



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MATHEMATICS AND COMPUTER SCIENCE)

SCO 106: ELECTRONICS

DATE: 16/6/2021

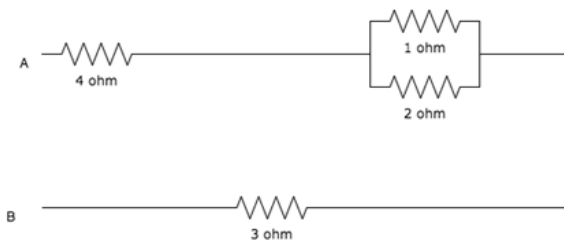
TIME: 2.00-4.00 PM

INSTRUCTIONS

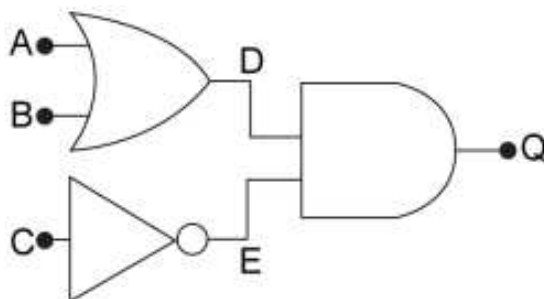
Answer question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

- Explain how the conductivity in pure semiconductors varies with temperature. (2 marks)
- A current of 2A flows for 10 hours through a 100 ohm resistor. What is the energy consumed by the resistor. (2 marks)
- Convert the decimal number equivalent of binary number 10011101 (2 marks)
- Convert 768 octal numbers to binary number equivalent (2 marks)
- Explain any FIVE laws of Boolean algebra (5 marks)
- Calculate the total resistance between the points A and B. (5 marks)



- Create a truth table for the following logic gate circuit. (4 marks)



- h) Simplify the expressions using Boolean postulates

$$Y = (A + B)(\bar{A} + C)(B + C) \quad (4 \text{ marks})$$

- i) Using a diagram, explain how covalent bonds are achieved in a silicon crystal. (4 marks)

QUESTION TWO (20 MARKS)

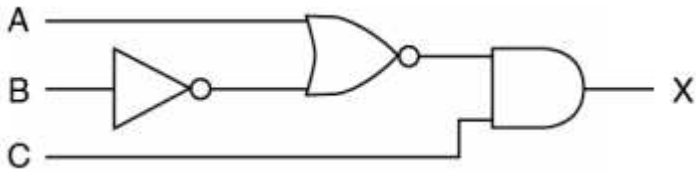
- a) Define A binary adder (2 marks)
- b) Consider the two binary numbers $A = 1011$ and $B = 0011$. Using a truth table for a four bit adder, show that their sum $S = 1110$ (8 marks)
- c) Using a well labeled table explain, the Encoder having eight inputs (one for each of the octal digits) and three outputs that generate the corresponding binary number. (10 marks)

QUESTION THREE (20 MARKS)

- a) Consider the conditions and answer the questions that follow; If chimney is not blocked and the house is cold and the pilot light is lit, then open the main fuel valve to start boiler, given
- b = chimney blocked
c = house is cold
p = pilot light lit
v = open fuel valve
- i. Make a truth table for this system. (2 marks)
- ii. Write the logic equation in SOP form. (2 marks)
- iii. Realize the circuit using AND-OR gates. (2 marks)
- b) Prove the following identities using Boolean algebra:
 $(A + B)(A + \bar{A}B)C + \bar{A}(B + \bar{C}) + \bar{A}B + ABC = C(A + B) + \bar{A}(B + \bar{C})$. (5 marks)
- c) Consider the following logic components;
- i. Draw the truth-table for a half-adder (2 marks)
- ii. Construct a logic diagram for a half-adder (2 marks)
- d) With 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)

QUESTION FOUR (20 MARKS)

- a) Using the logic circuit below, fill in the truth table shown for output X (8 marks)



Inputs			Output
A	B	C	X
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- b) Draw the logic circuit of a 3 line to 8 line decoder and explain its working. (8 marks)
- c) State four advantages of CMOS inverters (4 marks)

QUESTION FIVE (20 MARKS)

- a) Simplify $Y = f(A, B, C, D) = \sum m (1, 2, 3, 6, 8, 9, 10, 12, 13, 14)$. (6 marks)
- b) List four different types of counters other than Asynchronous and Synchronous counters (4 marks)
- c) Using a well labeled diagram, explain A 4-bit synchronous counter using JK flip-flops (10 marks)