MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION DIPLOMA IN ELECTRICAL ENGINEERING

EED205: DIGITAL ELECTRONICS I

DATE: 20/12/2017 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

This paper consists of FIVE Questions. Answer Question ONE and ANY OTHER TWO questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

a) With the aid of clear working and representations, Show

i) The decimal equivalent of hex number 1A53 (3 marks)

ii) the decimal equivalent of the hexadecimal number 'A0' (3 marks)

iii) the 2's complement of the number 1101101 (3 marks)

b) Explain the gates required to build a half adder (4 marks)

c) With the aid logic gates, show the equivalence of Demorgan's first theorem (4 marks)

d) What is the device which converts BCD to Seven Segment (3 marks)

e) Work out the arithmetic of the following numbers

i. 01100111 + 01010011 (3 marks)

ii. 00010110 – 00010101 (3 marks)

iii. Multiply (1101)2 by (110)2. (4 marks)

QUESTION TWO (20 MARKS)

a) Prove the following equations using the Boolean algebraic theorems: (10 marks)

(i) $A + \overline{A}.B + A.\overline{B} = A + B$ (ii) $\overline{A}BC + A\overline{B}C + AB\overline{C} + ABC = AB + BC + AC$

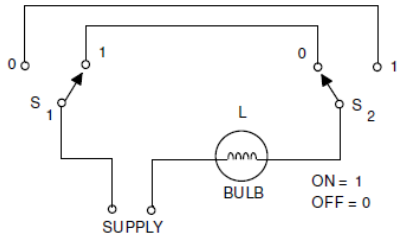
b) What is a demultiplexer? Discuss the differences between a demultiplexer and a decoder. (4 marks)

c) Draw the logic circuit of a 3 line to 8 line decoder and explain its working. (6 marks)

QUESTION THREE (20 MARKS)

a) Explain the differences between combinational logic circuits and sequential logic circuits. (6 marks)

b) A staircase light is controlled by two switches one at the top of the stairs and another at the bottom of stairs. The circuit diagram of the system is shown in figure



(i) Make a truth table for this system.
(ii) Write the logic equation in SOP form.
(iii) Realize the circuit using AND-OR gates. (10 marks)

c) Using diagrams, explain universal gates (4 marks)

QUESTION FOUR (20 MARKS)

a) Construct a logic circuit using NAND gates only for the expression x = A . (B + C). (8 marks)

b) Subtract 175 from 267 using XS-3 code. (3 marks)

c) Convert the binary 1001 to the Gray code. (3 marks)

d) By using appropriate symbols and truth tables, differentiate X-OR and NOR gates (6 marks)

QUESTION FIVE (20 MARKS)

a) Using examples, explain the difference between ASCII code and EBCDIC code (6 marks)

b) With the aid of illustrations, Explain any ten axioms and laws of boolean algebra:- (10 marks)

c) Subtract (10000)2 from (11010)2 using 1's complement. (4 marks)