MACHAKOS UNIVERSITY

University Examinations for 2018/2019

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: 2/5/2019 **TIME: 2.00-4.00 PM**

INSTRUCTIONS

Answer **question ONE and any other TWO questions.**

QUESTION ONE (30 MARKS)

a) Differentiate between the following quantities

i. Resistivity and Resistance

ii. Potential Difference and emf (2 marks)

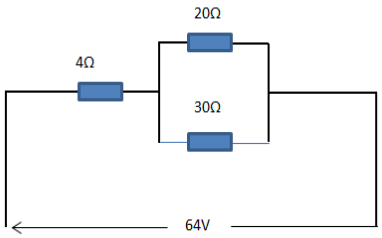
b) With the aid of a well labelled graph, explain the VI characteristics of a PN junction (5 marks)

c) Explain the working of a PNP transistor (3 marks)

d) Name and explain any four diodes and their applications in the electronic industry (2 marks)

i. Calculate the current flowing in the 30Ω resistor shown in the Figure below.

ii. What additional value of resistance would have to be placed in parallel with the 20Ω and 30Ωresistors to change the supply current to 8A, the supply voltage remaining constant? (5 marks)

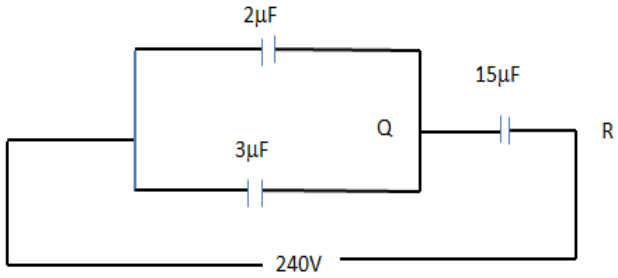


e) For the arrangement shown in the Figure below, find

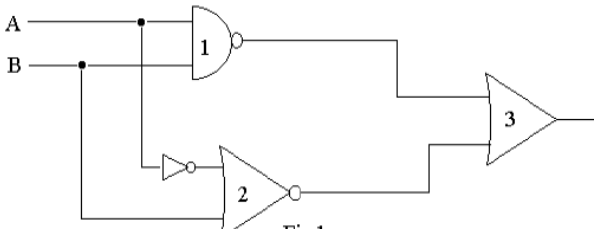
i. the equivalent capacitance of the circuit,

ii. the voltage across *QR*,

iii. the charge on each capacitor. (5 marks)



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



g) Simplify the expressions using Boolean postulates

$Y = (A + B)(\overline{A} + C)(B + C)$ (4 marks)

QUESTION TWO (20 MARKS)

a) Define a register. (2 marks)

b) What are 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

i. Make a truth table for this system.

ii. Write the logic equation in SOP form.

iii. Realize the circuit using AND-OR gates. (5 marks)

b) Prove the following identities using Boolean algebra:

$$(A+B)(A+\overline{AB})C+\overline{A}(B+\overline{C})+\overline{A}B+ABC=C(A+B)+\overline{A}(B+\overline{C}).$$ (5 marks)

c) With the help of truth-table and logic diagram, Explain a half-adder (5 marks)

d) with aid of a the 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) Minimise the following logic function

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

b) *Draw the logic circuit of a 3 line to 8 line decoder and explain its working.* (8 marks)

c) State the advantages of CMOS inverter (4 marks)

QUESTION FIVE (20 MARKS)

a) Simplify and draw the logic diagram for the given expression

$$F=\overline{ABC}+\overline{AB}C+\overline{A}B\overline{C}+A\overline{BC}+A\overline{B}C.$$ (6 marks)

b) *Design a 4 to 1 Multiplexer by using the three variable function given by*

$$F(A,B,C)=\sum m(1,3,5,6)$$ (8 marks)

c) *Draw and explain block diagram for 4 bit parallel adder.* (8 marks)