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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

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

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 50×10^6 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 Δ_i is the i^{th} step size and p_i is the probability that the input signal amplitude lies within the i^{th} interval. Assume that the step size Δ_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 wavefors. Also, illustrate the problems of delta modulation with necessary waveforms. 8

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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

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 $N_0 = 10^{-10}$ 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} W, will this received power be adequate to maintain the error probability found in part (a)?