Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 710203N **Date: 17/02/2012**
Subject Name: Information Theory and Coding
Time: 10.30 am – 01.00 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)**	In an experiment with space S={H, T}, both symbols are equally probable. Give the space for a second experiment performing two repeat trials of the first experiment. Sketch probability plots for the first and the second experiments.	**07**
	(b)	Explain mean-ergodic and WSS (Wide Sense Stationary) properties of random processes.	**07**
Q.2	**(a)**	Explain how the uncertainty and the information are related and entropy of a discrete source is determined.	**07**
	(b)	Explain Hamming distance and error detection and correction capabilities of 3-repeat code.	**07**
		OR	
	(b)	Explain MPEG-1 standard giving the details of audio and video compression techniques applied.	**07**
Q.3	**(a)**	Determine and sketch the PDF (Probability Density Function) and CDF (Cumulative Distribution Function) of a uniform random variable over the interval (2, 3). Also determine mean and variance of the given random variable.	**07**
	(b)	Explain the characteristic function and the moment generating function for a continuous random variable.	**07**
		OR	
Q.3	**(a)**	Explain the conditional probability and Bay's rule.	**07**
	(b)	Explain three different types of source encoding techniques: differential, transformation and vector quantization with examples for multi-media.	**07**
Q.4	**(a)**	Explain the procedure to determine the spectrum of a WSS random process.	**07**
	(b)	Explain the procedure to determine the relation between two different WSS random processes correlated with each other.	**07**
		OR	
Q.4	**(a)**	Explain the transmission of a WSS random process through a LSI (Linear Shift Invariant) system having the impulse response h[n], deriving the relation between the PSD (Power Spectral Density) of the input and the PSD of the output.	**07**
	(b)	Explain the model of traditional cryptography and three different types of ciphers: substitution, transposition and one-time pad with examples.	**07**

Q.5	**(a)**	Find a quaternary compact code for the source emitting symbols s1, s2, …, s11 with the corresponding probability, 0.21, 0.16, 0.12, 0.10, 0.10, 0.07, 0.07, 0.06, 0.05, 0.05, and 0.01, respectively.	**07**
	(b)	Draw a state diagram of a second order Markov source with the conditional symbol properties P(0|00)=P(1|11)=0.8, P(1|00)=P(0|11)=0.2, and P(0|01)=P(1|01)= P(0|10)=P(1|10)=0.5. If the stationary distribution of the above source is P(00)=P(11)=5/14, and P(01)=P(10)=2/14, then find the entropy of the source.	**07**

OR

Q.5	**(a)**	Explain generator and parity-check matrices of a (7, 4) systematic code, giving an example.	**07**
	(b)	Find generator polynomial of a (7, 4) cyclic code with a code word 1110100. Also determine the other code words.	**07**

****