



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

2 + 3

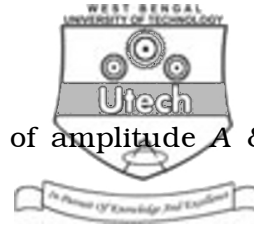
GROUP – C

(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 filter. 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

=====