



Name : .....  
Roll No. : .....  
Invigilator's Signature : .....

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

**2011**

**ADVANCED DIGITAL COMMUNICATION**

Time Allotted : 3 Hours

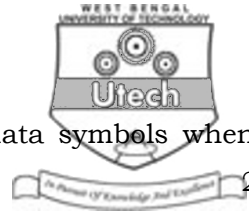
Full Marks : 70

*The figures in the margin indicate full marks.*

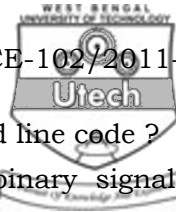
*Candidates are required to give their answers in their own words as far as practicable.*

*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  $\pm 100$  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  $\eta$  is noise spectral density. Determine the bit error rate for polar signals in terms of average bit energy  $E_d$  and  $\eta$ . 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  $G(f) = \frac{|X(f)|^2}{T_b} \sum_{k=-\infty}^{\infty} R(k) e^{j2\pi k f T_b}$ , 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
- $$Y_k = \begin{cases} 0.3 & k = 1 \\ 0.9 & k = 0 \\ 0.2 & k = -1 \\ 0 & \text{otherwise} \end{cases}$$
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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