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| **Q No.** |  | **Marks** |
| **Q1**  **(a)**  **(b)** | A binary channel has the following properties:  (a) P(Y/X) =  (b) The input symbols have probabilities 1/4 and 3/4 respectively.  Find the values of H(X), H(X, Y) and H(Y/X).  **Write short notes on** (**ANY TWO**):-   1. Channel capacity 2. Deterministic channel 3. Source Encoding | 10  10 |
| **Q2**  **(a)**  **(b)** | A symbol set S = {a, b, c, d, e, f, g} with symbol probabilities {1/3, 1/27, 1/3, 1/9, 1/9, 1/27, 1/27} respectively is used for source encoding. Show the encoding using:-   1. Shannon-Fano method 2. Huffman method.   Also calculate the efficiency in each case.  **Explain the terms (ANY TWO):-**   1. Prefix codes 2. Kraft’s Inequality theorem 3. Run Length Encoding | 10  10 |
| **Q3**  (a)  (b)  (c) | Consider the Convolutional encoder given below:-    Draw the state diagram and state table for the same  Draw the Trellis diagram  If the received message is R = [ 11 01 00 00 ] calculate the original message(s) using the Viterbi decoding (maximum likelihood path) method. | **05**  **05**  **10** |
|  | **Continued on page 2** |  |
| **Q4** | The parity check bits of a (7,4) hamming code are given by:-  p1 = d1 + d3 + d4  p2 = d1 + d2 + d3  p3 = d2 + d3 + d4  Where d1, d2, d3 and d4 are the message bits.   1. Construct the G and H matrices 2. Prove that G\*HT = 0.   **--- OR ---**  For a systematic (6,3) linear block code the parity matrix P is given by:-  [P] =   1. Find all possible code words. 2. Find the error detecting and error correcting capability. | 10  **-- OR –**  10 |
| **Q5** | 1. What is Fermat’s Little Theorem? Use it to evaluate 7**2001** ÷ 5. 2. Reduce (37)1**03** mod 40 using modular arithmetic.   **--- OR ---**  Write short notes on:-   1. Primitive Roots 2. Jacobi and Legendre symbols | 10  **-OR-**  10 |
| **Q6** | 1. Using Chinese Remainder Theorem, find the value of X such that:-   X ≡ 4 mod 5  X ≡ 5 mod 6  X ≡ 1 mod 7   1. Use the linear congruence method (a.k.a. Euclidean method or Diophantine method) to find the values of X and Y such that   100X + 65Y = 15  **--- OR ---**   1. Explain the step-by-step encryption and decryption process using the **Affine** cipher with a numerical example. 2. Use the **Vigenere** cipher method to encode and decode the message “EFFECTIVE” using the key word “RUPEE”. | 10  10  **--OR--**  10  10 |
|  | **---- END -----** |  |