01961

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

Term-End Examination

December, 2013

BIEL-023 : INFORMATION THEORY AND CODING

Time : 3 hours   *Maximum Marks : 70*

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

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

1. (a) An event has six possible outcomes with the   5

    probabilities, $P_1 = \frac{1}{2}$, $P_2 = \frac{1}{4}$, $P_3 = \frac{1}{8}$,

    $P_4 = \frac{1}{16}$, $P_5 = \frac{1}{32}$ and $P_6 = \frac{1}{32}$. Find
    the entropy of the system. Also find the rate
    of information if there are 16 outcomes per
    second.

   (b) A countinuous signal is bandlimited to 5kHz.   5
    The signal is quantized in 8 levels of a PCM
    system with probabilities 0.25, 0.2, 0.2, 0.1,
    0.1, 0.05, 0.05 and 0.05. Calculate the
    entropy and the rate of information.

2. A discrete source transmits message x_1, x_2 and x_3 **10** with probabilities 0.3, 0.4 and 0.3. The source is connected to the channel as shown. Calculate all the entropies.
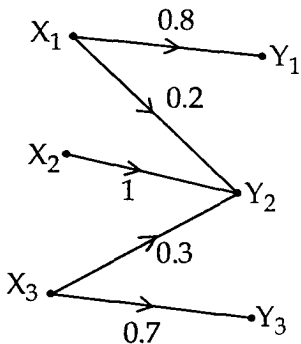
3. Derive the expression for the channel capacity of   **10** a Binary Erasure channel (BEC).

4. Apply the shanon - Fano coding procedure for   **10** the following message ensemble :

$[x] = [x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7]$

$[P] = [0.4 \quad 0.2 \quad 0.12 \quad 0.08 \quad 0.08 \quad 0.08 \quad 0.04]$

Determine :

(a) Average word length $(\bar{L})$

(b) Coding Efficiency (n)

Take $M = 2$ and observe following partitions.

(i) $[x_1] = [x_1 \ x_2] \ [x_2] = [x_3 \ x_4 \ x_5 \ x_6 \ x_7]$

(ii) $[x_1] = [x_1] \ [x_2] = [x_2 \ x_3 \ x_4 \ x_5 \ x_6 \ x_7]$

5. Describe the process of syndrome testing, error **10** detection and error correction.

6. Describe four types of trade - offs which can be **10** accomplished by using an error correcting code.

7. What are soft - decisions, and how much greater **10** complexity is there in the process of soft - decision Viterbidecoding as compared with hard - decision decoding ?

8. (a) Explain why Reed - Solomon codes perform **5** so well in a bursty - noise environment.
    (b) Explain why a syndrome can be calculated **5** by evaluating received polynomial at each of the roots of the codes generator polynomial.

9. For MPSK modulation, bandwidth efficiency **10** increases with higher dimensional signaling but for MFSK, it decreases. Explain why ?

10. Why do binary and 4 - any orthogonal frequency shift keying (4 - FSK) manifest the same band **10** width efficiency relationship ? Explain with the help of mathematical equations.

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