MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
FIRST YEAR FIRST SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTHY SCIENCES
MASTERS OF SCIENCE(PHYSICS)

COURSE CODE: PHY 8208

COURSE TITLE: Digital Electronics

DATE: APRIL 2023 **TIME: 2HOURS**

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **Two** questions
2. Use of sketches is recommended to answer questions

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

Question one [30 Marks]

a. Find the decimal equivalent of the octal number 7126.45. [3marks]

b. Convert the following decimal numbers into binary.(i) 35 (ii) 127 [3marks]

c. What is the range of unsigned and signed decimal numbers as well as binary numbers that can be represented in a 10 bit system? [3marks]

d. Find the binary equivalent of the following gray code numbers [6marks]

(i) 101010101 (ii) 110010101 (iii) 1001010111

e. A seven bit Hamming code received at the receiver is 1110100. Is there any error in the received code? If yes, what is the correct code? [2marks]

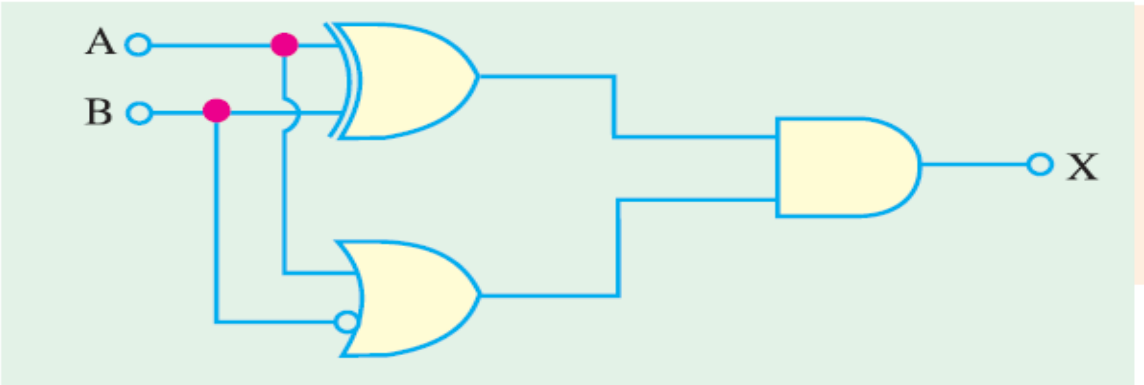
f. Express the following Boolean function in PS form. [6marks]

$$F = A \cdot \overline{B} + \overline{B} \cdot C$$

g. Draw the K – maps for the following Boolean function of three variables [3marks]

$$F_1(A,B,C) = \sum (m_1, m_3, m_5, m_6, m_7)$$

h. Determine the output X of the logic circuit shown and Simplify the output expression using Boolean algebra and theorems . Redraw the logic circuit using the reduced expression [4marks]



QUESTION TWO [20 MARKS]

a. Using the theorems of Boolean algebra, reduce the following functions [10marks]

(i) $F_1(a,b,c) = \prod(0,1,4,5,7)$

(ii) $F_2(a,b,c,d) = \sum(3,5,7,11,13,14,15)$

b. Implement the following Boolean expression using a minimum of 3-input Nand gates[10marks]

$$f(A, B, C, D) = \Sigma(1, 2, 3, 4, 7, 9, 10, 12)$$

QUESTION THREE [20MARKS]

a. Minimize the following function using K – map [10 marks]

$$X(A,B,C,D) = \sum(0,1,2,5,8,10,11,14,15)$$

b. Implement realized part (a) with AND, OR & NOT logic gates [10marks]

QUESTION FOUR [20MARKS]

Design the combinational logic circuit using NAND gates only for the following word statement.

The insurance policy will be issued to the applicant, if he is:

(i) a married female of 22 years or more, or

(ii) a female under 22 years, or

(iii) a married male under 22 years and who has not been involved in a car accident, or

(iv) a married male who has been involved in a car accident, or

(v) a married male of 22 years old or above and who has not been involved in a car accident.

Design the circuit which can issue the insurance policy to the applicant.