D 11941 (Pages : 2) Name..............................

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SEVENTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, NOVEMBER 2016

CS 09 706 L14—INFORMATION THEORY AND CODING

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

I. (a) Define Information.

(b) State Shannon's Source Coding Theorem.

(c) Define cyclic codes.

(d) List the properties of a group.

(e) Define constraint length of a convolutional code.

($5 \times 2 = 10$ marks)

Part B

Answer any **four** *questions.*

II. (a) Prove that upper bound on entropy of the source, $H(S) \leq \log_2 M$; where M is the number of messages emitted by the source.

(b) A binary Symmetric Channel (BSC) has an error probability, $p = 0.2$. The apriori probability of the symbols 0 and 1 at the input of the channel is 0.4 and 0.6 respectively. What is the probability of receiving 1 at the output of the channel ?

(c) What is Shannon's limit ? Explain its significance.

(d) Find the parity check polynomial for (7,4) cyclic code whose generator polynomial is $X^3 + X + 1$.

(e) Write a short note on BCH codes.

(f) Determine the output sequence $X_i^{(1)}$ and $X_i^{(2)}$ and the interleaved output X for the convolutional encoder with impulse response, $g^{(1)} = [1\ 1\ 1]$ and $g^{(2)} = [1\ 0\ 1]$ respectively using transform domain approach. Assume that the input sequence to the convolutional encoder is 101001.

($4 \times 5 = 20$ marks)

Part C

Answer **all** *questions.*

III. (a) A DMS have 8 source symbols with probabilities {0.25, 0.2, 0.15, 0.15, 0.1, 0.05, 0.05, 0.05}. Construct the Huffman code and find the coding efficiency.

Or

(b) Prove the properties of Mutual Information.

Turn over

IV. (a) A channel encoder uses a (7,4) linear cyclic code in the systematic form, the generator polynomial being $X^3 + X + 1$, Determine the correct codeword transmitted if the received vector is (a) 1 0 1 1 0 1 1 (b) 1 1 0 1 1 1 1.

Or

(b) The parity check matrix for a (7,4) linear block code is given :

$$H = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

(i) Find the generator matrix, G.

(ii) List all code vectors.

(iii) Find minimum distance, d_{min}.

(iv) How many errors it can correct ?

V. (a) How to construct a Galois field with example ?

Or

(b) Write a short note on Reed Solomon Codes with example.

VI. (a) A convolutional encoder has the following generating sequence, $g^{(1)} = [1\ 1\ 1]$, $g^{(2)} = [1\ 0\ 1]$. Find the output of convolutional encoder using code tree for the message sequence, 1 0 1 0 1 1.

Or

(b) A convolutional encoder has the following generating sequence, $g^{(1)} = [1\ 1\ 1]$, $g^{(2)} = [1\ 0\ 1]$. Apply Viterbi algorithm for the decoding of the received sequence, 1 0 1 0 0 1 1 0 1 1 1 1.

(4 × 10 = 40 marks)