Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH (ECE)/SEM-1/MCE-102/2010-11

2010-11
ADVANCED 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.

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

1. i) In which part of a communication system is an 'optimum filter' used ? 1

   ii) Distinguish between orthogonal and orthonormal signals. 2

   iii) 'Power spectrum of any periodic signal is discrete'. Why ? 2

   iv) What is cross-correlation power ? 2

   v) When a large number of noises affect a channel, the effective combined noise will be nearly Gaussian even if the individual noises are not so. Why ? 2

vi) Distortion due to band limitation of the channel can always be nullified if the channel is noise free. How ? 2

vii) In spite of being very near to true random binary sequences, *m*-sequences are poor performers as chipping codes in CDMA. Why ? 3

2. i) Derive an expression for power spectral density of a random binary signal in terms of its auto-correlation function. 7

ii) Draw waveform and PSD of UPRZ code and explain how this code facilitates self synchronizing. 4

iii) What problems may occur in digital data transmission if appropriate line code is not used ? 3

3. i) What causes ISI ? 2

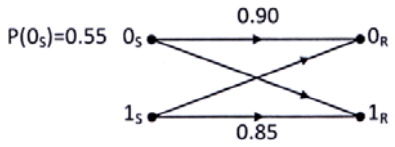
ii) Narrate and explain Nyquist's relation for zero ISI. 4

iii) Show that in case of an ideal band limited channel, it is possible to satisfy Nyquist relation only if bit rate is less than or equal to channel band width. 5

iv) Raised cosine pulse data is transmitted @ 3600bps through a channel, whose transfer function is given as $|H(f)| = \frac{1}{\sqrt{1 + (f/2700)^2}}$. Find roll-off factor of the signal pulse. 3

4. i) When a channel is called a symmetric channel ? 2

ii) A priori and transition probabilities in a binary channel are given. Apply optimum receiver algorithm and determine total probability of error. 6



iii) What causes MAI in CDMA ? 2

iv) What is 'near-far' problem in DSSS modulated communication and why is it absent in FHSS system ? 4

5. i) Establish that direct sequence spread spectrum modulation reduces effective power of a jamming signal by a factor equal to the length of chipping code. 8

ii) What are the desired characteristics of a binary sequence for use as chipping code ? 3

iii) Why does FHSS modulation need more stringent error control coding ? 3

6. i) Establish a general expression of bit error rate in a binary base band receiver in terms of a priori and transition probabilities of signals. 6

ii) Determine the probability of bit error due to an integrate-and-dump filter for rectangular antipodal signalling in a Gaussian channel. 5

iii) A PNRZ binary signal of ± 1V is corrupted by a Gaussian noise of power spectral density 10^{-4} V^2/Hz. The received signal is processed by an 'integrate and dump' type filter. What should be the minimum rate of transmission so that the probability of bit error does not exceed 10^{-4} ? Given *erfc* (2.63) = 2×10^{-4}. 3

7. Write short notes on any two : 2×7

i) Kasami sequence and its suitability as chipping code in CDMA

ii) Raised cosine pulse signal.

iii) Wide sense stationary signal