Electronics & Communication Engineering (CBCS Pattern) M.Tech. First Semester
(Old-CBS Pattern) CBCS

ECE-102 / PECS141 - Elective-I : Information Theory And Coding

P. Pages : 2 **GUG/W/18/10982**

Time : Three Hours * 3 1 0 8 * Max. Marks : 70

Notes : 1. Attempt **any five** questions.
2. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) What is Shannon's theorem. List out the properties of codes using Shannon encoding algorithm. **6**

b) Define Entropy. **8**
Consider a DMS w/m 8 possible symbols xi where L = 1, 2, 3 ..... 8 and their corresponding probabilities are
$P(x_1) = 0.36$
$P(x_2) = 0.25$
$P(x_3) = 0.12$
$P(x_4) = 0.10$
$P(x_5) = 0.05$
$P(x_6) = 0.08$
$P(x_7) = 0.03$
$P(x_8) = 0.01$
Find entropy of source and efficiency of code.

2. a) Derive the expression for channel capacity. **7**

b) Explain source coding and channel coding. Explain the difference between them. **7**

3. a) Explain Lempel - Ziv encoding algorithm with suitable example. **7**

b) Apply Huffman coding algorithm for the following messages - **7**
$[X] = [X_1\ X_2\ X_3\ X_4\ X_5\ X_6\ X_7]$
$[P] = [Y_2\ Y_4\ Y_4\ Y_8\ Y_8\ Y_{16}\ Y_{16}]$
Suppose M = 2 then find -
i) Average length of codeword
ii) Entropy
iii) Efficiency of code

4. a) Calculate the syndrome vector of a single bit error if the parity check matrix of (7, 4) Hamming code is given as - **8**

$$H = \left[\begin{array}{cccc|ccc} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 \end{array}\right]$$

Find all the code vectors and find the error syndrome if there is error in the 3rd bit of the 4th code in the code sequence.

b) What is the role of inter leaving in the performance of concatenated codes. How is it used to improve the performance of these codes ? **6**

5. a) Discuss the role of d_{min} in error correction and detection methods. **7**

b) Describe Viterbi decoding algorithm. **7**

6. a) For a (2, 1, 3) convolution code described by **8**
$g_1 = [1\ 0\ 1]$ and $g_2 = [1\ 1\ 0]$
draw the state diagram, tree diagram and Trellis diagram.

b) Differentiate between convolution codes and block codes. **6**

7. a) Explain iterative coding using in BCJR algorithm. **8**

b) Discuss upper and lower bounds in linear codes. **6**

8. Write short notes on **any two.** **14**

a) Justeen codes.

b) Reed Solomon codes

c) Turbo codes

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