

M. Tech. Electronics & Communication Engineering (CBCS Pattern) Semester-I  
**PECS141 / 14(A) - Information Theory and Coding**

P. Pages : 2

Time : Three Hours



**GUG/S/25/10982**

Max. Marks : 70

- Notes :
1. All questions carry marks as indicated.
  2. Assume suitable data wherever necessary.
  3. Illustrate your answers wherever necessary with the help of neat sketches.
  4. Solve **any five** questions.

1. a) Define mutual information. Show that mutual information of channel is symmetric that is  $I(x : y) = I(y : x)$ . 7  
b) What is entropy? Derive an expression which indicate relationship between entropy and mutual information. 7
2. a) State and explain 6
  - i) Shannon channel coding theorem.
  - ii) Shannon source coding theorem.b) Consider a DMS source with probabilities  $\{0.35, 0.25, 0.20, 0.15; 0.5\}$  8
  - i) Determine the Huffman code for this source.
  - ii) Average length of codeword
  - iii) Efficiency of code.
3. a) Explain Lempel – Ziv encoding algorithm with suitable example. 7  
b) Derive the expression for channel capacity. 7
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 code vectors and find the error syndrome if there is a error in the 3<sup>rd</sup> bit at the 4<sup>th</sup> code in code sequence.

b) What is the role of interleaving in the performance of concatenated codes? How is it used to improve the performance of these codes? 6

5. a) What are convolution code? How is it different from linear block code? 7
- b) What are the different methods of controlling error? Explain in brief. 7
6. a) Explain in brief Reed-Solomon codes. Also discuss why R-S codes performs well in bursty – noise environment. 7
- b) Differentiate between convolution codes and block codes. 7
7. a) Write a short notes on 7
- i) Justeen code
- ii) Generalized BCH codes.
- b) Explain the concept of Trellis coded modulation with suitable example. 7
8. a) Explain briefly the upper and lower bounds based on the performance of convolution codes. 7
- b) Explain briefly following 7
- i) Turbo codes.
- ii) Viterbi decoding techniques.

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