

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 3091**

Roll No.

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### B.Tech.

(SEM VI) EVEN SEMESTER THEORY EXAMINATION,  
2009-2010

### DIGITAL COMMUNICATION

Time : 3 Hours

Total Marks : 100

- Note :** (i) Attempt all questions.  
(ii) Each question carries equal marks.  
(iii) Assume data wherever missing.

1. Attempt any four of the following : (4×5=20)
- Write the advantages and disadvantages of digital communication system.
  - Explain the difference between Band pass and Baseband transmission.
  - Three students A, B and C are given a problem in Maths. The probabilities of their solving the problem are  $\frac{3}{4}$ ,  $\frac{2}{3}$  and  $\frac{1}{4}$  respectively. Determine the probability that the problem is solved if all of them try to solve the problem.

(d) The joint PDF of X and Y is given by  $f_{xy}(X,Y) = Ke^{-(\alpha x + \beta y)} u(x)u(y)$  where  $\alpha$  and  $\beta$  are positive constants. Determine the value of constant K.

(e) Derive Auto correlation and Power spectral density of a random process. A pulse train consists of rectangular pulses having an amplitude of 2 volts width which are either 1 micro sec or 2 micro sec with equal probability. The mean time between pulses is 5 micro sec. Find the power spectral density  $G_n(f)$  of the pulse train.

(f) A source emits one of four symbols  $S_0, S_1, S_2$  and  $S_3$ , with probabilities  $1/3, 1/6, 1/4$  respectively. The successive symbols emitted by the source are independent. Calculate the entropy of source.

2. Attempt any four of the following : (4x5=20)

(a) Find out the power spectral density of NRZ and AMI signal format.

(b) For the binary sequence 011010110 construct NRZ, RZ, AMI and Manchester format.

(c) Explain the working of Differential Pulse code Modulation.

(d) Explain Inter symbol interference. Discuss its causes and method to reduce it.

(e) Explain Nyquist criterion to get Zero Inter symbol interference.

(f) A Binary PAM wave is to be transmitted over a low pass channel with an absolute Maximum Bandwidth of 75 kHz. The bit duration is 10  $\mu$ s. Find the raised cosine spectrum that satisfies these requirements.

3. Attempt any two of the following : (2x10=20)

(a) What is Gram-Schmidt orthogonalization procedure ? Explain it with suitable example. State central limit theorem.

(b) Derive the probability of bit error for QPSK scheme in A WGN channel. Explain in short what do you understand by amplitude shift keying and phase shift keying ?

(c) Classify Digital Modulation. Explain DPSK Modulator Demodulator with relevant figures and mathematical support.

4. Attempt any two of the following : (2x10=20)

(a) What is Quadrature Amplitude shift keying ? How QASK signal is generated and Calculate the bandwidth of QASK signal.

(b) Derive Probability of error of a matched filter.

(c) Two analog signals  $m_1(t)$  is 3kHz, and that of  $m_2(t)$  are to be transmitted over a common channel by means of time-division multiplexing. The highest frequency of  $m_1(t)$  is 3kHz, and that of  $m_2(t)$  is 3.5 kHz. What is the minimum value of the permissible sampling rate ? With diagram discuss T1 carrier system. Explain the term Byte Interleaving.

5. Attempt any two of the following : (2x10=20)

- (a) A parity-check code has the parity-check matrix.

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

- (i) Determine the Generator matrix G.  
(ii) Find the code word that begins 101.  
(iii) Suppose that the received word is 110110. Decode this received word.

(b) Explain the importance of State and Trellis diagram by considering any example of convolution coder. Discuss Viterbi Algorithm.

(c) For a (7, 4) cyclic code, the generating polynomial  $g(x) = 1 + x + x^3$ . Find the code word if data word is :

- (i) 0011                      (ii) 0100

What do you understand by Hard and soft decision decoding ?

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