



MAASAI MARA UNIVERSITY

**REGULAR UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
THIRD YEAR SECOND SEMESTER**

**SCHOOL OF PURE APPLIED AND HEALTH
SCIENCES
BACHELOR OF SCIENCE (PHYSICS)**

COURSE CODE: PHY 3227-1

COURSE TITLE: DIGITAL ELECTRONICS

DATE: 21/4/2023

TIME: 0830-1030 HRS

INSTRUCTIONS TO CANDIDATES

- Answer **Question ONE** in and any other **TWO** in Section B.
- Use of sketch diagrams where necessary and brief illustrations are encouraged.
- Read the instructions on the answer booklet keenly and adhere to them.

*There are 3 Printed Pages, **PLEASE TURN OVER***

SECTION A

QUESTION ONE (10 MARKS)

- a) Prove the following Boolean identity: $(\bar{A}+\bar{B})(A+B)(A+C)=AC$. **(5mks)**
b) Study the logic circuit in figure 1 below and answer questions that follow;

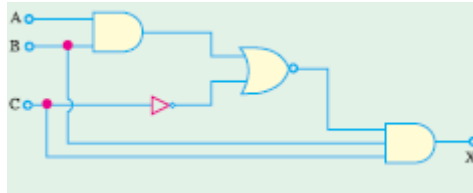


Figure 1.

- i) Determine the Boolean expression for the logic circuit. **(1mk)**
ii) Simplify the Boolean expression using Boolean laws and De Morgan's theorem. **(2mks)**
iii) Redraw the Logic circuit using the simplified logic expression. **(2mks)**
- c) Perform the following conversions
- (i) $(965.125)_{10}$ to octal **(2mks)**
(ii) $(8765.025)_{10}$ to hexadecimal **(2mks)**
(iii) $(6754.05)_8$ to decimal. **(2mks)**
- d) Differentiate between the following terms
- i) Multiplexer and demultiplexer **(1mk)**
ii) Encoder and decoder **(1mk)**
iii) Half adder and full adder **(1mk)**
iv) Half subtractor and full subtractor **(1mk)**
- e) Design the logic circuit of a half adder using NAND gates only and draw its truth table. **(5mks)**
f) Draw the circuit diagram of a Diode transistor logic **(3mks)**
g) State **TWO** advantages that binary number systems have over other number systems used in digital circuit design. **(2mks)**

SECTION B

QUESTION TWO (10 MARKS)

- a) Draw a logic symbol of R-S flip flops and describe its characteristic table. **(4mks)**
- b) With suitable examples, distinguish between combinational logic circuit and sequential logic circuit. **(4mks)**
- c) Find the decimal equivalent of the Hexadecimal number 3BC7.46. **(2mks)**

QUESTION THREE (10 MARKS)

- a) Do the following conversions:
 - (i) $(110011010110111110.101)_2$ to hexadecimal **(2mks)**
 - (ii) $(2AB6E7.5D4)_{16}$ to binary **(2mks)**
- b) Using K-map simplify following Boolean function of three variables. **(6mks)**

$$F(A, B, C) = \sum (m_0, m_1, m_5, m_6, m_7).$$

QUESTION FOUR (10 MARKS)

- a) Differentiate between asynchronous and synchronous counter. **(2mks)**
- b) List any two Universal gates **(2mks)**
- c) Draw the logic circuit diagram of a master-slave JK flip-flop using a NOR latch. **(6mks)**

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