



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



7 × 1 = 7

b) Choose the correct alternatives :

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) triangular
- 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

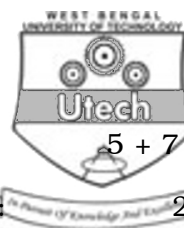
- a) \sqrt{T}
- b) T
- c) T^2
- d) none of these.

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
- first criterion of Nyquist for zero ISI
 - second criterion of Nyquist for controlled ISI
 - none of these.
- xiv) A Gate pulse in time domain is
- a sync pulse in frequency domain
 - a gate pulse in frequency domain
 - a triangular pulse in frequency domain
 - 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 $\eta = 0.001 \mu \text{ W/Hz}$ is fed to following :
- a) an RC low pass filter of $R = 1000 \text{ ohm}$ and $C = 0.1 \mu \text{F}$
 - 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
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