No. of Printed Pages : 3

BIEL-023

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

00086

June, 2015

BIEL-023 : INFORMATION THEORY AND CODING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. If any data is missing, assume suitable value. Use of scientific calculator is allowed.*

1. (a) What is meant by uniquely decidable code ? *4*

(b) Write a comparative note on Huffman code and Shannon's codes. *6*

2. Prove that for any instantaneous code (prefix code) over an alphabet size D, the codeword length I_1, I_2, ..., I_m must satisfy the inequality $\sum_i D^{-I_i} \leq 1$. Also prove that for a given set of codeword lengths that satisfy this inequality, there exists an instantaneous code with these word lengths. *10*

3. (a) Discuss the various properties of differential entropy and mutual information. *7*

(b) Let U be a memoryless source taking values in {A, B, C, D, E, F, G} with the probabilities

{0·4, 0·2, 0·15, 0·1, 0·05, 0·05, 0·05}

respectively. Find the entropy of U. *3*

4. (a) Discuss briefly about the importance of Reed-Solomon codes. *5*

(b) Prove that a cyclic code has a unique complement that is also cyclic. *5*

5. (a) Explain, why BCH codes are not suitable in cases of compact discs, digital audio tapes and other data storage systems. *5*

(b) Prove that a BCH code of designed distance δ has minimum weight at least δ. *5*

6. What do you mean by band limited channel ? Discuss its utility in communication over a radio network. *10*

7. Derive an expression to prove the fact that the entropy of a pair of random variables is the entropy of one plus the conditional entropy of the other. *10*

8. (a) Discuss the basic properties of finite fields and the prerequisite conditions for its construction. *5*

(b) Describe briefly about the error detection and correction codes. *5*

9. Write short notes on any ***two*** of the following : *2×5=10*

(a) Error Probability Plane

(b) M-ary Signalling

(c) Bandwidth Efficient Modulation

10. The input source to a noisy communication channel is a random variable X over the four symbols a, b, c and d. The ouput from this channel is a random variable Y over these same four symbols. The joint distribution of these two random variables is given in the following table :

	x = a	x = b	x = c	x = d
y = a	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{4}$
y = b	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{16}$	0
y = c	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{16}$	0
y = d	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{16}$	0

Find the mutual information I (X : Y) between the two random variables in bits. *10*