

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE AWARD OF DIPLOMA IN COMPUTER  
SCIENCE**

**COSC 0211: DIGITAL ELECTRONICS****STREAMS: BSC. COMPUTER SCIENCE****TIME: 2 HOURS****DAY/DATE: THURSDAY 13/04/2023****11.30 A.M. –1.30 P.M.****Instructions**

- Answer question **ONE** and **TWO** other questions
- Do not write anything on the question paper
- This is a **closed book exam**, no reference materials are allowed in the examination room
- There will be **NO** use of mobile phones or any other unauthorized materials
- Write your answers legibly and use your time wisely.

**QUESTION ONE [30 MARKS] COMPULSORY**

- a. Define the following terms
- i. Universal gate (2 marks)
  - ii. Logic gate (2 marks)
  - iii. Cache memory (2 marks)
- b. State the De Morgan's theorem (2 marks)
- c. Explain the **TWO** types of sequential circuits (4 marks)
- d. Use Boolean laws to simplify the Boolean expression below (4 marks)
- $$\bar{A}(A + B) + (B + AA)(A + \bar{B})$$
- e. With the aid of a truth table and a logic diagram, discuss the operation of a 4 to 2 encoder (4 marks)
- f. Discuss **TWO** types of Random Access Memory (4 marks)

- g. State and explain TWO principal Input/output techniques (4 marks)
- h. With the aid of a diagram, discuss combinational logic circuits (2 marks)

**SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

**QUESTION TWO [20 MARKS]**

- a. Show that  $(X + Y).(X + \bar{Y}) = X$  using:
  - i. Boolean laws (4 marks)
  - ii. Truth table (4 marks)
- b. With the help of a Truth table, draw the circuit diagram and explain the working operation of a half adder (8 marks)
- c. With the aid of a well labelled diagram, discuss **TWO** clock triggering mechanisms used in sequential circuits (4 marks)

**QUESTION THREE [20 MARKS]**

- a. Distinguish between a latch and a flip-flop (2 marks)
- b. Below is a truth table of a combination circuit with 3-inputs X, Y, Z and two outputs P and Q, use it to answer the following questions.

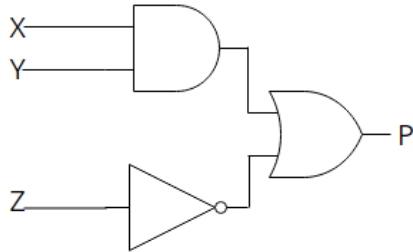
| INPUTS |   |   | OUTPUTS |   |
|--------|---|---|---------|---|
| X      | Y | Z | P       | Q |
| 0      | 0 | 0 | 1       | 0 |
| 0      | 0 | 1 | 1       | 1 |
| 0      | 1 | 0 | 1       | 0 |
| 0      | 1 | 1 | 0       | 1 |
| 1      | 0 | 0 | 0       | 0 |
| 1      | 0 | 1 | 0       | 0 |
| 1      | 1 | 0 | 0       | 1 |
| 1      | 1 | 1 | 0       | 1 |

- i. Deduce the Boolean expression of output P in POS form (3 marks)
- ii. Deduce the Boolean expression of output Q in SOP form (2 marks)
- iii. Use K-map to minimize the POS equation in (i) above (5 marks)
- c. With the aid of a well labelled diagram, discuss the internal components of a digital computers (8 marks)

**QUESTION FOUR [20 MARKS]**

a) Discuss TWO differences between Sum of Products and Product of Sum (4 marks)

a) Below is a combinational logic circuit, use it to answer the questions that follow



i. Deduce the output P (2 marks)

ii. Draw the truth table of the Boolean expression in (i) above (4 marks)

iii. Draw the timing diagram of the circuit (5 marks)

iv. Write a VHDL program to implement the above circuit (5 marks)

**QUESTION FIVE [20 MARKS]**

a. With the aid of a well labelled logic diagram, discuss the operation of a NOR SR latch (8 marks)

b. State and explain the FOUR main movements of data through a shift register (8 marks)

c. Citing an example of a storage device in each case, discuss the following access methods to storage devices

i. Associative access (2 marks)

ii. Sequential access (2 marks)