Code : 104711

B.Tech 7th Semester Exam., 2021

(New Course)

INFORMATION AND CODING THEORY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* of the following questions : 2×7=14

(a) List the properties of entropy.

(b) What is state source coding theorem?

(c) Explain the term 'mutual information'.

(d) What is the significance of a syndrome vector in the context of error control coding?

(e) What is meant by constraint length and free distance of a convolution code?

(f) Explain conditional mutual information.

(g) What do you mean by the term 'bandwidth' of a channel?

(h) What is channel redundancy?

(i) Calculate the entropy of source with a symbol set containing 64 symbols each with a probability $P = 1/64$.

(j) Define information rate.

2. (a) Define hamming weight and hamming distance. Find the hamming weight of 10110 and the hamming distance between 1111 and 0000. 7

(b) Explain soft decision decoding with example. Also give the benefits of soft decoding. 7

3. (a) Derive an expression for average information content of symbols in long independent sequence. 7

(b) Explain the chain rule for mutual information. 7

4. A file contains the following characters with the frequencies as shown :

Characters	Frequencies
A	10
B	15
C	12
D	3
E	4
F	13
G	1

If Huffman coding is used for text compression, calculate—

(a) Huffman code for each character;

(b) average code length;

(c) length of Huffman encoded message (in bits). 14

5. (a) What do you understand by information? What are its units? How does it relate to the entropy? 7

(b) A memory-less source emits six messages with probabilities {0·4, 0·4, 0·2, 0·2, 0·1 and 0·1}. Find the Shannon-Fano code and determine its efficiency. 7

6. (a) In a (15, 5) cyclic code, the generator polynomial is given by

$$g(X) = 1 + X + X^2 + X^4 + X^5 + X^8 + X^{10}$$

Find whether $r(X) = 1 + X^4 + X^6 + X^8 + X^{14}$ a valid code word or not. 7

(b) If the spectrum of a channel is between 3 MHz and 5 MHz, find the maximum channel capacity if the SNR is 251. 7

7. Discuss the terms 'alterant', 'goppa' and 'generalized BCH' codes in detail. 14

8. (a) Explain Kraft inequality with suitable example. 7

(b) Explain Massey's minimum shift-register synthesis technique and its relation to Berlekamp's algorithm. 7

9. Explain the following terms : 7×2=14

(a) Wozencraft's sequential decoding algorithm

(b) Viterbi decoding algorithm

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