

**GUJARAT TECHNOLOGICAL UNIVERSITY****M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015****Subject code: 710203N****Date: 10/12/2015****Subject Name: Information Theory and 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) A communication system always encounters one of these possible interference waveforms:  $F_1$ ,  $F_2$  and  $F_3$ . The probability of each interference is 0.8, 0.16, and 0.04 respectively. The communication system fails with probabilities 0.01, 0.1, and 0.4 when it encounters  $F_1$ ,  $F_2$  and  $F_3$  respectively. Given that the system has failed, find the probability that the failure is a result of  $F_1$ ,  $F_2$  or  $F_3$  respectively. **07**
- (b) Find the mean, the mean square, and the variance of the Gaussian continuous random variable. **07**
- Q.2** (a) Explain: Stationary and non-stationary random process, Wide-sense (weakly) stationary process, and Ergodic wide-sense stationary process. **07**
- (b) Discuss Rayleigh distribution function. **07**
- OR**
- (b) Define: CDF, PDF, Discrete random variable, Continuous random variable, Random process, Stochastic process, Statistical average (mean). **07**
- Q.3** (a) A memory less source emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1, and 0.08. Find the 4-ary (quaternary) Huffman code. Determine its average word length, the efficiency, and the redundancy. **07**
- (b) Explain: Uniquely decodable code and instantaneous code in details. **07**
- OR**
- Q.3** (a) Explain Shanon-fano code **07**
- (b) State and prove the Kraft's inequality and Sardina's Patterson theorem. **07**
- Q.4** (a) Find a generator polynomial  $g(x)$  for a (7, 4) cyclic code and find code vectors for the following data vectors: 1010, 1111, 0001, and 1000. **07**
- (b) What is Hamming Distance? Give the criteria for error detection and error correction capabilities of a code. **07**
- OR**
- Q.4** (a) For a (6, 3) code, the generator matrix  $G = [1\ 0\ 0\ 1\ 0\ 1; 0\ 1\ 0\ 0\ 1\ 1; 0\ 0\ 1\ 1\ 1\ 0]$ . For all eight possible data words, find the corresponding code words, and verify that this code is a single-error correcting code. **07**
- (b) Explain a convolution coding using suitable example. **07**
- Q.5** (a) Explain generator and parity-check matrices of a (7, 4) systematic code with a suitable example. **07**
- (b) Write short note on Cryptography. **07**
- OR**
- Q.5** (a) Explain Arithmetic code in detail with suitable example. **07**
- (b) Explain lossy JPEG image compression standards. **07**

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