

M. Tech. Electronics & Communication Engineering (CBCS Pattern) Sem-I
PECS141 - Information Theory and Coding

P. Pages : 2

Time : Three Hours

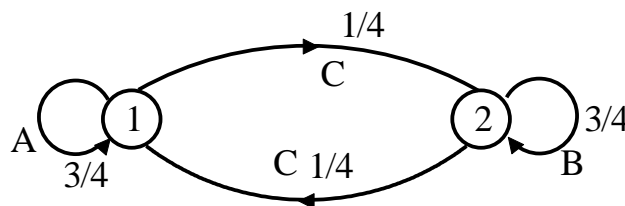


GUG/W/22/10982

Max. Marks : 70

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

1. a) Define mutual information. Show that the mutual information of a channel is symmetric that is $I(x : y) = I(y : x)$ 7
- b) For the source model given below. Determine: 7
- i) Entropy of the source
 - ii) Entropy of each state.



2. a) State and explain 7
- i) Shannon's channel coding theorem.
 - ii) Shannon's source coding theorem.
- b) Consider a DMS source with probabilities $\{0.35, 0.25, 0.20, 0.15, 0.5\}$ 7
- i) Determine Huffman code for this source.
 - ii) Determine average length of code words.
 - iii) Efficiency of the code.
3. a) Write a short note on Lempel – ziv encoding algorithm. 4
- b) Apply the Shannon – fano encoding procedure for the following message ensembler. 10
- $[X] = [x_1 \ x_2 \ x_3 \ x_4 \ x_5 \ x_6 \ x_7]$
 $[P] = [0.4 \ 0.2 \ 0.12 \ 0.08 \ 0.08 \ 0.08 \ 0.04]$
- Take $M = 2$, then find
- i) Average length of the code word
 - ii) Entropy $H(x)$
 - iii) Efficiency of the code.

4. a) For a systematic linear block codes the parity matrix is given by 10
- $$[P] = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$
- Find
- All possible codewords.
 - Minimum weight of this code
 - Parity check matrix
 - For a received code vector $R = 111101$ detect and correct an error that has occurred due to noise.
- b) Explain the following terms 4
- Hamming distance
 - Code rate
 - Systematic code
 - Linear code.
5. a) What are the convolution codes? How is it different from Linear block codes? 7
- b) What are the different methods of controlling errors? Explain in brief. 7
6. a) Explain in brief Reed – Solomon codes. Explain why R - S codes performs well in bus try – noise environment. 7
- b) Explain concatenated codes. How does use of interleaving improve the performance of concatenated codes? 7
7. a) Explain interleaving technique for the correction of burst and random errors. Consider $(15, 7)$ BCH codes generated by $g(x) = x^8 + x^4 + x^2 + x + 1$ construct a interleave code with $\lambda = 5$, with burst error correcting ability of 10. 8
- b) Write a short note on: 6
- Trellis diagram.
 - Golay codes.
8. a) For the convolution encoder 6
- $$g^{(1)} = 1 \ 1 \ 1, g^{(2)} = 1 \ 0 \ 1$$
- Draw the encoder block diagram.
 - find generator matrix.
- b) Explain briefly the following: 8
- Turbo codes.
 - Viterbi decoding techniques.
