**SEMESTER: WINTER SESSION: 2016-17**

**Examination: M.Tech(CSE-IS) Time: 03 Hours Max Marks: 100**

**Subject: Information Theory & Coding (CSC52103)**

**Instructions:** Answer any **FIVE** questions. Answer all parts of any Question at one place.

Assume suitable data wherever not provided.

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| **1.** | **a.** | “The self-information content of a message is a logarithmic function of its probability of emission”. Justify this statement. | **4** |
| **b.** | State and proof the Kraft Inequality. | **6** |
| **c.** | Find the source entropy for the given Markov source. | **5** |
| **d.** | Show that the average codeword length of an optimal code for a source is greater than or equal to the entropy of that source*.* | **5** |
| **2.** | **a.** | Construct the Shannon codes for a source having four symbols  with probabilities ***0.4, 0.3, 0.15*** and ***0.15*** respectively. Also find the source efficiency and redundancy. | **5+3** |
| **b.** | The symbol set {a, b} is used for LZW encoding with initial dictionary is as follow:   |  |  | | --- | --- | | Index | Entry | | 1 | a | | 2 | b |   Decode the sequence 1,2,4. Explain your steps. | **4** |
| **c.** | Consider a bit-error probability of a communication channel is *0.1* then find the probability of correct decoding, a decoding error and a decoding failure for the *(5,1)* repetition code. | **4** |
| **d.** | Explain the minimum-error decoding rule with a suitable example. | **4** |
| **3.** | **a.** | Write the properties of liner block code. Show that the (4,3) odd parity code is not a linear code. | **2+3** |
| **b.** | Consider in a linear block code, the syndrome is computed as follow:    where  is the received vector and is the syndrome value.   1. Find the generator matrix. 2. List all codewords. 3. Determine its error detection and correction capabilities. 4. Compute the syndrome table 5. For an erroneous received code vector 1000010, correct the error. | **3×5** |
| **4.** | **a.** | What is the primitive polynomial over GF(2)? Verify whether the given polynomial, is primitive or not over GF(24). | **2+4** |
| **b.** | Define the generator polynomial. Prove that the nonzero code polynomial of minimum degree in a cyclic code, C, is unique. | **2+4** |
| **c.** | Construct a systematic encoder, with low order input, for (7,4) cyclic code with generator polynomial g(x)=x3+x+1. Find the codeword when the input polynomial of the encoder is x3+x. | **3+5** |
| **5.** | **a.** | Describe the process of decoding double-error correcting BCH code. | **5** |
| **b.** | Given the primitive polynomial  over GF (2), find the field elements of GF (24) and therefore construct the generator polynomial of double error correcting (15, 7) BCH code over GF(24). Consider a double error correcting (15, 7) BCH code over GF (24) is transmitted over communication channel and errors have been incurred in two bit positions. Find the transmitted codeword when the received polynomial is. | **4+6+5** |
| **6.** | Write short notes on the following: | | **2×10** |
| **a.** | Meggitt Decoder |
| **b.** | Reed-Solomon codes |