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SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2008

EC 04 701—INFORMATION THEORY AND CODING

(2004 Admissions)

Time : Three Hours   Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Define discrete entropy, H(X) of a random variable X and find the entropy H(X) of a discrete memoryless source with probabilities {0.3, 0.25, 0.2, 0.15, 0.1}.

 (b) Find the channel capacity of a binary symmetric channel with transition probability 0.01.

 (c) Explain error detecting capability of a linear block code.

 (d) Show that the degree of the generator polynomial of an (n, k) cyclic code is $(n - k)$.

 (e) Define Galois field and explain.

 (f) Explain about Reed-Solomon codes.

 (g) Define constraint length of a convolutional code and explain its significance.

 (h) What is meant by interleaving ? Explain.

(8 × 5 = 40 marks)

Part B

II. (a) Show that the entropy for a discrete source is maximum when the output symbols are equally probable.

Or

 (b) Using Huffman coding procedure construct binary optimal code for the following probabilities and find the coding efficiency.

{0.2, 0.2, 0.15, 0.15, 0.1, 0.1, 0.05, 0.05}

III. (a) Consider a linear (7, 4) block code with generator matrix :

$$G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}.$$

 (i) Find the parity check matrix.

 (ii) Find the error detecting and correcting capabilities of the code.

 (iii) Construct enconder and syndrome computation circuit.

(3 + 4 + 8 = 15 marks)

Or

Turn over

(b) (i) Obtain the generator matrix and parity check matrix corresponding to the generator polynomial $1 + X^2 + X^3$ in systematic form.

(8 marks)

(ii) Explain syndrome decoding for cyclic code.   (7 marks)

IV. (a) (i) State the axioms of vector space and explain.   (7 marks)

(ii) Define group and construct group under modulo-5 additions and multiplications.

(8 marks)

Or

(b) (i) Explain the steps for determining the generator polynomial of a t-error correcting BCH code.

(8 marks)

(ii) Define primitive polynomial and explain.   (7 marks)

V. (a) (i) Explain the distance properties of convolutional encoder.   (7 marks)

(ii) Explain the sequential decoding of convolutional code.   (8 marks)

Or

(b) Draw the block diagram of TCM encoder and explain in detail.   (15 marks)

[4 × 15 = 60 marks]