



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; Dec - 2017/Jan - 2018

Information Theory and Coding

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

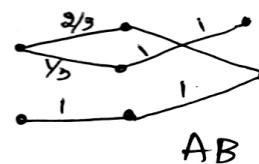
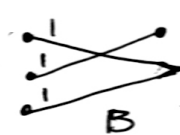
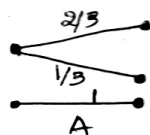
UNIT - I

- 1 a. Define and discuss the following terms : 9
 - i) Self information ii) Mutual information iii) Average self information.
- b. Find the relationship between Hastley nats and bits. 6
- c. Consider a source and which generate 3 symbols with the $P = \{0.5, 0.25, 0.25\}$, calculate; 5
 - i) Self information ii) Entropy.
- 2 a. State and prove the source coding theorem. 5
- b. Discuss the JPEG standard for lossy compression. 5
- c. Consider a DMS with seven possible symbols $x: = 1, 2, \dots, 7$ and the corresponding probabilities are: $P(x_1) = 0.37, P(x_2) = 0.33, P(x_3) = 0.16, P(x_4) = 0.07, P(x_5) = 0.04, P(x_6) = 0.02, P(x_7) = 0.01;$ 10
 - i) Determine Huffman code for the same
 - ii) Determine the average number of binary digits/symbol
 - iii) Find the efficiency of the code.

Place the composite symbol as low as possible.

UNIT - II

- 3 a. Explain the noisy channel theorem interms of critical rate. 5
- b. Obtain Shannon limit derived from channel capacity theorem. 7
- c. Consider the channels A, B and cascaded AB shown in below figure.
 - i) Find C_A and C_B ii) Determine the combined capacity of C_{AB}
 - iii) Explain relation between C_A, C_B and C_{AB} .



- 4 a. Explain the information capacity theorem. 10
- b. With neat block diagram, explain the digital communication system indicating the various types of communication channels. 10

UNIT - III

- 5 a. Explain the block diagram of digital communication system and mention the objectives of error control coding scheme. 10
- b. List the properties of field. 5
- c. Define the following : 5
 - i) Word ii) Code iii) Block code iv) Hamming weight v) Code rate.
- 6. a. Define syndrome decoding and explain the steps involved. 5
- b. Consider a (7, 4) linear block code whose generator matrix is given below : 10

$$\left[\begin{array}{cccc|ccc} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array} \right]$$
 - i) Find all the code vector of this code ii) Find the parity check matrix of this code
 - iii) Find the minimum weight of this code.
- c. Define: i) Hamming weight ii) Hamming distance. 5

UNIT - IV

- 7 a. Define cyclic codes and explain how cyclic codes are generated from the generating polynomial? 8
- b. Compute generator matrix G and parity check matrix H for a binary code of length $n = 7$, given, 8

$$x^7 - 1 = (x - 1)(x^3 + x + 1)(x^3 + x^2 + 1), g(x) = x^3 + x + 1.$$
- c. Define prime polynomial. 4
- 8 a. Explain the matrix description of cyclic codes. 10
- b. Explain the following codes : 10
 - i) Quasi cyclic codes and shortened cyclic codes
 - ii) Burst error correction iii) Fire code iv) Golay code.

UNIT - V

- 9 a. Define constraint length and explain a shift register encoder that generates the tree code. 6
- b. Explain the matrix description of convolutional codes. 8
- c. Define and explain the followings : 6
 - i) Convolutional code ii) Generator polynomial iii) Sliding block code.
- 10 a. Discuss the concept of coded modulation. 10
- b. Explain the general structure of TCM encoder and list of the design rules based on heuristics. 10