



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 106: INTRODUCTION TO ELECTRONICS

DATE: 25/2/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS

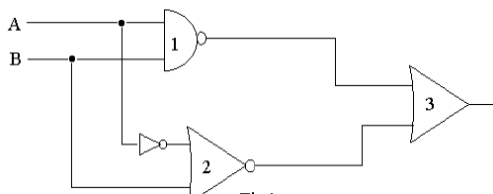
Answer question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

- a) Draw the logic circuit equivalent of the expression below (4 marks)

$$X = (\bar{A} \cdot B \cdot \bar{C}) + (\bar{A} \cdot \bar{B} \cdot C) + (A \cdot B \cdot \bar{C})$$

- b) Using diagrams, explain how covalent bonds are achieved in a silicon crystal. (4 marks)
- c) Explain any FIVE laws of Boolean algebra (5 marks)
- d) Capacitances of 1 μF , 3 μF , 5 μF and 6 μF are connected in parallel to a direct voltage supply of 100V. Determine (a) the equivalent circuit capacitance, (b) the total charge and (c) the charge on each capacitor. (8 marks)
- e) Find the Boolean expression for logic circuit shown in the Figure below and reduce it using Boolean algebra. (4 marks)



- f) Simplify the expressions using Boolean postulates

$$Y = (A + B)(\bar{A} + C)(B + C)$$

(5 marks)

QUESTION TWO (20 MARKS)

- a) Prove the following identities using Boolean algebra:
$$(A + B)(A + \overline{AB})C + \overline{A}(B + \overline{C}) + \overline{AB} + ABC = C(A + B) + \overline{A}(B + \overline{C}).$$
 (5 marks)
- b) With the aid of a truth table of S-R and D-flip-flops explain how to convert the given S-R flip-flop to a D-flip-flop. (5 marks)
- c) With the help of a truth-table and a logic diagram, Explain a half-adder (10 marks)

QUESTION THREE (20 MARKS)

- a) Minimize the following logic function
$$F(A, B, C, D) = \prod M(1, 2, 3, 8, 9, 10, 11, 14) \cdot d(7, 15)$$
 (10 marks)
- b) Draw the logic circuit of a 3 line to 8-line decoder (5 marks)
- c) Explain the working of the 3 line to 8-line decoder drawn in (a) above (5 marks)

QUESTION FOUR (20 MARKS)

- a) Distinguish between combinational logic circuits and sequential logic circuits. (4 marks)
- b) With the help of a suitable diagram, explain how to convert a JK flip-flop to T type flip-flop. (6 marks)
- c) Simplify the following logic expression (5 marks)
$$F = \overline{A}BC + \overline{A}BC + \overline{A}BC + \overline{A}BC + \overline{A}BC.$$
- d) Draw the logic diagram for the given expression in b) above (5 marks)

QUESTION FIVE (20 MARKS)

- a) Outline the applications of Shift Registers. (4 marks)
- b) Draw a 4 bit parallel adder. (6 marks)
- c) Explain the working of the block diagram for a 4 bit parallel adder in b) above (6 marks)
- d) Design a 4 to 1 Multiplexer by using the three variable function given by (10 marks)

$$F(A, B, C) = \sum m(1, 3, 5, 6)$$