

Roll No. ....  
Printed Pages : 3

**36110**

**BT-6 / M-18**  
**DIGITAL COMMUNICATION**  
**Paper-ECE-306 N**

*Time allowed : 3 hours]*

*[Maximum marks : 75*

*Note :- There are total Eight questions. Each question carries equal marks. The candidate is required to attempt five questions, selecting one question from each unit.*

**Unit-I**

1. (a) For a (6,2) linear block code, the generator matrix G is

$$G = \begin{bmatrix} 10 & 1 & 11 & 0 \\ 01 & 1 & 01 & 1 \end{bmatrix} \quad 7$$

- (i) Construct the code table for this code and determine the minimum distance between code-words.

- (ii) Prepare a suitable decoding code.

- (b) Define Entropy. Prove that entropy is maximum when all messages are equiprobable. 8

2. (a) A zero memory source emits six messages with probabilities 0.1, 0.2, 0.1, 0.3, 0.05, 0.1, 0.05 and 0.1. Find the 4-ary Huffman code and determine the code efficiency. 7

- (b) A continuous signal is band limited to 5 KHz. The signal is quantized to 8 levels with probabilities 0.025, 0.2, 0.2, 0.1, 0.1, 0.05, 0.05, 0.05. Calculate entropy and rate of information. 8

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(2)

### Unit-II

3. (a) What is Nyquist rate? Why the sampling below the Nyquist rate results in frequency aliasing? Explain. 8
- (b) A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of system is equal to  $50 \times 10^6$  b/s. 3+4
- (i) What is the maximum message bandwidth for which the system operates satisfactorily?
- (ii) Determine the output signal-to-(quantization) noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz. is applied to the input.
4. (a) Show that, with a non-uniform quantizer, the mean square value of the quantization error is approximately equal to  $(1/12) \sum_i \Delta_i^2 p_i$ , where  $\Delta_i$  is the  $i^{\text{th}}$  step size and  $p_i$  is the probability that the input signal amplitude lies within the  $i^{\text{th}}$  interval. Assume that the step size  $\Delta_i$  is small compared with the excursion of input signal. 7
- (b) What is delta modulation? Draw the block diagram of delta modulator transmitter and explain its working with its waveforms. Also, illustrate the problems of delta modulation with necessary waveforms. 8

### TOPPERWorld Unit-III

5. (a) Briefly explain tapped delay line equalization and adaptive equalization. 8
- (b) Binary data at 9600 bits/sec. are transmitted using 8-ary

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PAM modulation with a system using a raised cosine roll-off characteristics. The system has a frequency response out to 2.4 kHz. 3+4

- (i) What is symbol rate?
  - (ii) What is roll-off factor of filter characteristics?
6. (a) Define matched filter. Discuss probability of error in data transmission employing a matched filter. 8
- (b) What is Intersymbol Interference? How is its effect reduced? 7

#### Unit-IV

7. (a) Discuss the Gram Schmidt orthogonalization procedure? 7
- (b) A set of  $M$  signal waveform  $\{S_{im}(t)\}$  are complex valued. Derive the equation for the Gram Schmidt procedure that will result in a set of  $N \leq M$  orthonormal signal waveforms. 8
8. (a) Explain the generation and detection of QPSK. 8
- (b) A continuously operating coherent BPSK system makes errors at the average rate of 100 errors per day. The data rate is 100 bits/s. The single sided noise power spectral density is  $N_0 = 10^{-10} \text{ W/Hz}$ . 3+4
- (i) If the system is ergodic, what is the average bit error probability?
  - (ii) If the value of received average signal power is adjusted to be  $10^{-6} \text{ W}$ , will this received power be adequate to maintain the error probability found in part (a)?

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