

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

**PAPER ID : 3039**

Roll No.

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**B.Tech.**

SIXTH SEMESTER EXAMINATION, 2005-2006

**DIGITAL COMMUNICATION**

Time : 3 Hours

Total Marks : 100

- Note :**
- (i) Attempt **ALL** questions.
  - (ii) All questions carry equal marks.
  - (iii) In case of numerical problems assume data wherever not provided.
  - (iv) Be precise in your answer.

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1. Attempt *any four* parts of the following : (5x4=20)
- (a) A source emits one of four symbols  $S_0, S_1, S_2$  and  $S_3$  with probabilities  $\frac{1}{3}, \frac{1}{6}, \frac{1}{4},$  and  $\frac{1}{4}$  respectively. The successive symbols emitted by the source are independent. Calculate the entropy of source.
  - (b) Develop Shannon-fano code for five messages given by probabilities  $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}$  . Calculate the average no of bits/message.
  - (c) A voice grade channel of the telephone network has a Bandwidth of 3.4 kHz. Calculate the information capacity of the telephone channel for a signal-to-noise ratio of 30 dB.

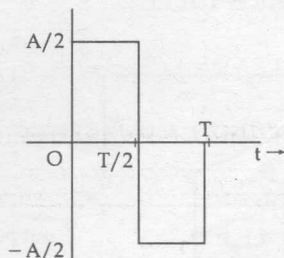
- (d) State Hartley - Shannon law.
- (e) Explain Natural and flat Top Sampling.
- (f) Give a method of Generation and detection of PPM (pulse position Modulation).

2. Attempt *any four* parts of the following : (5x4=20)

- (a) Describe the process of quantization. Prove that the mean square quantization error  $[\bar{e}]^2 = s^2/12$  where 'S' is step size.
- (b) What is Time Division Multiplexing ? Discuss Bits/Frame, Synchronization, Bit rate and signalling of  $T_1$  digital system.
- (c) Draw and explain the block diagram of transmitter and Receiver of DPCM (Differential Pulse Code Modulation)
- (d) The input to a DM is  $m(t) = kt$ . Prove by graphically determining  $\tilde{m}(t)$ , that slope overload occurs when  $k$  exceeds a specified value. What is this value in terms of step size 'S' and sampling frequency  $f_s$  ?
- (e) A PCM system uses a uniform quantizer followed by a 7-bit encoder. The bit rate of the system is equal to  $50 \times 10^6$  bits/sec. What is max bandwidth for which the system operates satisfactorily ?
- (f) Discuss Idling noise and slope overload. Describe a system in which these errors can be improved.

3. Attempt *any two* parts of the following : (10x2=20)

- (a) For the binary sequence 1101011101 construct NRZ, RZ, AMI and Manchester format.
- (b) Consider the signal  $s(t)$  as shown in figure.



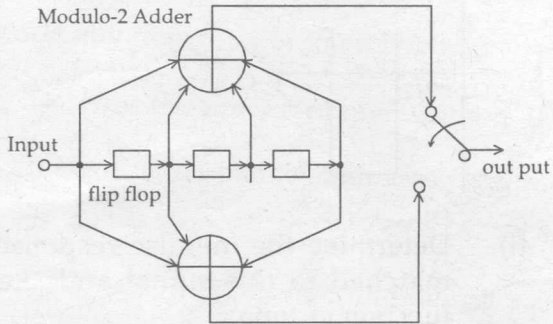
- (i) Determine the impulse response of a filter matched to this signal and sketch it as a function of time.
- (ii) Plot the matched filter output as a function of time.
- (iii) What is the peak value of out put ?
- (c) What is ISI ? Give nyquist criterion for zero ISI and raised cosine spectrum.

4. Attempt *any two* parts of the following : (10x2=20)

- (a) Give and explain the method for Generation and detection of BFSK (Binary Frequency Shift Keying).
- (b) Discuss the similarities between MSK and offset QPSK and features that distinguish them. Prove that in MSK.  $f_H - f_L = f_o/2$
- (c) Explain quadrature phase shift keying (QPSK). Give the block diagram of QPSK Transmitter. Explain it with the help of phasor diagram. Give a method to receive this signal.

5. Attempt *any two* parts of the following : (10x2=20)

- (a) Figure shown below shows the encoder for a rate  $r=1/2$  and Constraint length  $k=4$  convolutional code. Determine the encoder output produced by the message sequence 10111.....



- (b) Consider a (7, 4) Linear block code with the parity check matrix  $H$  given by -

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

Construct code words for this (7, 4) code and show that this code is a Hamming code.

- (c) What is Hamming distance? Give relation between minimum distance and error detecting and correcting capability. Describe a Hamming code. Also define Hamming sphere and Hamming bound.

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