

B. TECH.

SIXTH SEMESTER EXAMINATION, 2003-2004

DIGITAL COMMUNICATION

Time : 3 Hours

Total Marks : 100

Note : Attempt ALL questions.

Attempt any FOUR parts of the following :— (5×4=20)

- (a) What is Flat Top sampling ? Compare it with natural sampling.
- (b) Define Average Mutual Information between two discrete random variables and show that it is non-negative.
- (c) Design binary Huffman Code for a discrete source of five independent symbols A,B,C,D and E with probabilities 0.4, 0.2, 0.3, 0.08 and 0.02 respectively such that the variance of code-word lengths is minimum.
- (d) Derive channel capacity expression for a Binary Symmetric Channel.
- (e) Show that an n letter Discrete memoryless has maximum entropy of \log_2^n .
- (f) Compare the noise performance and bandwidth of PWM, PPM and PAM.

2. Attempt any FOUR parts of the following :— (5×4=20)

- (a) Explain Granularity and Slope-overload errors in Delta modulation.
- (b) What is Frame Synchronization in digital communication ? Explain how it is achieved using an example.

- (c) Why are non-uniform quantizers needed at all? How are they implemented?
- (d) What are the functions of a repeater in a PCM system? Is there something analogous to repeater in analog communication?
- (e) A speech signal of duration 15 sec. is sampled at sampling rate of 10 ks/s and encoded with signal to quantization noise ratio 50 dB. What is the minimum storage needed to store the encoded signal?
- (f) What is T1 system? Describe it briefly.
3. Attempt any TWO parts of the following :—
- (a) What do you understand by Inter-symbol Interference (ISI)? Derive the Nyquist criteria for zero ISI. (10)
- (b) Given a bit sequence of 0110010, draw the line codes in polar, bipolar (AMI), Manchester and HDB formats. Compare these formats on the basis of inbuilt clocking, bandwidth and noise performance. (10)
- (c) Consider a finite duration pulse $h(t)$ limited to time $0 \leq t \leq T$.
- (i) What is the impulse response of filter matched to the pulse $h(t)$? (2)
- (ii) If this filter is used to detect $h(t)$ in presence of additive white noise, show that Signal-to-Noise Ratio (SNR) at the output of the filter will be maximum. (8)
4. Attempt any TWO parts of the following :—
- (a) Derive the expression for probability of bit error for coherent BPSK scheme in presence of additive, white, Gaussian noise. (10)

- (b) (i) Differentiate between coherent and incoherent receptions. (4)
- (ii) Giving modulated waveforms, signal space diagrams and probability of bit errors, draw the optimum receiver structures for DPSK and coherent FSK modulation schemes. (6)
- (c) Explain the MSK modulation scheme and its optimum receiver structure. How is its noise performance related to that of coherent BPSK? (10)

5. Attempt any TWO parts of the following :—

- (a) Show that for single-bit error correcting block code, the columns of its parity check matrix must all be non-zero and distinct. (10)
- (b) Consider a (7,4) type systematic cyclic code with generator polynomial $g(X) = 1 + X + X^3$.
- (i) Draw the encoder and syndrome calculator circuits. (5)
- (ii) Determine the first two rows of its generator matrix. (5)
- (c) (i) Consider a rate $r = \frac{1}{3}$ convolutional code with constraint length $L=3$ and generators being $g_0 = [100]$, $g_1 = [111]$ and $g_2 = [101]$. Draw its trellis and state diagram. (5)
- (ii) Explain sequential decoding of convolutional code. (5)

