

International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunication Engineering

Final Examination

Program: **B.sc (Engg.)**
 Course Code: **ETE-3505**
 Total Marks: **50**

Semester: **Spring 2022**
 Course Title: **Information Theory Coding**
 Time: **2 Hours 30 Minutes**

(i) Answer all the questions. The figures in the right-hand margin indicate full marks. (ii) Course Learning Outcomes (COs) and Bloom's Levels are mentioned in additional Columns.						
Course Learning Outcomes (CLOs) of the Questions						
CLO1	Familiarization with the various fields/trends of communications like Information theory, error detection and error correction related to radio and telecommunication.					
CLO2	Analysis different types of error control code properties for secure and error free efficient communications.					
Bloom's Levels of the Questions						
Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A (Answer any Two of the following Questions.)

- Q1. a)** What is channel coding? Why is coding necessary? CLO2 U 4
- b)** Explain the following three basic mechanisms of reverse error correction methods with proper diagram. CLO2 Ap 6
- i) Stop and wait
 ii) Go-back-N
 iii) Selective retransmission

- Q2. a)** Consider a (5,2) linear systematic block code defined by the generator matrix CLO2 C

$$\mathbf{G} = \begin{bmatrix} \mathbf{g}_0 \\ \mathbf{g}_1 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \end{bmatrix}$$

- i) Find all the codewords of the code. 2
- ii) Find the parity check matrix for this code; 2
- iii) How many errors can the code correct; 3
- iv) Construct the syndrome lookup table for the code. 3

OR

- Q2. b)** Consider a (7,4) code whose generator matrix is CLO2 C

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

- i) Find all the codeword of the code. 2

- ii) Find H , the parity check matrix of the code. 2
- iii) Compute the syndrome for the received vector 1 1 0 1 1 0 1. Is this a valid code vector? 3
- iv) What is error correcting capability of the code? 3

Part B (Answer any Three of the following Questions.)

- Q3. a) What is a cyclic code? Let $U=10001$ for $n=5$. Express the codeword in polynomial form and solve for the 4th end-around shift of the codeword using the equation $U^{(i)}(X)=X^iU(X) \text{ modulo } (X^n+1)$ Where $U(X)$ is a codeword polynomial of degree $(n-1)$ and (i) represents the number of end-around shift of the codeword. CLO2 E 5
- b) Use a dividing circuit divide $V(X)=X^3+X^5+X^6$ by $g(X)=(1+X+X^3)$. Find the quotient and remainder terms. CLO2 E 5
- Q4. a) Using the generator polynomial $g(x)=1+X+X^3$, generate a systematic codeword from the $(7,4)$ codeword set for the message vector $m=0101$. CLO2 E 5
- b) Design a feedback shift register encoder for an $(8,5)$ cyclic code with a generator $g(x)=1+X+X^2+X^3$. Use the encoder to find the codeword for the message 10101 in systematic form. CLO2 E 5
- Q5. a) A convolutional encoder has two shift registers, two modulo-2 adders and an output parallel to serial multiplexer. The generator sequences of the encoder are as follows: CLO2 E

$$g^{(1)}=(1 \ 1 \ 1)_2$$

$$g^{(2)}=(1 \ 0 \ 1)_2$$

- (i) Draw the block diagram of the encoder; 2
- (ii) Generate convolutional code for message bits 1011? 2
- (iii) Draw the trellis diagram of the code; 3
- (iv) What are the message bits, if the received code word is 00010100; 3

OR

- Q5. b) Draw the state diagram, tree diagram and trellis diagram for the convolutional encoder characterized by the block diagram in the following Fig.1 CLO2 C 10

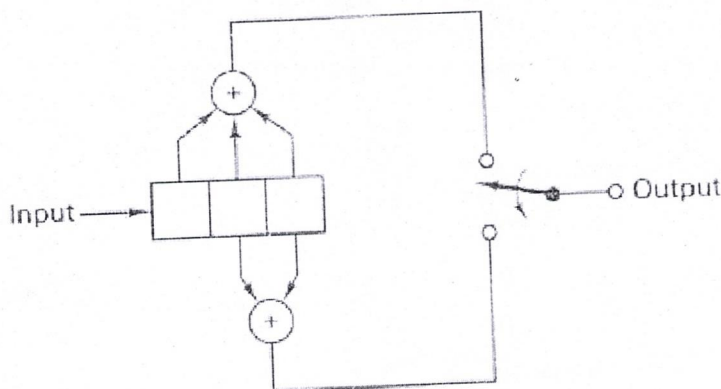


Fig.1