Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 710106N Date: 16-01-2013

Subject Name: Information Theory & Coding (Elective)

Time: 02.30 pm – 05.00 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)**	i) Discuss the conditional probabilities of random variables.	**03**
		ii)A binary symmetric channel (BSC) error probability is P_e. The probability of transmitting 1 is Q, and that of transmitting 0 is 1-Q. Determine the probabilities of receiving 1 and 0 at the receiver.	**04**
	(b)	i) Explain Chebyshev's inequality.	**03**
		ii)Discuss Rayleigh distribution. 1	**04**
Q.2	**(a)**	i) State and prove Central limit theorem.	**03**
		ii)Consider a communication system that transmits a data packet of 1024 bits. Each bit can be in error with probability of 10^{-12}. Find the probability that more than 30 of the 1024 bits are in error.	**04**
	(b)	Find the response of a Linear Time-Invariant system to a random input signal.	**07**
		OR	
	(b)	What are different Stochastic processes? Discus Cyclostationary processes.	**07**
Q.3	**(a)**	The source alphabets A,B,C,D,E,F appear with probabilities 0.4, 0.1, 0.1, 0.1, 0.2, 0.1 respectively. i) Find a binary Huffman code. ii) Find ternary Huffman code. iii) Compare the efficiencies of both the above.	**07**
	(b)	For a systematic linear block code, the three parity check digits,C_4, C_5, C_6 are given by $C_4 = d_1 \oplus d_2 \oplus d_3$, $C_5 = d_1 \oplus d_2$, $C_6 = d_1 \oplus d_3$ i) Construct G ii)Construct code generated by this matrix matrix iii) Prepare suitable decoding table iv)Decode the received word: 000110	**07**
		OR	

Q.3 **(a)** The parity check matrix of a particular (7,4) linear block code is Given by **07**

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

i) Find G and list all code words
ii) How many errors can be detected and corrected?
iii) Prepare syndrome table.

(b) i) In convolutional coding, why is flushing of the register periodically performed. **04**

ii) What is a finite state machine? **03**

Q.4 **(a)** Write a short note on cyclic codes also mention advantages and disadvantages. **07**

(b) i) What is mutual information? Show that mutual information has the symmetric property i.e.$I(x_j;y_k)= I(y_k ;x_j)$. **03**

ii) Prove that instantaneous codes always satisfy the Kraft's inequality. **04**

OR

Q.4 **(a)** i) What are Hamming Codes? What are their properties? **04**

ii) Prove that $GH^T = HG^T = 0$ for systematic Linear Block Code. **03**

(b) What is the uniqueness and efficiency of Arithmetic code? Illustrate with an example. **07**

Q.5 **(a)** Discuss soft-decision Viterbi decoding. **07**

(b) Describe any one decoding technique for the binary double error correcting BCH codes. **07**

OR

Q.5 **(a)** i) What are various security goals of Information system? **03**

ii) Explain Data Encryption Standard scheme. **03**

(b) Write short notes on **08**
i) Rice distribution
ii) Markov chain

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