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**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

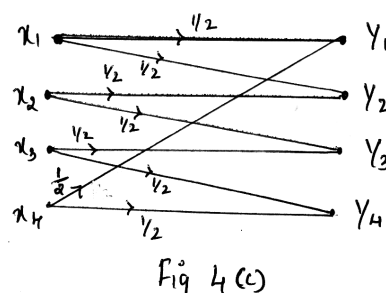
**Note:** Answer **FIVE** full questions, selecting **ONE** full question from each unit.

**UNIT - I**

- 1 a. Describe the mathematical model used in analysis and design. 6
- b. Discuss the deterministic models and probability models. 6
- c. Discuss the concept of reliability of systems and resource sharing systems. 8
- 2 a. Define and illustrate with an example the followings : 6
  - i) Commutative properties    ii) Associative properties    iii) Distributive properties.
- b. With the help of model for a binary communication channel, explain communication over unreliable channel. 6
- c. Compute the probabilities using counting methods. Apply the concept of uncertainty and information. 8

**UNIT - II**

- 3 a. Define and explain self information, mutual information and average mutual information. 6
- b. A card is drawn from a deck,
  - (i) You are told it is a spade. How much information did you receive? 6
  - (ii) How much information did you receive, if you are told that the card drawn is an ace?
  - (iii) If you are told that the card drawn is an ace of spade, how much information did you receive?
  - (iv) Is the information obtained in (iii) the sum of information obtained in (i) and (ii).
- c. Given the messages  $x_1, x_2, x_3, x_4, x_5$  and  $x_6$  with respective of probabilities of 0.4, 0.2, 0.2, 0.1, 0.07, and 0.03. Construct a binary code by applying Huffman encoding procedure. Determine the efficiency of the code. 8
- 4 a. Explain the concept of information capacity theorem. 6
- b. Apply the Shannon limit to analyze different channel and its capacity. 8
- c. Determine the capacity of the channel shown in Fig. 4(c).



**UNIT - III**

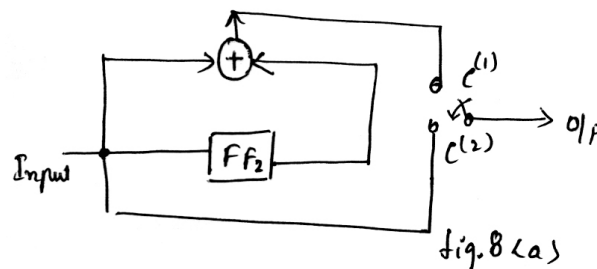
- 5 a. Define code rate, hamming weight, minimum distance and minimum weight. 6
- b. Describe LDPC codes with its algorithm. 5
- c. The parity check matrix for  $a(4, 2)$  linear block code is given below:

$$P = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

- (i) Find the generator matrix for the code vector set 9
- (ii) Find the code vector (iii) Construct standard array
- (iv) What are the error-detecting and error correcting capabilities of the code?
- 6 a. Explain Golay code, CRC codes, Burst error correction. 12
- b. Let the polynomial  $g(x) = x^3 + x + 1$  be the generator polynomial for a systematic (7, 4) cyclic code. 8
- (i) Find the generator polynomial G (ii) Find the parity check matrix H
- (iii) How many errors can this code correct?

**UNIT - IV**

- 7 a. Explain the process of decoding BCH codes along with their equations. 10
- b. Explain the implementation of R-S encoder and decoder circuit. 10
- 8 a. Consider the convolution encoder shown in Fig. 8(a). The code is systematic.
  - (i) Draw the state diagram (ii) Draw the code tree
  - (iii) Find the encoder output produced by the message sequence 10111
  - (iv) Verify the output using time domain approach. 15



- b. Explain the significance of interleaves design for turbo codes. 5

**UNIT - V**

- 9 a. Describe the concept of coded modulation. 5
- b. Explain the general structure of TCM encoder that processes in input bits. 5
- c. Explain space time trellis code, with performance criteria. 10
- 10 a. Describe the concept of symmetric cryptography. 6
- b. Explain the following concepts : 8
  - (i) Block Ciphers (ii) Stream Ciphers (iii) Public key algorithm (iv) Key.
- c. Explain RSA algorithm with example. 6