



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 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: INTRODUCTION TO ELECTRONICS

DATE: 10/12/2020

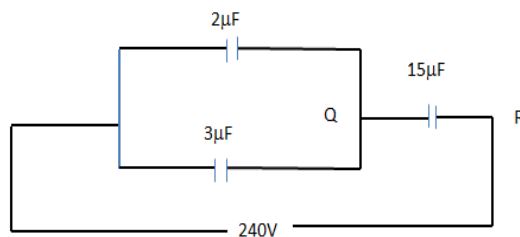
TIME: 8:30 – 10:30 AM

INSTRUCTIONS

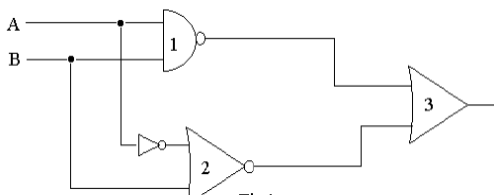
Answer question ONE and any other TWO questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Differentiate between the following quantities
- i. Resistivity and Resistance (2 marks)
 - ii. Potential Difference and EMF (2 marks)
- b) With the aid of a well labeled graph, explain the VI characteristics of a PN junction (5 marks)
- c) Explain any FIVE laws of Boolean algebra (5 marks)
- d) calculate, the voltage across QR, and the charge on each capacitor. (5 marks)



- e) Find the Boolean expression for logic circuit shown in Figure below and reduce it using Boolean algebra. (4 marks)



- f) Simplify the expressions using Boolean postulates

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

(4 marks)

- g) Highlight three types of diodes used in electronics industry (3 marks)

QUESTION TWO (20 MARKS)

- a) Define a register. (2 marks)
- b) List the various types of shift registers (3 marks)
- c) Construct and explain the working of a shift register from S-R flip-flops. (7 marks)
- d) Explain how a shift register can be used as a ring counter giving the wave forms at the output of the Flip-flops. (4 marks)
- e) Outline the applications of Shift Registers. (4 marks)

QUESTION THREE (20 MARKS)

- a) A staircase light is controlled by two switches one at the top of the stairs and another at the bottom of stairs
- Make a truth table for this system.
 - Write the logic equation in SOP form.
 - Realize the circuit using AND-OR gates. (6 marks)
- b) Prove the following identities using Boolean algebra:

$$(A + B)(A + \overline{A}B)C + \overline{A}(B + \overline{C}) + \overline{A}B + ABC = C(A + B) + \overline{A}(B + \overline{C}).$$
 (5 marks)
- c) With the help of truth-table and logic diagram, construct a half-adder (4 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) Minimize the following logic function

$$F(A, B, C, D) = \prod M(1, 2, 3, 8, 9, 10, 11, 14) \cdot d(7, 15)$$
 (8 marks)
- 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 inverter (4 marks)

QUESTION FIVE (20 MARKS)

- a) Simplify and draw the logic diagram for the given expression (6 marks)

$$F = \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + A\overline{B}\overline{C} + ABC.$$
- b) Design a 4 to 1 Multiplexer by using the three variable function given by

$$F(A, B, C) = \sum m(1, 3, 5, 6)$$
 (7 marks)
- c) Draw and explain block diagram for 4 bit parallel adder. (7 marks)