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BIEL-023

01570

B.TECH. IN ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

June, 2013

BIEL-023 : INFORMATION THEORY AND CODING

Time : 3 hours *Maximum Marks : 70*

Note : *(i) Attempt **seven** questions. All questions carry **equal** marks.*

*(ii) **Any missing** data may be suitably assumed.*

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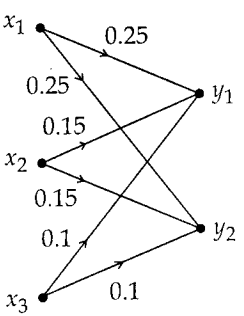
1. Define the term 'entropy'. Prove that for a binary system (M = 2), the maximum entropy is at $p = \frac{1}{2}$ and the value of maximum entropy is $H_{max} = 1$ bit/message. List important properties of entropy. **10**

2. Find the mutual information for the channel shown below : **10**



3. Define the following terms : **10**

(a) Channel Capacity

(b) Channel Efficiency

(c) Redundancy

Derive the expression for channel capacity of a symmetric channel.

4. Using Shanon - Hartley theorem prove that the capacity of a Gaussian channel is given by the **10**

expression $C = \omega \log \left[1 + \frac{S}{N}\right]$ bits/sec

where, symbols have usual meanings.

5. With the help of Hufman coding determine the following : **10**

(a) Average length of the message ($\overline{L}$)

(b) Coding Efficiency (η).

Message ensembled is :

$[X] = [x_1 \; x_2 \; x_3 \; x_4 \; x_5 \; x_6 \; x_7]$

$[P] = [.4 \; .2 \; .12 \; .08 \; .08 \; .08 \; .04]$

Take $M = 2$.

6. Design an encoder for (7, 4) systematic cyclic code generated by $g(x) = 1 + x + x^3$. Also, verify its operation for any one message word. **10**

7. Write short notes on the following : **10**

(a) BCH codes.

(b) Reed - Solomon Codes.

8. Explain M-ary signaling and prove that the bandwidth efficiency is given as : 10

$$\frac{R}{W} = \frac{1}{WT_b} \text{ bits/s/Hz.}$$

Where the symbols have usual meaning.

9. Explain Bandwidth - Efficient Modulation for QPSK and offset - QPSK Signalling. 10

10. Write notes on the following : 10

(a) Bandwidth - Limited Systems.

(b) Power - Limited Systems.