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SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE (2014 SCHEME) EXAMINATION, NOVEMBER 2017

Electronics and Communication Engineering

EC 14 701—INFORMATION THEORY AND CODING

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*

I. (a) Discuss the properties of entropy.

(b) Encode the following source using Shannon-Fano encoding. Find the efficiency of the code :

$P(X) = \{0.2, 0.1, 0.5, 0.2\}$.

(c) Define binary symmetric channel. Derive any two entropies of the system with BSC.

(d) Explain a Galois field with an example.

(e) Define the following terms :

Hamming distance, Hamming weight, Systematic LBC, Non-systematic LBC. Give an example for each.

(f) Show that for a (n, k) LBC, minimum Hamming distance is equal to minimum Hamming weight.

(g) Write notes on Reed Solomon codes.

(h) Assume a (n, k) cyclic code. Write down the generator and parity check matrices for the assumed code.

(i) Design a convolutional coder of constraint length 6 and rate efficiency $\frac{1}{3}$. Define also the terms constraint length and rate efficiency.

(j) Assume a convolutional coder. Draw the state diagram and trellis diagram of the coder.

$(8 \times 5 = 40$ marks)

Part B

II. (a) State and prove channel coding theorem.

Or

(b) For the communication system defined by the following joint probability matrix, find all possible entropies :

$$\begin{array}{c} X \backslash Y \\ \end{array} \begin{bmatrix} 0.15 & 0.01 & 0.03 \\ 0.02 & 0.3 & 0.07 \\ 0.08 & 0.09 & 0.25 \end{bmatrix}$$

X and Y are the transmitter and receiver respectively.

Turn over

(c) (i) Discuss the properties of linear block code.

(ii) Explain the construction and properties of linear block code.

Or

(d) Explain the encoding and decoding of messages using a (n, k) linear block code. Make suitable assumptions.

(e) Design a (7, 4) cyclic encoder and syndrome generator. Explain their working with the message word 1101 and generator polynomial $1 + x^2 + x^3$.

Or

(f) Explain the coding and decoding techniques using BCH codes.

(g) (i) Explain the distance properties of convolutional codes.

(ii) Write notes on interleaved convolutional codes.

Or

(h) Explain maximum likelihood decoding of convolutionally coded words.

(4 × 15 = 60 marks)