Seat No.: \_\_\_\_\_

Enrolment No.

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015 Subject code: 710402 Date: 09/12/2015 Subject Name: Information Theory & Coding Time: 10:30 AM to 1:00 PM Total Marks: 70 Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- **Q.1** (a) State and explain Shannon's Hartley law. Derive the expression for the upper limit of the channel capacity. Discuss the tradeoff between S/N ratio and bandwidth
  - (b) Explain construction of Instantaneous code and Kraft Inequality.
- Q.2 (a) Prove that the entropy attains a maximum value when all the source symbols become equiprobable.
  - (b) Write a short note on Hamming codes-perfect codes for single errors. Draw and explain an encoder for the Hamming code of length 7.

#### OR

- (b) Discuss various types of discrete channels and calculate channel capacity for the same.
- Q.3 (a) A computer executes four instructions that are designated by the code words (00, 01, 10, 11). Assuming that the instructions are used independently with probabilities (1/2, 1/8, 1/8, 1/4), calculate the percentage by which the number of bits used for the instructions may be reduced by the use of an optimum source code. Construct a Huffman code to realize the reduction.
  - (b) Explain any one code which can correct burst error.

### OR

- Q.3 (a) A message source produces two independent symbols A and B with probabilities P(A) = 0.4 and P(B) = 0.6. Calculate the efficiency of the source and hence redundancy. If the symbols are received in average with 4 in every 100 symbols in error, calculate the transmission rate of the system.
  - (**b**) Explain Secret key algorithm.
- Q.4 (a) For a (7, 4) cyclic code, the received vector Z(x) is 1110101 and generator polynomial is  $g(x) = 1 + x + x^3$ . Draw the syndrome calculation circuit and correct the single error in the received vector.
  - (b) Discuss Data encryption standards.

## OR

- Q.4 (a) Justify that (23, 12) Golay code is a perfect binary code
  - (b) Write a short note on JPEG Standard for lossy compression
- Q.5 (a) There are 8 messages with probabilities 0.4, 0.2, 0.15, 0.10, 0.06, 0.04, 0.03 and 0.02. Find the entropy of the code and coding efficiency using Shannon-Fano coding scheme.
  - (b) Explain Arithmetic coding with example and its applications.

### OR

- Q.5 (a) Explain in detail steps of Viterbi decoding algorithm using suitable example.
  - (b) Explain in detail public key and private key.