

# MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

## FACULTY OF ENGINEERING, APPLIED SCIENCES AND TECHNOLOGY

DEPARTMENT: COMPUTER SCIENCE AND INFORMATION SYSTEMS

MODULE: DIGITAL ELECTRONICS

CODE: BCOS114

SESSIONAL EXAMINATIONS

JUNE-2024

DURATION: 3 HOURS

EXAMINER: MRS R CHITAKUNYE

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### INSTRUCTIONS

1. Answer *ALL questions* in Section A
2. Answer Any *three (3) questions* in Section B
3. Start a new question on a fresh page
4. Total marks 100

*Additional material(s): None*

## SECTION A

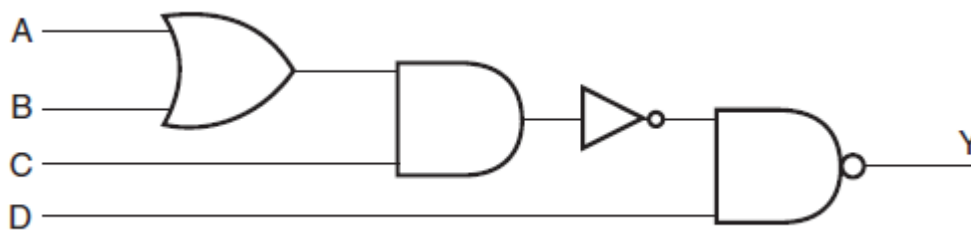
### Question 1

- a) Find the decimal equivalent of the following binary numbers expressed in the Signed Bit Magnitude format:
- 00001110;
  11110010. **[6 Marks]**
- b) Find the binary equivalent of  $(13.375)_{10}$ . **[4 Marks]**
- c) Consider the decimal numbers +37 and +18. Using the 2's complement of each number in 8-bit representation, perform addition of the 2 numbers and convert your answer to its decimal equivalent. **[5 Marks]**
- d) Perform the following addition operation in binary :  $(275.75)_{10} + (37.875)_{10}$  **[5 Marks]**
- e) Subtract  $(1110.011)_2$  from  $(11011.11)_2$  using basic rules of binary subtraction and verify the result by showing equivalent decimal subtraction. **[5 Marks]**

## SECTION B

### Question 2

- a) How would you hardware-implement a four-input OR gate using two-input OR gates only? Explain with a logic circuit diagram. **[6 Marks]**
- b) Prove the universality of a NAND gate by constructing a two-input AND gate from two-input NAND gates. **[4 Marks]**
- c) Draw the truth table of the logic circuit shown below: **[15 Marks]**

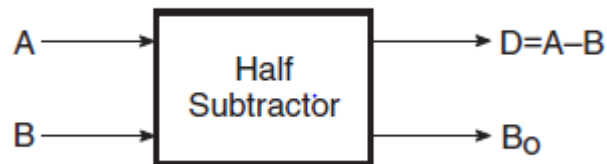


### Question 3

- a) Write the SOP canonical form and POS canonical form Boolean functions expressed by  $f(A, B, C) = \sum(1, 2, 4, 5, 6)$ . Clearly show the minterms and maxterms in the truth table. **[10 Marks]**
- b) Given the following function  $f(A, B, C) = \sum(0, 2, 4, 6)$ , show the truth table, draw the SOP Karnaugh map and give the minimal form. **[15 Marks]**

### Question 4

- a) Given the following block diagram of a half subtractor, construct its truth table and draw corresponding logic diagram. **[10 Marks]**



- b) Construct the truth table for all the numbers that can be displayed on a seven display. **[15 Marks]**

### Question 5

- a) Discuss the distinct characteristics of any four flip flops. **[20 Marks]**
- b) Define a counter, and describe any two types of counters. **[5 Marks]**

**END OF EXAMINATION**