Department of BES-II

Digital Design and Computer Architecture 23EC1202

Topic:

ENCODER, DECODER

Session No: 06

AIM OF THE SESSION

To familiarize students with the basic concept of Encoder & Decoders.

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

1. Relate the concepts of encoding and decoding to their practical applications in digital systems.
2. Explore the applications of encoders and decoders in fields such as digital communications, signal processing, and data interpretation.

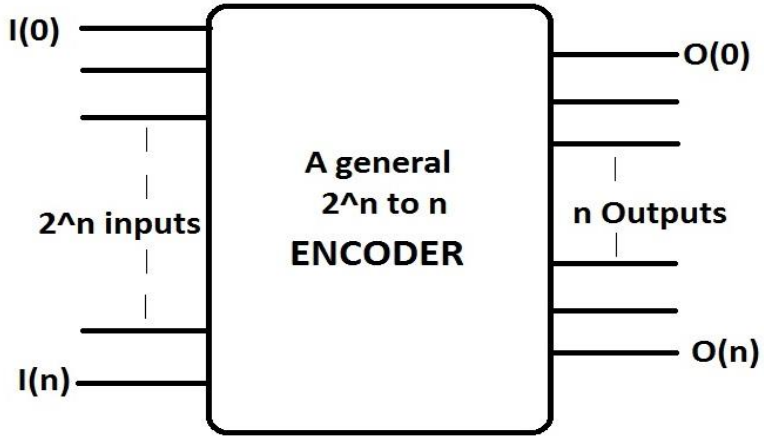
LEARNING OUTCOMES

At the end of this session, you should be able to:

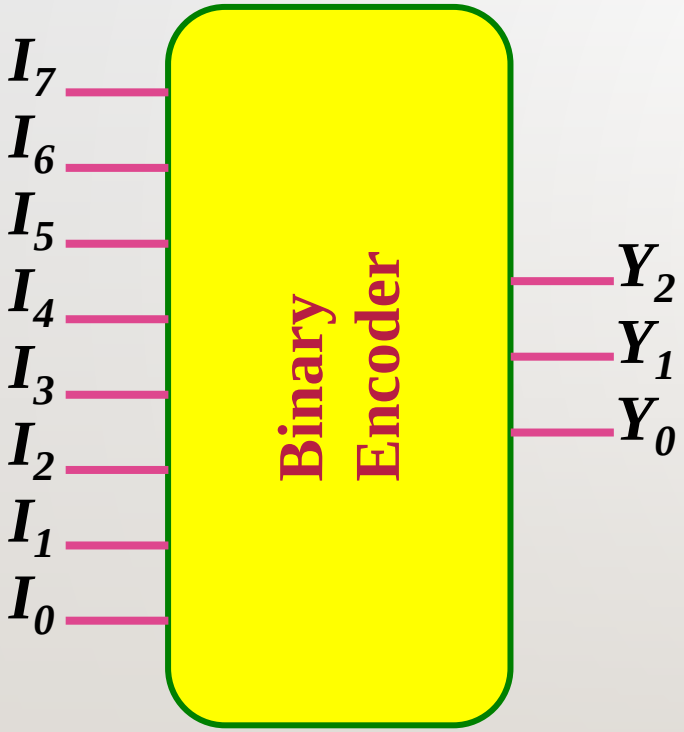
1. Demonstrate problem-solving skills by applying encoder and decoder knowledge to real-world scenarios.
2. Relate the learned concepts of encoding and decoding to practical applications in digital systems.

SESSION INTRODUCTION: ENCODER

- An encoder is a device which converts numbers or characters or symbols into a coded format.
- It reduces the number of bits needed to represent the given information.
- Encoders are used for transmitting the information.
- Thus the transmission link uses fewer lines to transmit the encoded information.
- Eg: QR code, calculators, Keyboard, etc.

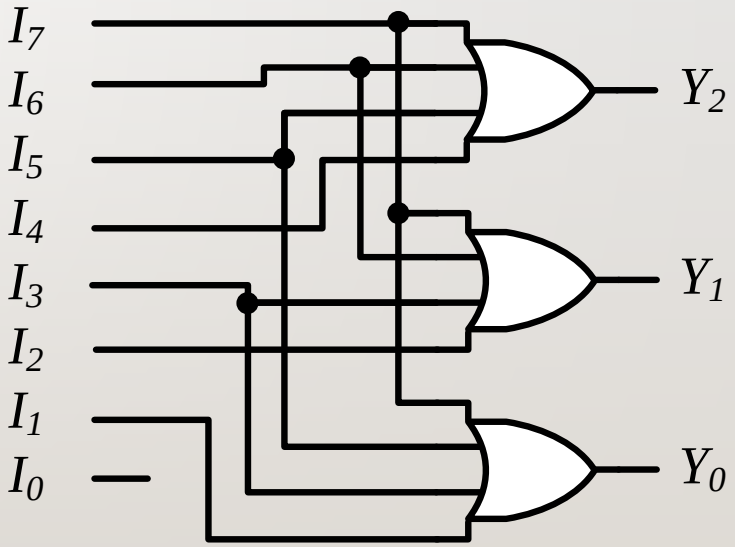


ENCODER: 8 to 3 Encoder



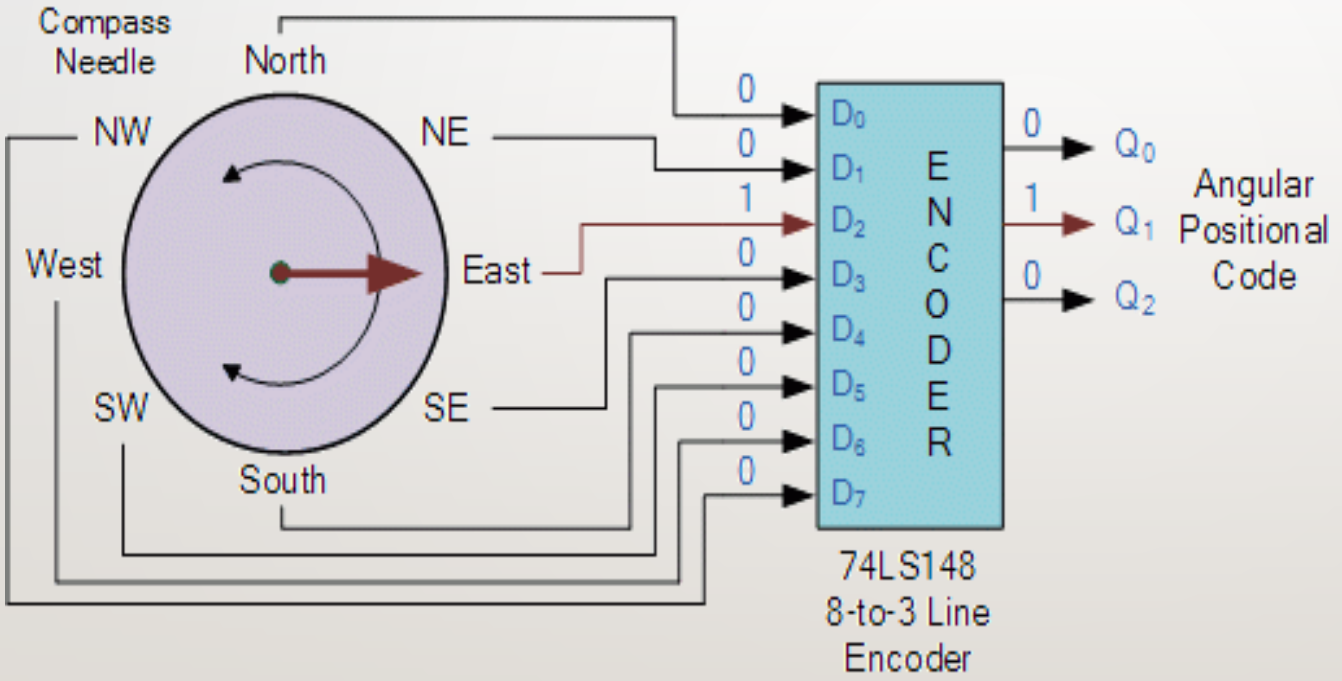
I_7	I_6	I_5	I_4	I_3	I_2	I_1	I_0	Y_2	Y_1	Y_0
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1

$$Y_2 = I_7 + I_6 + I_5 + I_4$$
$$Y_1 = I_7 + I_6 + I_3 + I_2$$
$$Y_0 = I_7 + I_5 + I_3 + I_1$$



ENCODER Application

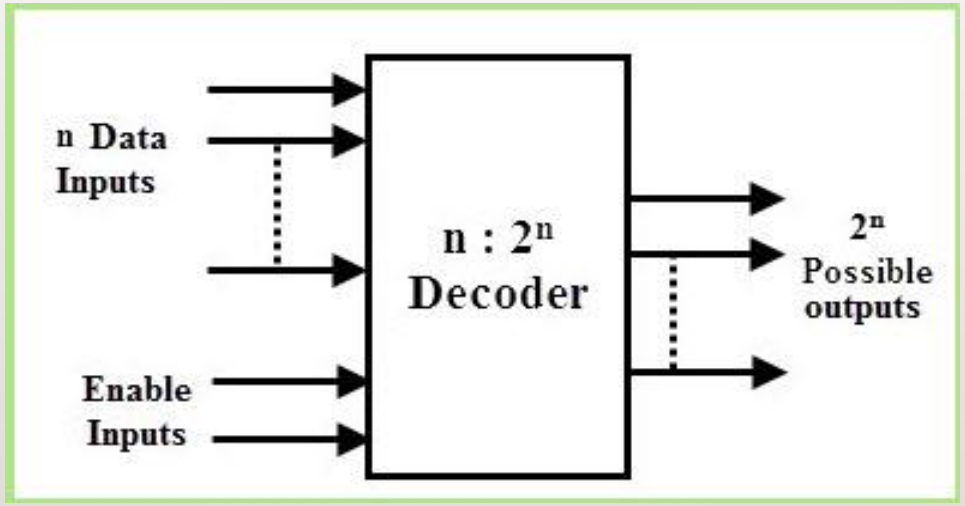
Encoder Navigation



Compass Direction	Binary output		
North	0	0	0
North-East	0	0	1
East	0	1	0
South-East	0	1	1
South	1	0	0
South-West	1	0	1
West	1	1	0
North-West	1	1	1

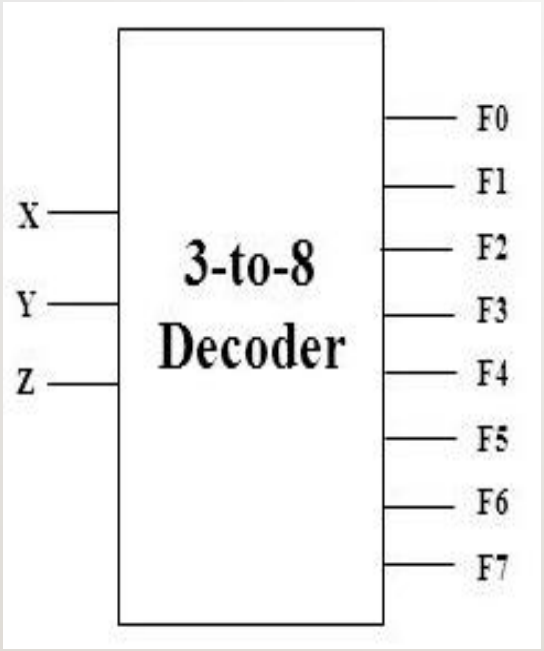
DECODER

Decoder is a combinational circuit that has 'n' input lines and maximum of 2^n output lines. One of these outputs will be active High based on the combination of inputs present, when the decoder is enabled.



3–to-8 DECODER

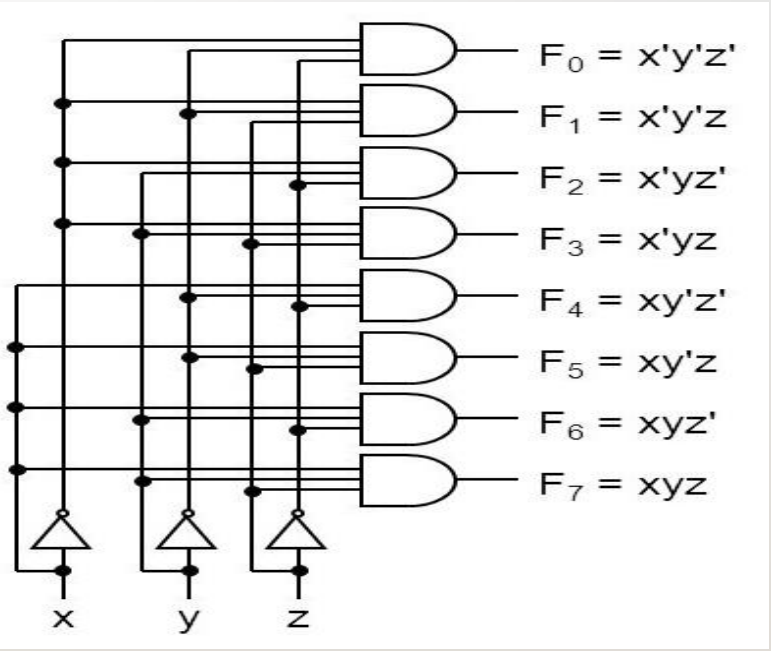
Block Diagram



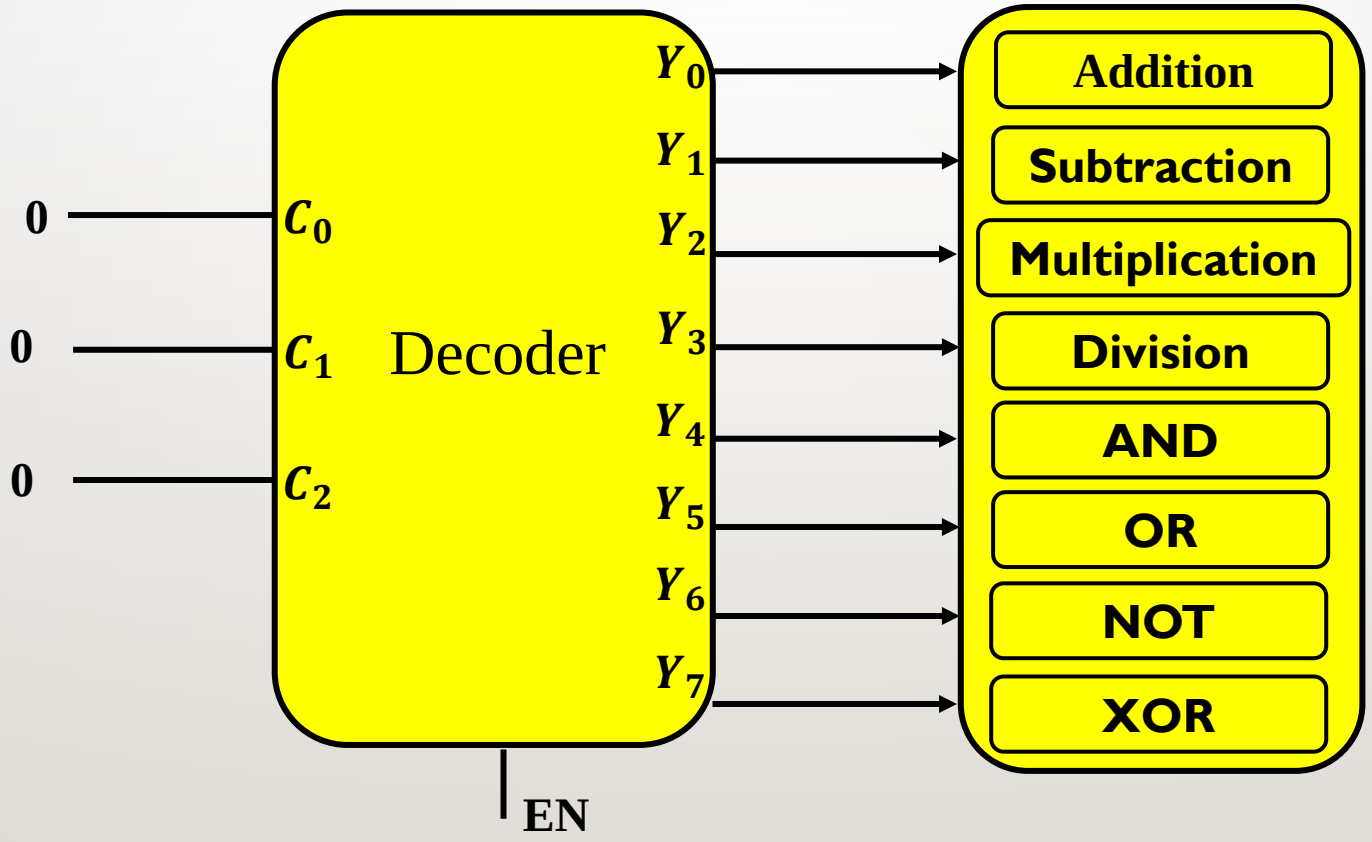
Truth Table

X	Y	Z	F7	F6	F5	F4	F3	F2	F1	F0
0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	1	0	0	0	0	0	0	1	0	0
0	1	1	0	0	0	0	1	0	0	0
1	0	0	0	0	0	1	0	0	0	0
1	0	1	0	0	1	0	0	0	0	0
1	1	0	0	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

Logic Diagram



DECODER Application

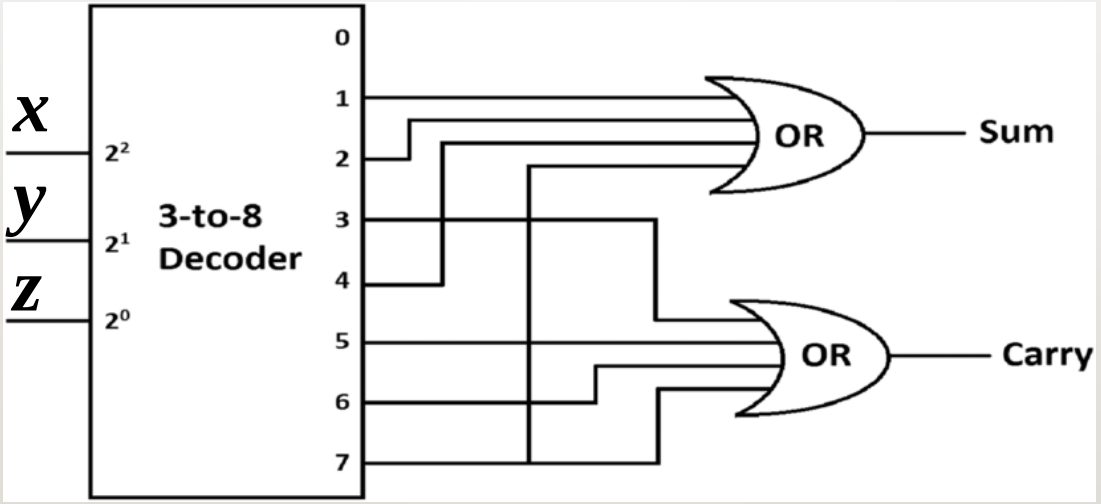


Implementation of Boolean Functions using Decoder

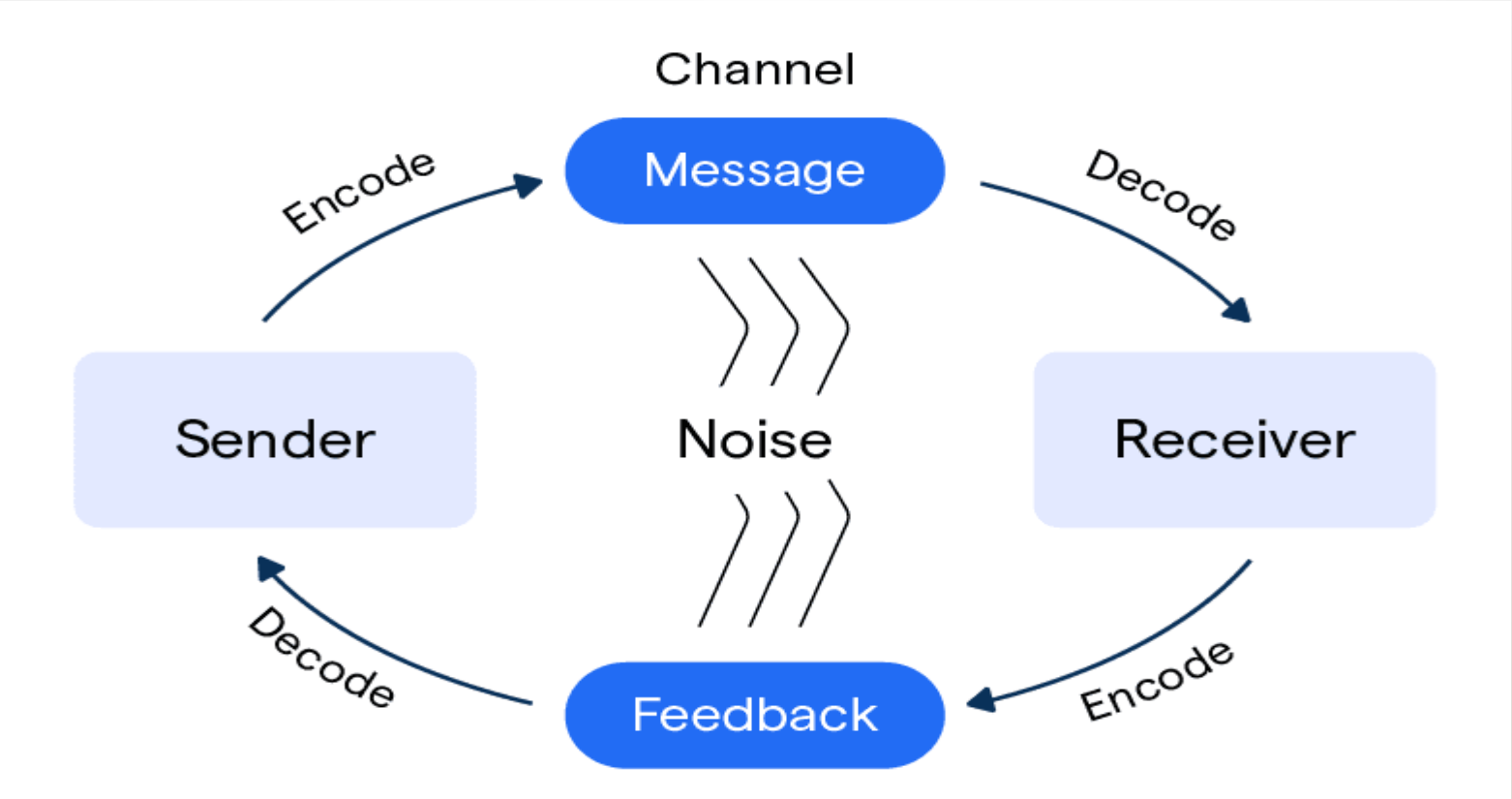
Eg : Implement a Full adder using a suitable decoder and OR gates.

$S(x, y, z) = \sum m(1, 2, 4, 7)$

$C(x, y, z) = \sum m(3, 5, 6, 7)$



TRADITIONAL ENCODE-DECODE MODEL OF COMMUNICATION



SELF-ASSESSMENT QUESTIONS

1. What is the primary function of an Encoder?

A. To combine multiple inputs into one output
B. To decode digital signals into analog signals
C. To convert digital data into a coded form
D. To amplify signals

2. How many input lines are required for a 4-to-2 Encoder?

A. 2
B. 3
C. 4
D. 8

SELF-ASSESSMENT QUESTIONS

3. What is the configuration of a Decoder?

A. One input, multiple outputs
B. Multiple inputs, one output
C. Multiple inputs, multiple outputs
D. One input, one output

4. In a 2-to-4 Encoder, if the input is 01, which output line will be active?

A. Output 0
B. Output 1
C. Output 2
D. Output 3

TERMINAL QUESTIONS

Short answer questions:

1. Draw the truth table of a 8:3 encoder.
2. Name any two practical applications where an encoder is commonly used.

Long answer questions:

1. Design a circuit diagram for a 8-to-3 line encoder. Include input and output labels in your diagram.
2. Design a circuit diagram for a 3-to-8 line decoder. Include input and output labels in your diagram.
3. Design a Full Adder circuit utilizing an appropriate decoder and OR gates.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer System Architecture by M. Moris Mano

2. Fundamentals of Digital Logic with Verilog HDL by Stephen Brown and ZvonkoVranesic

Sites and Web links:

1. https://www.prepbytes.com/blog/digital-electronics/difference-between-encoder-and-decoder/
2. https://www.geeksforgeeks.org/difference-between-encoder-and-decoder/

THANK YOU

(DEEMED TO BE UNIVERSITY)

Team – Digital Design & Computer Architecture