

xv) The bit rate of a digital communication system is 34 Mbps. The modulation scheme is QPSK. The band rate of the system is

a) 68 Mbps b) 34 Mbps

c) 17 Mbps d) 85 Mbps.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain with a suitable block diagram how an analog signal is converted into a digital signal using PCM.

3. Explain the principle of operation of QPSK modulator with suitable block diagram.

4. What are the desirable properties of line codes ?

5. What is a PN sequence ? What are the properties of a PN sequence ? 2 + 3

6. Explain the operation of early-late gate bit synchronizer.

GROUP – C
(Long Answer Type Questions)

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

7. a) Deduce the transfer function of a matched filter. 5

   b) Show that the SNR at the output of an optimum filter optimized for error performance is $8E_s/\eta$ where E_s = signal energy & $\eta/2 = G_n(f)$ is the PSD of AWGN. 5

c) Consider a rectangular pulse $s(t)$ of amplitude A & duration T sec. given by

$$s(t) = A, \ 0 < t < T$$

$$= 0, \text{ otherwise}$$

and given that $AT = 1$

i) Find the spectrum of the output signal of the matched filter.

ii) Determine the output SNR of the matched filtre. 5

8. a) Draw & explain the working of QPSK modulator and demodulator. 5

b) What are the advantages and disadvantages of DPSK modulation ? 5

c) Compare the performance of QPSK and DPSK modulation schemes. 5

9. a) What is intersymbol interference (ISI) ? 3

b) What is Nyquist criterion for zero ISI ? 2

c) What are the limitations of Nyquist pulse ? How is it solved using Raised Cosine Pulse. 6

d) A communication channel of bandwidth 75 kHz is required to transmit binary data at a rate of 0·1 Mbps using raised cosine pulses. Determine the roll-off factor. 4

10. a) State and explain Shanon-Hartley channel capacity theorem. 5

b) What is meant by Shanon limit ? 2

c) Eight message symbols

$[X] = [x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8]$ have probabilities $[P] = [1/4, 1/8, 1/16, 1/16, 1/16, \frac{1}{4}, 1/8, 1/16]$ respectively.

Apply Shanon–Fano coding procedure to find out efficiency of the coding scheme. Take $M = 2$. 8