

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**PDDC - SEMESTER-VI • EXAMINATION – SUMMER 2013**

**Subject Code: X61101****Date: 04-12-2013****Subject Name: Digital Communication****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a)** What is quantization? Derive the equation for signal to quantization noise ratio for PCM. **07**

**(b)** Find the channel capacity of a binary symmetric channel. **07**

**Q.2 (a)** What is Inter symbol interference? Discuss Nyquist's first criterion for zero ISI. **07**

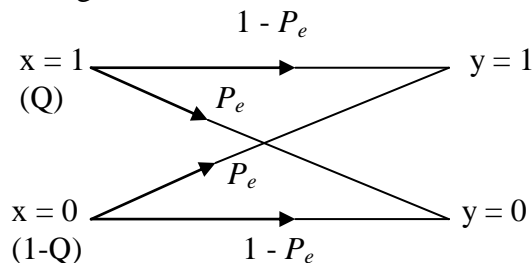
**(b)** The ASCII code has 128 characters which are binary-coded. If a certain computer generates 100,000 characters per second, determine the following: **07**

(1) The number of bits required per character.

(2) The number of bits per second required to transmit the computer output and the minimum bandwidth required to transmit this signal.

**OR**

**(b)** A binary symmetric channel error probability is  $P_e$ . The probability of transmitting 1 is  $Q$  and that of transmitting 0 is  $1-Q$ . Determine the probabilities of receiving 1 and 0 at the receiver. **07**



**Q.3 (a)** Explain Delta modulation and demodulation technique with neat diagrams. **07**

**(b)** A source emits seven messages with probabilities  $1/2, 1/4, 1/8, 1/16, 1/32, 1/64$  and  $1/64$  respectively. Find the entropy of the source. Obtain the compact binary code and find the average length of the codeword. Determine the efficiency and redundancy of the code. **07**

**OR**

**Q.3 (a)** Find the PSD of polar signaling and discuss the advantages and disadvantages of polar signaling. **07**

**(b)** For a (6,3) code, the generator matrix  $G$  is **07**

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

For all eight possible data words, find the corresponding codewords. What is the error correcting capability of the code? If the receiver receives  $r = 100011$ , determine the corresponding data word if the channel is a BSC and the maximum likelihood decision is used.

**Q.4 (a)** Explain the noncoherent detection of FSK modulated signal and derive the equation of bit error probability. **07**

**(b)** Explain convolution encoder with a suitable example. **07**

**OR**

- Q.4** (a) i) What is hamming bound? Derive the expression for hamming bound. **04**  
ii) List and explain the desirable properties of line codes. **03**  
(b) Explain in brief the binary digital carrier modulation techniques, ASK, FSK and PSK. **07**
- Q.5** (a) Use the generator polynomial  $g(x)=x^3+x+1$  for a systematic (7,4) cyclic code and find code vectors for the following data vectors: 1010, 1111, 0001, 1100, 1001 and 1000. What are the error correcting capabilities of this code? **07**  
(b) Discuss the following : **07**  
(1) Chebyshev's Inequality.  
(2) Conditional probability

**OR**

- Q.5** (a) i) State and explain central limit theorem. **04**  
ii) An experiment consists of drawing two cards from a deck in succession (without replacing the first card drawn). Assign a value to the probability of obtaining two red aces in two draws. **03**  
(b) What is entropy of a source? Show that entropy is maximum when all messages are equiprobable. **07**

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