



# MACHAKOS UNIVERSITY

University Examinations for 2018/2019

**SCHOOL OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING  
SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR  
DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING**

**EED205: DIGITAL ELECTRONICS I**

**DATE: 24/9/2019**

**TIME: 2:00 – 4:00 PM**

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## INSTRUCTIONS

1. You should have an examination booklet for this examination
2. Question **ONE** is compulsory
3. Answer **ANY** other **TWO** questions.
4. Maximum marks for each part of a question are as shown.

1. a) (i) State FOUR examples of numbering systems.

(4 marks)

(ii) With the aid of diagrams, distinguish between a half adder and a full adder logic circuits.

(7 marks)

b) (i) Convert the following numbers as instructed:

- $743_8$  to binary;
- $FFF2D_{16}$  to decimal.

(4 marks)

(ii) Perform the following binary arithmetic operations:

- $11111 + 1011 + 10001$
- $10101 \times 1111$ .
- $110010 \div 10100$
- $1100 - 1110$  using  $1^s$  complement

(9 marks)

c) Simplify the logic expression;

$$F = A.C + A.\bar{C} + \bar{A}.B + B.\bar{B} \text{ using Boolean algebra.}$$

(6 marks)

2. a) (i) Using a K – Map, simplify the expression;

$$F = \bar{A}.B.\bar{C}.\bar{D} + \bar{A}.\bar{B}.C.D + A.\bar{B}.\bar{C}.D + \bar{A}.\bar{B}.\bar{C}.D + \bar{A}.B.C.\bar{D} + A.B.\bar{C}.\bar{D}$$

(6 marks)

(ii) Using the 8421 BCD arithmetic, perform the following operation of decimal numbers

$$243 + 317$$

( 4 marks )

(iii) Express the following XS – 3 number in decimal;

$$1011011010010$$

( 2 marks )

(iv) Perform the following conversions;

- $1011101011$  binary to gray code

- 011001111000 BCD to XS – 3

( 2 marks )

b) (i) With the aid of symbols, name any six logic gates used in digital systems.

(6 marks )

3. a) (i) State Demorgan's Theorems

(2 marks)

(ii) With the aid of a truth table, prove the Demorgan's theorems.

(6 marks)

b) Perform the following conversions;

- $(1111\ 1111\ 1111\ 1111)_2$  into hexadecimal
- $(11001)_2$  into decimal
- $(1010111.011)_2$  into octal

(6 marks)

c) Simplify using K map the following Boolean expression;

$$f(A,B,C,D) = \sum(0,1,2,3,4,5,6,7,8,9,12,13)$$

(6 marks)

4 a) Draw a lamp switch circuit analogy for;

- AND gate
- OR gate
- NAND gate
- NOT gate
- NOR gate

( 10 marks )

b) For each of the above lamp switch circuits in question number 4 (a), determine the;

(i) Truth Table

(ii) Logic Boolean Expression.

( 10 marks )

5. a) With the aid of a truth table, verify that  $M.(D + F) = M.D + M.F$

( 4 marks )

b) Design a full adder logic circuit using a 8-to-1 multiplexer.

( 6 marks )

c) Use Quine MC Clusky method to minimize the function given by;

$$f(A, B, C, D) = \sum(0,5,6,9,10,13,14,15,7)$$

(10 marks)