AFRICA UNIVERSITY
A United Methodist-Related Institution

"Investing in Africa's Future"

COLLEGE OF ENGINEERING AND APPLIED SCIENCES

CSC 1104 FUNDAMENTALS OF DIGITAL ELECTRONICS

END OF FIRST SEMESTER EXAMINATIONS

NOVEMBER 2025

LECTURER: MR ALLAN C MUZENDA

TIME: 3 HOURS

INSTRUCTIONS

Answer *all* questions in Section **A** and any *three* from Section **B**

Start **each** question on a new page in your answer booklet

Credit will be awarded for logical, systematic and neat presentations

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SECTION A

Question 1

a. What is the hexadecimal value equivalent to 0101001101101101? Show working.[4 marks]

b. With the aid of a logic circuit diagram, explain the operations of a J-K flip flop, also include a truth table. [12 marks]

c. Use an example to describe a real-world application of any one logic gate of your choice. [4 marks]

e. Imagining that you are in charge of technology at any organization of your choice: Describe three justifiable problems that digital electronics can be used to address. [12 marks]

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 the sum of products; and [4 marks]

ii. Obtain the simplified functions in the product of sums. [4 marks]

SECTION B

Question 2

a) The most popular controllers for prototypes are Arduino, PIC, and Raspberry Pi. Use examples to give enough information about the circumstances that each of these is most appropriate. [12 marks]

b) Use examples to compare the above-mentioned controller boards. [6 marks]

c) Identify two (2) most common electronic components used in embedded systems with controllers. [2 marks]

Question 3

a. Explain a demultiplexer and develop the timing diagram for a demultiplexer with specified data and data selection inputs. [10 marks]

b. i. Convert 366_8 to binary. [3 marks]

ii. Convert $B5E_{16}$ to binary. [3 marks]

iii. Convert 766_8 to hexadecimal. [4 marks]

Question 4

a. In most modern embedded systems, there is a need for analogue signal input and processing. Use examples to explain how such digital systems:

i. accept analogue signals; and [2 marks]

ii. process analogue signals [2 marks]

b. Identify four (4) devices that can be used to input analogue signal from real world environment. [4 marks]

c. Use diagrams and examples to illustrate the differences between analogue signals and digital signals [6 marks]

d. How does a clock differ from a timer in microcontrollers? [6 marks]

Question 5

a. Explain parallel counters. Give the circuit representation of 4-bit synchronous counter and explain how it works. [6 marks]

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 marks]

c. Distinguish between a gate and a circuit. [4 marks]

END OF EXAMINATION