

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2003.

Fifth Semester

Information Technology

IF 356 — INFORMATION CODING TECHNIQUES

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is prefix coding?
2. State the Channel Coding Theorem for a discrete memoryless channel.
3. What are the advantages of Lempel – Ziv encoding algorithms over Huffman coding?
4. Explain Subband coding for speech signal.
5. What is Hamming distance in error control coding?
6. Why cyclic codes are extremely well-suited for error detection?
7. State the main application of Graphics Interchange Format (GIF).
8. Explain Run – Length encoding.
9. What is the need of MIDI standard?
10. What is Dolby AC-1?

PART B — (5 × 16 = 80 marks)

11. (i) A discrete memoryless source has a alphabet of five symbols whose probabilities of occurrence are as described here : (8)

Symbols : X_1 X_2 X_3 X_4 X_5

Probability : 0.2 0.2 0.1 0.1 0.4

Compute the Huffman code for this source. Also calculate the efficiency of the source encoder.

- (ii) A voice grade channel of telephone network has a band width of 3.4 KHz. Calculate

- (1) the information capacity of the telephone channel for a signal-to-noise ratio of 30 dB and
- (2) the minimum signal-to-noise ratio required to support information transmission through the telephone channel at the rate of 9.6 Kb/s. (8)

12. (a) With the block diagram explain DPCM system. Compare DPCM with PCM and DM systems. (16)

Or

- (b) (i) Explain DM systems with block diagrams. (10)
- (ii) Consider a sine wave of frequency f_m and amplitude A_m , which is applied to a delta modulator of step size ∇ . Show that the slope-overload distortion will occur if (6)

$$A_m > \frac{\nabla}{2\pi f_m T_s}$$

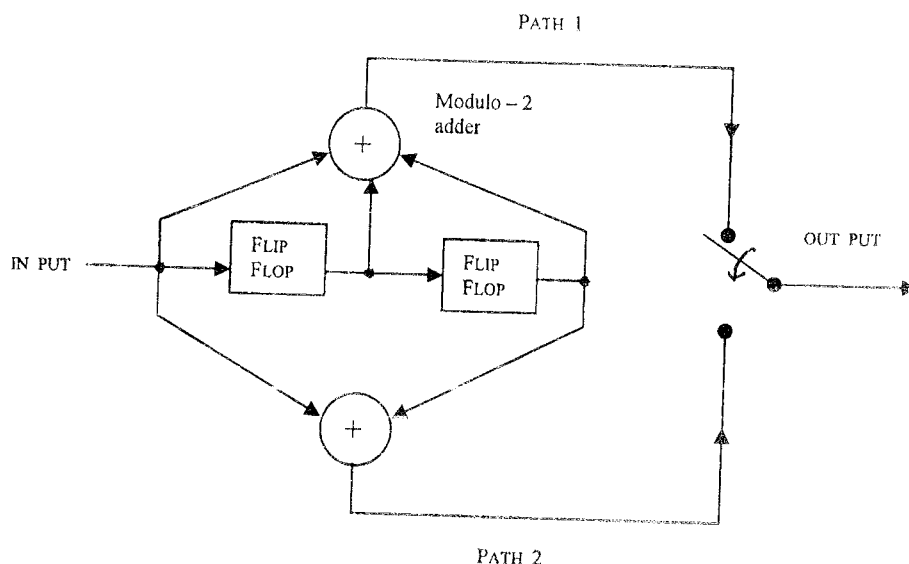
where T_s is the sampling period.

What is the maximum power that may be transmitted without slope-overload distortion?

13. (a) Consider the generation of a (7, 4) Cyclic code by generator polynomial $g(x) = 1 + x + x^3$. (16)
- (i) Calculate the code word for the message sequence 1001 and construct systematic generator matrix G .
 - (ii) Draw the diagram of encoder and syndrome calculator generated by polynomial $g(x)$.

Or

- (b) For the convolutional encoder shown below encode the message sequence (10011). Also prepare the code tree for this encoder. (16)



14. (a) With the following symbols and their probability of occurrence, encode the message "went#" using Arithmetic coding algorithms. Compare Arithmetic coding with Huffman coding principles. (16)

Symbols : e n t w #

Probability: 0.3 0.3 0.2 0.1 0.1

Or

- (b) (i) Draw the JPEG encoder schematic and explain. (10)

- (ii) Assuming a quantization threshold value of 16, derive the resulting quantization error for each of the following DCT coefficients.

127, 72, 64, 56, -56, -64, -72, -128.

(6)

15. (a) Explain the Linear Predictive Coding (LPC) model of analysis and synthesis of speech signal. State the advantages of coding speech signal at low bit rate. (16)

Or

- (b) Explain the encoding procedure of I, P, and B frames in video compression techniques. State intended application of the following video coding standard :

MPEG - 1, MPEG - 2, MPEG - 3, and MPEG - 4.

(16)