Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2023

Sixth and Seventh Semester

18ECE225T – INFORMATION THEORY AND CODING

(For the candidates admitted from the academic year 2020-2021 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours | Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
1. Morse Code is a (A) Fixed Length Code (B) Variable Length Code (C) Binary Code (D) ASCII Code	1	1	1	2
2. The number of characters that can be represented in ASCII – 8 are (A) 128 (B) 256 (C) 32 (D) 64	1	1	1	2
3. The number of instruction in a computer with K binary digits for each instruction is (A) 2^K (B) 10^K (C) 2^{K+1} (D) 2^{K-1}	1	1	1	2
4. In Cyclic redundancy checking, the divisor is _____ the CRC (A) Of same size as (B) One bit more than (C) One bit less than (D) Two bit less than	1	1	1	2
5. The type of encoding where no character code is the prefix of another character code is termed as (A) Optimal Encoding (B) Prefix Encoding (C) Frequency Encoding (D) Tree Encoding	1	1	2	2
6. The efficiency of Huffman code is linearly proportional to (A) Average length of the code (B) Maximum length of the code (C) Average Entropy (D) Entropy and maximum length	1	1	2	2
7. Instantaneous code is also called as (A) Gamma Code (B) Comma Code (C) Alpha Code (D) Beta Code	1	1	2	2
8. The average block length in Huffman coding is (A) Zero (B) Always Unity (C) Maximum (D) Minimum	1	1	2	2

9. The most common Hamming Codes are a generalized version of 1 2 3 2
   (A) Hamming (7,4) Code (B) Hamming (8,4) Code
   (C) Hamming (6,3) Code (D) Hamming (5,7) Code

10. _____ reduces the data rate through the channel 1 1 3 2
   (A) Check Bit (B) Even Parity
   (C) Odd Parity (D) Message Bit

11. The Hamming distance between 100 and 001 is 1 2 3 2
   (A) 0 (B) 1
   (C) 2 (D) 3

12. The divisor in cyclic code is called as 1 1 3 2
   (A) Degree (B) Generator
   (C) Redundancy (D) Checksum

13. In Trellis diagram, the number of nodes _____ at successive branching 1 1 4 2
   (A) Increases by 1 (B) Doubles
   (C) Triples (D) Decreased

14. In maximum likelihood detector, the error probability is 1 1 4 2
   (A) Maximum (B) Minimum
   (C) Zero (D) Unity

15. In Viterbi's algorithm, the selected paths are regarded as 1 1 4 2
   (A) Survivors (B) Defenders
   (C) Destroyers (D) Carriers

16. In VITERBI'S algorithm, the metric adopted for decision making is 1 14 2
   (A) Hamming Distance (B) Galois Field
   (C) Hamming Bound (D) Parity – Check

17. The Entropy H(x/y) is called is 1 1 5 2
   (A) Equivocation (B) Joint Entropy
   (C) Mutual Information (D) Conditional Probability

18. If there is more uncertainity about the message, information carried is 1 1 5 2
   (A) Moderate (B) Unity
   (C) Less (D) More

19. The expected information contained in a message is called as 1 1 5 2
   (A) Entropy (B) Efficiency
   (C) Coded Signal (D) Information

20. When x and y are statistically independent, then I (x,y) is 1 1 5 2
   (A) 1 (B) 0
   (C) LN2 (D) Infinity

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

		Marks	BL	CO	PO
21.	Determine the multiplication table for octal numbers	4	2	1	2
22.	Verify the code 00, 01, 10, 110 and 111 are instantaneous and draw the decoding free.	4	2	2	2
23.	For a systematic linear block codes, three parity check bits are given by $C_4 = d_1 + d_3$, $C_5 = d_2 + d_3$ and $C_6 = d_1 + d_2 + d_3$. Construct a generation matrix and parity check matrix.	4	2	3	2
24.	Differentiate between code free and trellis diagram	4	1	4	2
25.	Prove that $H(x,y) = H(y/x) + H(x)$	4	2	5	2
26.	Determine the entropy of the source which produces symbols x_1, x_2, x_3 and x_4 with probability of 0.5, 0.25, 0.125 and 0.125 respectively.	4	2	5	2
27.	Explain the effect of noise in Huffman Coding Probabilities.	4	2	2	2

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	Write a short note on CRC method. A bit stream 10011101 is transmitted using standard CRC method. The generator polynomial is x^3+1. What is the actual bit string transmitted suppose that third bit from left is inverted receiver detect this error?	12	3	1	2
	(OR)				
b.	What are odd and even parity? Discuss single parity check and two dimension parity check.	12	3	1	2
29. a.	Obtain the ternary Huffman code for the word 'COMMITTEE'. Also find the average code word length.	12	3	2	2
	(OR)				
b.	Explain uniquely decodable code and instantaneous code with an example	12	3	2	2
30. a.	The generator matrix for a (7,4) linear block code is given below.	12	3	3	2

$$G=\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

Find all the code vectors of the code.

(OR)

b.	Design an syndrome calculator for (7,4) cyclic Hamming code generated by the polynomial $G(p) = P^3 + P + 1$. Calculate the syndrome for received word Y = (1001101).	12	3	3	2

31. a. Describe the essential features of a sequential decoding in brief. 12 3 4 2

(OR)

b. A rate 1/3 convolution encoder has generating vectors $g_1 = (1\ 0\ 1)$, $g_2 = (1,1,0)$ and $g_3 = (1\ 1\ 1)$. 12 3 4 2
   i. Sketch the encoder configuration
   ii. Draw the code tree, state diagram and trellis diagram.

32. a. Construct a Shannon Fano Code for a source which emits symbols S_1, S_2, S_3, S_4 and S_5 with probabilities 0.4, 0.2, 0.15, 0.15 and 0.1 respectively. Also calculate the efficiency of the code. 12 3 5 2

(OR)

b. Define: Channel Capacity. Show that for a Gaussian Channel with $\eta/2$ has power spectral density and S as the signal power, the channel capacity is $1.44\left(S/\eta\right)$. 12 3 5 2

* * * * *