Roll No. ..... Total Pages : 04

BT-6/M-19 36110

DIGITAL COMMUNICATION
ECE-306N

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

TOPPERWorld

Unit I

1. (a) A zero memory source emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1 and 0.08. Find the 4-ary Huffman code. Determine its average word length, the efficiency and the redundancy. 7

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

2. (a) For a (7, 4) cyclic code, the generator polynomial $g(x) = x^3 + x^2 + 1$. Find nonsystematic cyclic code vector for the following data vector : 7

   (i) 0001 (ii) 1000

   (iii) 1010

(b) Explain any *one* method of decoding of convolutional codes. Draw all the stages of viterbi decoding. 8

Unit II

3. (a) Explain the sampling process and its importance in pulse modulation. 6

(b) Specify the Nyquist rate and the Nyquist interval for each of the following signals : 3+3+3

(i) $g(t) = \text{sinc}(200t)$

(ii) $g(t) = \text{sinc}^2(200t)$

(iii) $g(t) = \text{sinc}(200t) + \text{sinc}^2(200t)$

4. (a) Consider a DM system designed to accommodate analog message signals limited to bandwidth W = 5 kHz. A sinusoidal test signal of amplitude A = 1 volt and frequency f_m = 1 kHz is applied to the system. The sampling rate of the system is 50 kHz. 4+3

(i) Calculate the step size Δ required to minimize slope overload.

(ii) Calculate the signal-to-(quantization) noise ratio of the system for the specified sinusoidal test signal.

(b) Draw and explain block diagram of ADPCM system. Compare PCM and ADPCM. 8

Unit III

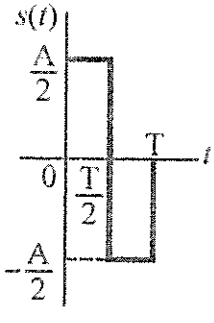
5. (a) Explain Nyquist criteria for distortion less baseband binary transmission. 8

(b) Consider the signal $s(t)$ shown in figure : 3+2+2

(i) Determine the input 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 the output ?



6. (a) Describe ideal Nyquist channel raised cosine spectrum in detail. 8

(b) Explainn the 'Least Mean Square' algorithm used for adaptive equalization. 7

Unit IV

7. (a) Discuss the performance of correlator to noise input in detail. 8

   (b) Discuss the Gram-Schmidt Orthogonalisation procedure in detail. 7

8. (a) What is QPSK ? Draw the signal space diagram of coherent QPSK system and explain it. Also show that QPSK signal has the minimum average energy. 8

   (b) (i) Sketch the waveforms of the in-phase and quadrature components of the MSK signal in response to the input binary sequence 1100100010.

   (ii) Sketch the MSK waveform itself for the binary sequence specified in part (a). 4+3=7

TOPPERWorld