



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS  
2023/2024 ACADEMIC YEAR  
FIRST YEAR, SECOND SEMESTER**

**SCHOOL OF PURE, APPLIED AND HEALTH  
SCIENCES  
BACHELOR OF SCIENCE (COMPUTER  
SCIENCE)  
COURSE CODE: PHY 1263-1**

**COURSE TITLE: INTRODUCTION TO DIGITAL  
ELECTRONICS**

**DATE: 16/5/2024**

**TIME: 0830-1030 HRS**

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## **INSTRUCTIONS TO CANDIDATES**

- **Question One is Compulsory**
- **Answer Any Other Two**

**Question one [30 Marks]**

- (a) State three characteristics of numbering systems [3marks]
- (b) Draw a symbol of a 2-input AND gate and write its truth table. [4marks]
- (c) Convert  $19FDE_{16}$  to decimal number system [3marks]
- (d) Find the binary equivalent of  $374_8$ . [3marks]
- (e) Write a truth table of 2-input OR Gate. [3marks]
- (f) State two advantages of using Emitter Coupled Logic (ECL) over Transistor-Transistor Logic (TTL) in designing a digital circuit [2marks]
- (g) Draw a logic symbol of R-S flip flops and describe its characteristic table. [4marks]
- (h) Explain two differences between Boolean Algebra and Ordinary Algebra [4marks]
- (i) Draw the transistor logic circuit of an AND gate and write its truth table. [4marks]

**QUESTION TWO [20 MARKS]**

- (a) Draw a 2-input Multiplexer circuit and write its truth table. [5marks]
- (b) Design a logic circuit to implement a full subtractor circuit. [4marks]
- (c) Convert the following binary numbers to decimal numbers
  - i. 0011 [2marks]
  - ii. 11001 [2marks]
- (d) State the advantages of binary number systems over other systems used in digital circuit design. [5marks]
- (e) Find the octal equivalent of  $2F_{16}$ . [2marks]

**QUESTION THREE [20MARKS]**

- (a) A full adder circuit is an arithmetic circuit block used to add three bits to produce a SUM and a CARRY output, write a truth table for the full adder [5marks]

(b) Convert the following hexadecimal numbers to binary numbers

i. F329 [2marks]

ii. ABC [2marks]

(c) Write the corresponding truth table for the 8 to 3-bit priority encoder shown in figure 1 [4marks]

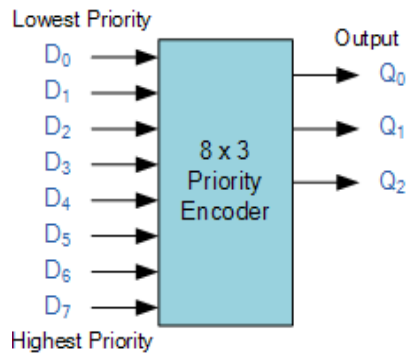


Figure 1: encoder block diagram.

(d) Suppose the cash room at a store has access restricted to certain employees, each of whom has a key, which produces a logic 1 at particular inputs to an unlocking circuit. Only the store manager (M) can enter alone. The assistant manager (A) and the cashier (C) also have access, but only when accompanied by each other, or by the store manager. Design a combinational logic circuit that will allow access by producing a logic 1 when the above conditions are met.

[5marks]

(e) Convert  $254_{10}$  to base 8. [2marks]

#### **QUESTION FOUR [20MARKS]**

(a) Express the decimal number +6 in 2's complement. [3marks]

(b) Convert each of the following decimal numbers to binary numbers

(i) 45.5 [2marks]

(ii) 0.375 [2marks]

(c) (i) Draw a logic circuit that would open the gate when two security switches are put on or when a switch in the living room is put on. [4marks]

(ii) Implement the circuit in c (i) using logic gates. [2marks]

(iii) Write a Boolean expression for c(ii) above. [2marks]

(d) Use De Morgan's law on the expression; [5marks]

**QUESTION FIVE [20MARKS]**

(a). Express  $(FFFF)_{16}$  to decimal number system. [2marks]

(b). Find the sum of the following binary numbers

i. + 1101 and - 1011 [2marks]

ii. +1110 and -1101 [2marks]

(c). Design a logic circuit to implement a full adder circuit. [5marks]

(d). Simplify the following Boolean expressions.

(i).  $A + AB$ . [2marks]

(ii)  $A + \bar{A}B$ . [2marks]

(e). Draw the transistor logic circuit of a NAND gate and write its truth table. [5marks]

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