Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (ECE)/SEM-2/EC-1001/2010

2010

MODERN DIGITAL COMMUNICATION TECHNIQUE

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.

Answer Question No. 1 and any *four* from the rest.

1. a) Fill in the blanks : $7 \times 1 = 7$

   i) The transmission bandwidth of a line code should ideally be ..... .

   ii) ..... is a transparent line code.

   iii) The set of n independent vectors in an n-D space are called ..... .

   iv) Subcarrier orthogonality is found in the multiplexing scheme called ..... .

   v) For a car moving at 30 mph directly towards a transmitter radiating a sinusoidal carrier frequency of 1600 MHz the received carrier frequency is ..... .

   vi) The processing gain of DS/SS is ..... than that of FH/SS.

   vii) The device used for eliminating noise in a digital transmission system is ..... .

b) Choose the correct alternatives : $7 \times 1 = 7$

viii) The noise bandwidth of a low pass filter with cut-off frequency f_c is

a) f_c b) $(\pi/2)\, f_c$

c) πf_c d) none of these.

ix) The power spectral density of white noise is

a) uniform over entire spectrum

b) trianglar

c) rectangular

d) none of these.

x) Noise associated with the flow of current across semiconductor junctions is referred to as

a) thermal noise b) shot noise

c) flicker noise d) none of these.

xi) Standard deviation of noise at the output of integrate and dump filter is proportional to

a) $\sqrt{T}$ b) T

c) T^2 d) none of these.

xii) An optimum filter is the filter that

a) minimizes the SNR

b) maximizes the SNR

c) maximizes the probability of error

d) none of these.

xiii) Duo binary pulse is proposed in

a) first criterion of Nyquist for zero ISI

b) second criterion of Nyquist for controlled ISI

c) none of these.

xiv) A Gate pulse in time domain is

a) a sync pulse in frequency domain

b) a gate pulse in frequency domain

c) a triangular pulse in frequency domain

d) none of these.

2. a) What is HDBN signalling ? Code the following input digits with HDBN ($N = 3$) and draw the transmitted waveform : 1010010000101011000010000110100001.

b) What do you mean by power spectral density of a line code ?

c) The probability of error for bipolar is 50% higher as compared to on-off. Does it appear to be a serious degradation ? Comment. 2 + 5 + 3 + 4

3. a) Explain the principle of operation of regenerative repeater with diagram.

b) What is the utility of eye-pattern ? Explain its key features and mark them in your diagram. 7 + 7

4. a) What are the characteristics of a spread spectrum system ?

b) Find out an expression for the interference from the *k*th user at the output of the first user of a direct sequence spread spectrum system.

c) What do you mean by processing gain ? 5 + 7 + 2

5. Write short notes on any *two* of the following : 2 × 7

a) Doppler shift in fading

b) Detection error probability for polar signalling

c) Gram Schmidt Orthogonalization procedure

d) OFDM.

6. a) Explain the working principle of an Integrate and dump filter.

b) Find the output signal to noise ratio of an integrate and dump filter and explain how the integration process enhances signal energy more than noise energy. 7 + 7

7. a) What is Intersymbol interference (ISI) ?

"A time limited signal cannot be bandlimited" Explain.

b) Discuss the partial response coding scheme of controlled ISI. Compare it with the first criterion for pulse shaping as proposed by Nyquist. 7 + 7

8. Given a white noise of magnitude η = 0·001 μ W/Hz is fed to following :

a) an RC low pass filter of R = 1000 ohm and C = 0·1 μF

b) an ideal low pass filter of bandwidth = 1000 Hz.

Find output noise power in each case. Derive the formula you use. How does result change in each case if low pass cut-off frequency is doubled in each case ? 14