



# MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

## FACULTY OF ENGINEERING, APPLIED SCIENCES AND TECHNOLOGY

DEPARTMENT: COMPUTER SCIENCE AND INFORMATION SYSTEMS

MODULE: FUNDAMENTALS OF DIGITAL ELECTRONICS

CODE: BCOS 114

SESSIONAL EXAMINATIONS  
DECEMBER 2023

DURATION: 3 HOURS

EXAMINER: MR A.C MUZENDA

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### INSTRUCTIONS

1. Answer **all** questions in **Section A**
2. Answer **any three(3)** questions in **Section B**
3. Start a new question on a fresh page
4. Total marks 100

## SECTION A

### Question 1 (40 marks)

- a. What is the hexadecimal value equivalent to 0101001101101101? Show working. [4]
- b. With the aid of a logic circuit diagram, briefly explain the operations of a J-K flip flop, also include a truth table. [12]
- c. Use an example to describe real world application of any one logic gate of your choice. [4]
- e. Imagining that you are in charge of technology at any organization of your choosing:  
Describe three justifiable problems that digital electronics can be used to address. [12]
- f. Given the following truth table:

W	X	Y	Z
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

- i. Obtain the simplified functions in sum of products. [4]
- ii. Obtain the simplified functions in product of sums [4]

## SECTION B (60 marks)

### Question 2

- a) For prototype, the most popular controllers are Arduino, PIC, and Raspberry Pi. Use examples to give enough information about the circumstances that each of these is most appropriate in order to generate practical answers. [12]
- b) Use examples to compare above-mentioned controller boards. [6]
- c) Identify two (2) most common electronic components used in embedded systems with controllers. [2]

### Question 3

- a. Explain a demultiplexer and develop the timing diagram for a demultiplexer with specified data and data selection inputs. [10]
- b. i. Convert  $366_8$  to binary. [3]  
ii. Convert  $B5E_{16}$  to binary. [3]  
iii. Convert  $766_8$  to hexadecimal. [4]

### Question 4

In most modern embedded systems, there is need for analogue signal input and processing.

Use examples to explain how such digital systems:

- a) accept analogue signals [2]  
b) process analogue signals [2]  
c) Identify four (4) devices that can be used to input analogue signal from real world environment. [4]  
d) Make use of diagrams and examples in outlining the differences between analogue signal and digital signal. [6]  
e) How does a clock differ from a Timer in microcontrollers? [6]

### Question 5

- a. Explain parallel counters. Give the circuit representation of 4-bit synchronous counter and explain its working. [6]
- b. Simplify the Boolean function  $F(w,x,y,z)=w'x'z'+w'yz+w'xy$  using don't care conditions  $d=w'xy'z+wyz+wx'z'$  in (i) sum of products and (ii) product of sums using Karnaugh map. [10]
- c. Distinguish between a gate and a circuit. [4]