



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 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: ELECTRONICS

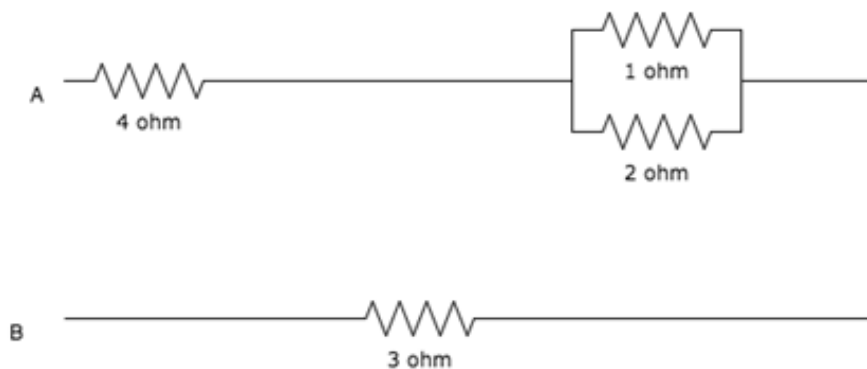
DATE: 2/2/2022

TIME: 8.30-10.30 AM

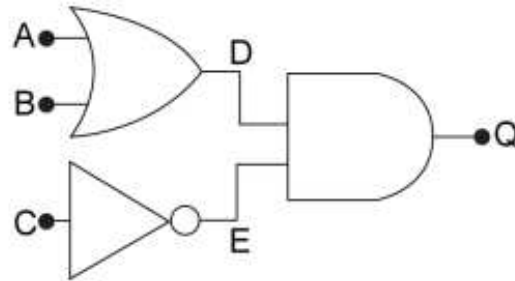
INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (30 MARKS)

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



- g) 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)

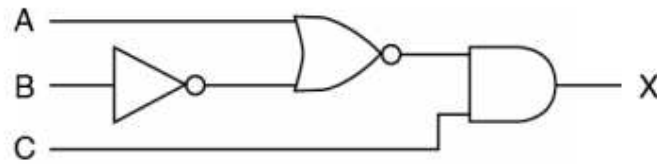
- a) Define A binary adder (2 marks)
- b) Consider the two binary numbers $A = 1011$ and $B = 0011$. Using a truth table for a four bit adder, show that their sum $S = 1110$ (8 marks)
- c) Using a well labeled table explain, the Encoder having eight inputs (one for each of the octal digits) and three 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
- Draw a truth table for this system. (2 marks)
 - Write the logic equation in SOP form. (2 marks)
 - Design the circuit using AND-OR gates. (2 marks)
- b) Prove the following identities using Boolean algebra:
- $$(A + B)(A + \bar{A}B)C + \bar{A}(B + \bar{C}) + \bar{A}B + ABC = C(A + B) + \bar{A}(B + \bar{C}). \quad (5 \text{ marks})$$
- c) Describe the applications of logic gates in electronic industry. (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)