70

(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER EXAMINATIONS
FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: BCS 211

COURSE TITLE: DIGITAL ELECTRONICS

DATE: 05/12/2022 **TIME:** 08:00-10:00AM

INSTRUCTIONS TO CANDIDATES

- Answer **Questions ONE** and **ANY OTHER TWO.**

TIME: 2 Hours

QUESTION ONE 30 MARKS (COMPULSORY)

a. Find the hex sum of $(93)_{16} + (DE)_{16}$. **4 Marks**

b. Perform 2's complement subtraction of $(7)_{10} - (11)_{10}$. **3 Marks**

c. Evaluate $x = \overline{A}.B + C(\overline{A.D})$ using the convention A = True and B = False. **4 Marks**

d. Simplify the Boolean expression F = C(B + C)(A + B + C). **6 Marks**

e. Simplify the following expression into sum of products using Karnaugh map

$F(A,B,C,D) = \sum(1,3,4,5,6,7,9,12,13)$ **6 Marks**

f. Draw the circuit diagram of a Master-slave J-K flip-flop using NAND gates. What is race around condition? How is it eliminated in a Master-slave J-K flip-flop? **7 Marks**

QUESTION TWO 20 MARKS

a.

b. Determine the binary numbers represented by the following decimal numbers.
(i) 25.5 (ii) 10.625 (iiii) 0.6875 **6 Marks**

c. Simplify the given expression to its Sum of Products (SOP) form. Draw the logic circuit for the simplified SOP function $Y = (A+B)(A+\overline{AB})C + \overline{A}(B+\overline{C}) + \overline{A}B + ABC$ **(5)**

d. Prove the following Boolean identities.
(i) $XY + YZ + \overline{Y}Z = XY + Z$
(ii) $A.B + \overline{A}.B + \overline{A}.\overline{B} = \overline{A} + B$ **4 Marks**

Prove the following equations using the Boolean algebraic theorems:
(i) $A + \overline{A}.B + A.\overline{B} = A + B$ (ii) $\overline{A}BC + A\overline{B}C + AB\overline{C} + ABC = AB + BC + AC$

5 Marks

QUESTION THREE 20 MARKS

a.

A combinational circuit has 3 inputs A, B, C and output F. F is true for following input combinations

A is False, B is True
A is False, C is True
A, B, C are False
A, B, C are True

(i) Write the Truth table for F. Use the convention True=1 and False = 0.
(ii) Write the simplified expression for F in SOP form.
(iii) Write the simplified expression for F in POS form.
(iv) Draw logic circuit using minimum number of 2-input NAND gates. **6 Marks**

b.

Prove the following Boolean identities using the laws of Boolean algebra:

(i) $(A+B)(A+C)=A+BC$

(ii) $ABC+A\bar{B}C+AB\bar{C}=A(B+C)$ **4 Marks**

c. The Karnaugh map for a SOP function is given below in Fig.1. Determine the simplified SOP Boolean expression. **5 Marks**

AB \ CD	00	01	11	10
00	1	1		1
01		1		
11				
10	1	1		1

Fig.1

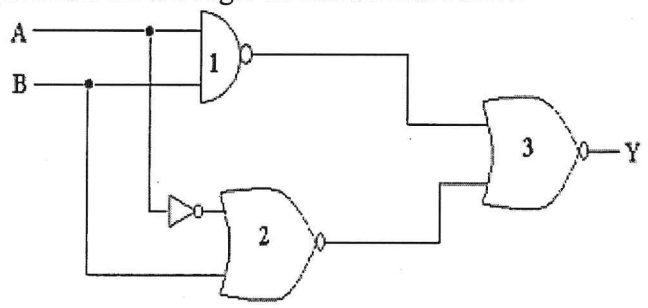
d.

e. What are universal gates? Construct a logic circuit using NAND gates only for the expression x = A. (B + C). **5 Marks**

QUESTION FOUR 20 MARKS

a. What is a half-adder? Explain a half-adder with the help of truth-table and logic diagram. **5 Marks**

b. Find the Boolean expression for the logic circuit shown below. **3 Marks**



c.

d. With relevant logic diagram and truth table explain the working of a two input EX-OR gate. **6 Marks**

e. With the help of clocked JK flip flops and waveforms, explain the working of a three bit binary ripple counter. Write truth table for clock transitions. **6 Marks**

QUESTION FIVE 20 MARKS

a. Distinguish between ROM, PROM, EPROM, EEPROM **6 Marks**

b. State and prove Demorgan's laws. **4 Marks**

c. Simplify the expressions using Boolean postulates **6 Marks**

(i) $XY+XYZ+X(Y+XY)$

(ii) $Y = (A + B)(A + C)(B + C)$

(iii) $XY + XZ + XYZ(XY + Z)$

d. Write the expression for Boolean function $F(A, B, C) = \sum m(1,4,5,6,7)$ in standard POS form. **4 Marks**