Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech (ECE)/SEM-5/EC-502/2010-11

2010-11
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)   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.

ii) A rectangular pulse of duration T is applied to matched filter. The output of the filter is a

   a)   Rectangular pulse of duration T

   b)   Rectangular pulse of duration $2T$

   c)   Triangular pulse

   d)   Sine function.

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iii) The compander in a digital communication system serves to

a) equalise the SNR for both weak and strong PAM signals

b) increase amplification of the signals

c) improve A/D conversion

d) improve multiplexing.

iv) Entropy is basically a measure of

a) Rate of information

b) Average information

c) Probability of information

d) Channel capacity for transmission of information.

v) The bit rate of a digital communication system is 34 Mb/s. The modulation scheme is QPSK. The baud rate is

a) 68 Mbps   b) 34 Mbps

c) 17 Mbps   d) 8·5 Mbps.

vi) The use of non-uniform quantization leads to

a) reduction of transmission bandwidth

b) increase in maximum SNR

c) increase in SNR for low bend signal

d) simplification of quantization process.
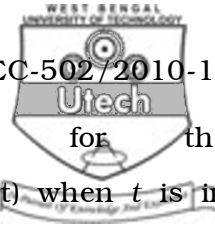
vii) The Nyquist sampling rate for the signals(t) = 10 cos (50πt) cos^2 (150 πt) when t is in seconds is

   a)   150 samples/second   b)   200 samples/second

   c)   300 samples/second   d)   350 samples/second.

viii) The entropy of an message source generating four messages with probabilities 0·5, 0·25, 0·125 and 0·125 is

   a)   1·0 bit/message   b)   1·75 bit/message

   c)   3·32 bit/message   d)   5·93 bit/message.

ix) Coherent demodulation of FSK signal can be effected using

   a)   correlation receiver

   b)   bandpass filters and envelope detector

   c)   matched filter

   d)   discriminator detection.

x) If the number of bits per sample in a PCM system is increased from n to $n + 1$, the improvement in signal-to-quantisation noise ratio will be

   a)   3 dB   b)   6 dB

   c) $2n$ dB   d) n dB.

xi) A PAM signal can be detected by using

    a) an ADC   b) an integrator

    c) a bandpass filter   d) a highpass filter.

xii) The probabilities of the five possible outcomes of an experiment are $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$ and $\frac{1}{16}$ respectively. The source entropy is

    a) 1·578 bits/symbol   b) 1·5 bits/symbol

    c) 1·978 bits/symbol   d) 1·875 bits/symbol.

GROUP – B

(Short Answer Type Questions)

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

2. Explain the implication of Inter-Symbol Interference (ISI) in digital communication. What is Nyquist criterion for zero ISI ?

3. a) What is Aliasing ?

    b) What is the function of anti-aliasing filter for the generation of PAM signal ?   2 + 3

4. What is coherent detection technique ? Describe ASK demodulation through coherent detection.   2 + 3

5. a) Why is DPSK scheme of carrier modulation used ?

    b) Compare the bandwidths of QPSK and BPSK.   2 + 3

6. What is companding ? Why is companding needed in digital communication ?   2 + 3

GROUP – C

(Long Answer Type Questions)

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

7. a) With neat block diagram. Explain the generation & detection of the BFSK signal.   6

    b) Define line coding. Write the properties of line coding.

        1 + 4

    c) A BPSK modulator has the carrier frequency 70 MHz and input bit rate is 10 Mbps. Determine the maximum and minimum frequencies of the modulated signal.   4

8. a) With neat block diagram, explain the generation & reception of Delta Modulation (DM).   6

    b) What are the limitations of DM ? How these can be solved ?   3 + 2

    c) For a sinusoidal signal (A cos ωt), find the condition for no slope overload, if step size is Δ & sampling period is Ts.   4

9. a) List the advantages and disadvantages of DPSK technique.   2 + 2

    b) With suitable block diagram, explain the working principle of QPSK transmitter and receiver. Sketch its state space diagram.   4 + 4 + 1

    c) What are the drawbacks of MSK technique ?   2

10. a) What do you mean by information source and a discrete memoryless source. 2 + 2

   b) With suitable expression explain Entropy of a communication system. 6

   c) The probabilities of the five possible outcomes of an experiment are given as $P(x_1) = \dfrac{1}{2}$, $P(x_2) = \dfrac{1}{4}$, $P(x_3) = \dfrac{1}{8}$, $P(x_4) = \dfrac{1}{16}$ and $P(x_5) = \dfrac{1}{16}$. Determine the entropy and information rate if there are 16 outcomes per second. 5

11. a) A DMS X has five symbols with respective probabilities 0·2, 0·15, 0·05, 0·1 and 0·5. Construct a Hoffman code and calculate the code efficiency. 8

   b) The parity check matrix of a particular (7, 4) linear block code is expressed as

   $$[H] = \begin{bmatrix} 1 1 1 0 1 0 0 \\ 1 1 0 1 0 1 0 \\ 1 0 1 1 0 0 1 \end{bmatrix}$$

   i) Obtain the generator matrix

   ii) List all the code vectors. 7

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

    a)   Matched filter

    b)   Shannon-Fano Algorithm

    c)   Regenerative Repeater

    d)   Linear Block code

    e)   Eye pattern.