## TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

## UNIVERSITY EXAMINATION

DIPLOMA IN TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING

## EEE 2102: DIGITAL ELECTRONICS I

## END OF SEMESTER EXAMINATION

## SERIES: AUGUST 2019

## TIME: 2 HOURS

### DATE: Pick Date Select Month Pick Year

**Instructions to Candidates**
You should have the following for this examination
*-Answer Booklet, examination pass and student ID*
This paper consists of FIVE questions. Attempt any **THREE** Questions
Each question 20 marks
**Use of electronics calculator Prohibited**
**Do not write on the question paper.**

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## QUESTION 1

(a) Describe with the help of suitable diagrams the difference between a digital and an analogue signal.

**(4  marks)**

(b) Perform the following conversions

(i)     $1101.11_2$ to decimal
(ii)    $AB_{16}$ to decimal
(iii)   $250_{10}$ to BCD

**(9 marks)**

(c) Describe a Half-adder and with the help of a suitable truth table, implement its logic circuit. Using suitable block diagram, illustrate how a Full-adder can be implemented from a Half-adder hence draw the truth table of a full-adder.

**(7 marks)**

## QUESTION 2

(a) Differentiate between Sequential and Combinational logic circuit.     **(2 marks)**

(b) Define a flip-flop. Draw the logic circuit and Symbol of an R-S flip and briefly describe its operation with the help of a Truth-table **(6 marks)**

(c) Using Boolean algebra, simplify the following logic expressions:

(i) $F = \overline{AC + \overline{BC}} + \overline{B + C} + AB$

(ii) $F = \overline{C(\bar{A} + \bar{B} + C)} + \overline{A + B + C}$

**(12 marks)**

## QUESTION 3

(a) Perform the following binary numbers subtraction using 2's

(i) 101101 - 10010
(ii) 11011 - 110101

**(8 marks)**

(b) Access to a building having four tenants is controlled by three switches A, B and C with each switch being either ON or OFF. The four tenants David, Jane, Ann and William can only have access to the building when their switches are in the following states:
David: A=OFF, B=ON, C=OFF
Jane: A=ON, B=OFF, C=ON
Ann: A = ON, B =ON, C= ON
William: A=ON, B=ON, C=OFF.
Draw the truth table for this system and using Karnaugh mapping, simplify its logic expression hence design a simplified logic circuit that will give the three tenants access to the building. **(12 marks)**

## QUESTION 4

(a) Define a Multiplexer. With the help of a suitable Truth table and logic circuit describe the operation of a 4-to-1 Multiplexer.

**(12 marks)**
(b) Illustrate how an OR gate can be implemented using NAND gates only. **( 4 marks)**
(c) Logic function is given by: $f(A, B)=\sum 1, 3$. Show that $f(A, B)=\prod 0, 2$. **(4 marks)**

## QUESTION 5

(a) State FOUR advantages digital circuit over analogue circuit. **(4 marks)**
(b) Describe the following terms with respect to logic gates
   (i) Fan-in
   (ii) Propagation delay time
   (iii) Fan-out

**(6 marks)**
(c) Describe FIVE major steps involved in the design of a combinational logic circuit **(10 marks)**