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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
END SEMESTER EXAMINATION MAY JUNE - 2016
M.Tech. II Semester (EC)

COURSE CODE: 10M11EC213 MAX. MARKS: 35
COURSE NAME: INFORMATION AND CODING THEORY
COURSE CREDITS: 03 MAX. TIME: 2. HRS

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. All parts of a question must be answered in one place.

1a. Prove that Huffman coding is optimum.
b. Is $I(XY;Z) \geq I(X;Z)$ always true? If yes, prove it.

2a. Explain how to determine if a channel is symmetric.
b. If f (α) is a convex ∩ function of α, where α is a probability vector, state and prove the sufficiency requirements for an α to maximize f(α).

3a. Prove that an (n,k) block code must have $d_{min} \leq n - k + 1$. Prove that if d_{min} is odd, then all $(d_{min} - 1)/2$ bit error patterns can be corrected.
b. Given the parity check code described by $x_l = \sum_n d_n g_{l,n}$ with $g_{1,1} = g_{2,2} = g_{3,3} = g_{2,4} = g_{3,4} = g_{1,5} = g_{3,5} = g_{1,6} = g_{2,6} = 1$ and all other g = 0, construct the generator matrix. Given the message word 101 write the code word.

4a. Define and explain a field.
b. Prove the unique factorization theorem for polynomials over a field.

5a. For a GF (2^5) find the factors of $D^4 - 1$. Prove the process required.
b. Prove that every Galois Field must contain a unique subfield of prime order.
c. Describe how to get the generator polynomial for BCH codes.

6a. Consider a field GF (2^4) modulo the polynomial $D^4 + D + 1$. List the elements of this field in terms of α and in terms of polynomials g(t). Show that $D^4 + D + 1$ is the minimal polynomial for α^4.
b. Draw a circuit for multiplying α(t) with β(t).

7a. Explain with a block diagram, convolution coding. In a (3, 2, 1) the outputs are given by $x_j = m_j$, $x_j' = m_j + m_{j-1} + m_{j-3}$ and $x_j'' = m_j + m_{j+2}$. Draw the state diagram for this coder.
b. Describe and discus Viterbi Decoding for convolution codes.