Roll No…….. **Total No. of Printed Pages: 1**

Total No. of Questions: [09]

B. Tech ECE (Semester –5th)

INFORMATION THEORY & CODING

Subject Code: BECES1-502

Paper ID: [18111321]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a) What is an information and what are its unit?
b) What is Code Rate?
c) What do you mean by Binary Symmetric Channel.
d) Differentiate between Hamming Distance and Hamming Weight in Codes.
e) What is error control coding?
f) State the Kraft Inequality theorem.
g) What is Lossless Channel?
h) Explain the term Coding Gain.
i) Explain Source Coding Theorem.
j) Differentiate between error correction and error detection.

Section – B **(5 marks each)**

Q2. Discuss the channel capacities for Deterministic and Noiseless channels.

Q3. Construct a Shannon-Fano Code for DMS having four symbols with probabilities $P(x_1)=0.5$, $P(x_2)=0.25$, $P(x_3)=P(x_4)=0.125$. Also find the efficiency of the code.

Q4. Obtain the code vectors for the (7,4) code having $G(p) = I + p + p^3$ for the message code 1101.

Q5. For a code vector X= (0 11 10 0 0) and the parity check matrix H given below, prove that $XH^T = (0, 0, ..., 0)$

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}_{3\times 7}$$

Q6. Explain the Viterbi Decoding Algorithm.

Section – C **(10 marks each)**

Q7. (a) Calculate the Entropy of DMS X having four symbols with probabilities $P(x_1)=0.4$, $P(x_2)=0.3$, $P(x_3)=0.2$, $P(x_4)=0.1$.

(b) Using suitable example explain Lempel-Ziv Algorithm.

Q8. (a) Draw the channel diagram for a channel with channel matrix given below.

$$[P(X)] = [1 - p \; p \; 0 \; 0 \; p \; 1 - p]$$

(b) Explain Syndrome and its Use for Error Detection in linear block codes.

Q9. For systematic (7,4) cyclic code, determine the generator matrix and parity check matrix. Given: G(p)=p3+p+1.