MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
THIRD YEAR SECOND SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTHY SCIENCES
BACHELOR OF SCIENCE

COURSE CODE: PHY 3227-1

COURSE TITLE: DIGITAL ELECTRONICS

DATE: 31/5/ 2024 **TIME: 1430-1630HRS**

INSTRUCTIONS TO CANDIDATES

- **Question One is Compulsory (20 Marks)**
- **Answer Any Other Two (15 Marks Each)**

*This paper consists of **three** printed pages. Please turn over.*

Question one [20 Marks]

(a) Simplify the following expression [3marks]

$$\overline{\overline{A} + \overline{BC}} + \overline{\overline{A}\overline{B}}$$

(b) With suitable examples, distinguish between combinational logic circuit and sequential logic circuit. [2marks]

(c) State De Morgan's theorems [2marks]

(d) Using the theorems of Boolean algebra, prove the following identity. [4marks]

$$(A+B)\cdot(A+\overline{A}.\overline{B})\cdot C + \overline{\overline{A}\cdot(B+\overline{C})} + \overline{A}\cdot B + A\cdot B\cdot C = A+B+C$$

(e) Find the binary equivalent of 374_8. [3marks]

(f) Draw a truth table of a 2-to-4 line decoder [2marks]

(g) Write a truth table for Boolean expression for this 1-to-4 Demultiplexer with outputs A to D and data select lines a, b. [2marks]

(h) Distinguish between digital to analogue conversion and analogue to digital conversion [2marks]

QUESTION TWO [15 MARKS]

(a) (i) Draw a logic circuit that would open the gate when two security switches are put on or when a switch in the living room is put on. [3marks]

(ii) Implement the circuit in c (i) using logic gates. [3marks]

(iii) Write Boolean expression for c(ii) above. [1marks]

(b) Discuss two applications of combinatorial networks [4marks]

(c) Draw a logic symbol of R-S flip flops and describe its characteristic table. [4marks]

QUESTION THREE [15MARKS]

(a) The following Boolean Algebra expression is given as:

$$Q = \overline{A}(\overline{BC} + BC + B\overline{C}) + ABC$$

(i) Convert this logical equation into an equivalent sum of product term [3marks]

(ii) Use a truth table to show all the possible combinations of input conditions that will produces a "1" output. [3marks]

(iii) Draw a logic gate diagram for the sum of product expression. [4marks]

(b) What is a Complementary Metal Oxide Semiconductor? Explain one advantages of CMOS [2marks]

(c) Discuss three differences between Boolean Algebra and Ordinary Algebra [3marks]

QUESTION FOUR [15MARKS]

(a) Draw the transistor logic circuit of a NAND gate and write its truth table [4marks]

(b) State three advantages that binary number systems have over other number systems used in digital circuit design. [3marks]

(c) Find the octal equivalent of $2F_{16}$. [2marks]

(d) Draw a symbol of a 2-input Ex-OR gate and write its truth [3marks]

(e) Define the term visual display. State any two examples of visual displays [3marks]

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