Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ECE)/SEM-1/MCE-102/2011-12

2011

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* ***four*** *from the rest.*

1. a) The two signals $A\sin(\omega t)$ and $B\cos(\omega t)$ are orthogonal but not orthonormal. Why ? 2

   b) If a channel is made up of 10 identical sections and the probability of random bit error in any section is 1%, what is the probability of error for the whole channel ? 2

   c) If the probability distribution function of the amplitude v of a signal is given as $p(v) = e^{-\pi v^2}$, what is its variance ? 2

   d) What is the bandwidth of a 1Mbps data when modulated in a 16-Ary PSK modulator ? 2

   e) Why are unipolar line coded symbols not suitable for ac coupled channels ? 2

f) What is the bandwidth of 1 Mbps data symbols when sinc pulses are used as symbols ? 2

g) Amplitude of a zero mean Gaussian noise has variance 10. What is the total probability that its amplitude at any instant is larger than ± 100 V ? 2

2. a) Explain the design principle of an LFSR based $(2^m - 1)$ bit *m*-sequence generator based on a primitive polynomial of degree *m*. 7

b) Discuss statistical properties of *m*-sequences and their suitability as chipping codes in CDMA. 7

3. a) Random bit error rate in a binary base band receiver is given by $P_e = Q\sqrt{\frac{E_d}{2\eta}}$, where E_d is energy of difference signal and η is noise spectral density. Determine the bit error rate for polar signals in terms of average bit energy E_d and η. 4

b) Explain the operating principle of an integrate-and-dump filter with the help of a neat block diagram and signal waveforms and obtain a general expression for the probability of bit error when the input is PNRZ coded antipodal binary symbols. 10

4. a) What are partial response signals ? 3

b) Explain how partial response signals can meet Nyquist criteria for zero ISI and also maintain Nyquist rate of transmission. 4

c) Explain the principle of symbol by symbol sub-optimum detection of duo binary signals. 7

5. a) What are the desired properties of a good line code ? 3

b) Power spectral density of a random binary signal is given as $G(f)=\frac{|X(f)|^2}{T_b}\sum_{k=-\infty}^{\infty}R(k)e^{j2\pi kfT_b}$, where the symbols have their usual meanings. Determine the power spectral density of a Manchester coded signal. 7

c) Draw the approximate PSD curve. 1

d) Mention its important features. 3

6. a) Briefly explain the principle of operation of tapped delay line filters. 6

b) Under what conditions a band limited channel can be called ideal or non-distorting ? 4

c) In a binary communication system with band limited channel the received signal pulse is given by its following sample amplitudes. Design a three tap zero forcing linear equalizer for the receiver. 4

$$Y_k=\begin{cases}0\cdot3 & k=1\\ 0\cdot9 & k=0\\ 0\cdot2 & k=-1\\ 0 & \text{otherwise}\end{cases}$$

7. a) Explain the basic principle of CDMA with a neat block diagram of multiple transmitters and receivers and derive an expression for the amount of multiple access interference. 8

b) Which are the three basic factors on which the amount of multiple access interference in a CDMA system depends ? State how their effects can be reduced. 6

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