MAASAI MARA UNIVERSITY

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

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

COURSE CODE: PHY 8208

COURSE TITLE: Digital Electronics

DATE: DEC 2023 TIME: 2HOURS

INSTRUCTIONS TO CANDIDATES

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

Question one [30 Marks]

a. 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]

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

    (i) 101010101   (ii) 110010101   (iii) 1001010101111

c. 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]

d. Convert the hexadecimal number 4AC7.4B in to its equivalent octal number. [4marks]

e. Find the decimal equivalent of the binary number 11011001.0101 [3marks]

f. Find the decimal equivalent of the Hexadecimal number 3BC7.46 [3marks]

g. Using the theorems of Boolean algebra, reduce the following functions [6marks]

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

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

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 [3marks]
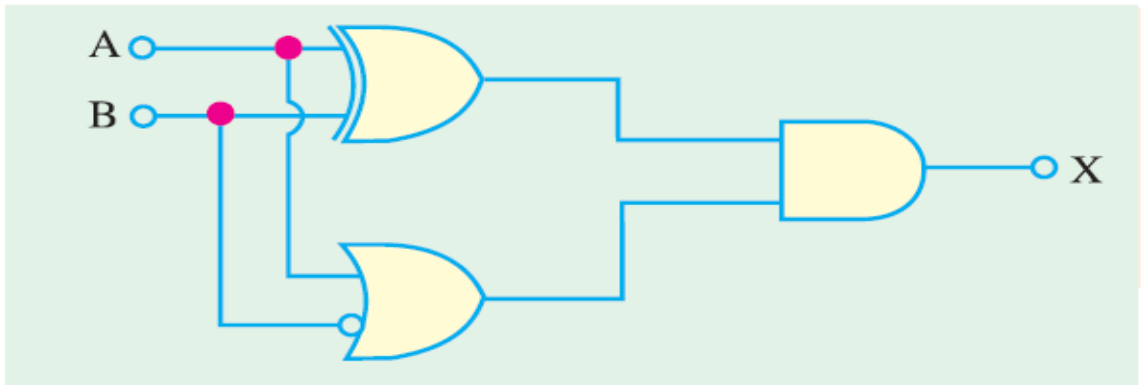
QUESTION TWO [20 MARKS]

a. Using 16 X 4 PROM, implement the following functions of 4 variables. [10marks]

$$Y_0(A, B, C, D) = \sum (0, 1, 4, 5, 8, 9, 10, 14, 15)$$
$$Y_1(A, B, C, D) = \sum (2, 3, 4, 9, 10, 11, 13, 15)$$
$$Y_2(A, B, C, D) = \sum (4, 5, 7, 8, 10, 12, 15)$$
$$Y_3(A, B, C, D) = \sum (5, 6, 7, 10, 13)$$

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

QUESTION FOUR [20MARKS]

There are five board of directors (A, B, C, D, E) of a company. The board of director A owns 10% shares, B owns 30% shares, C owns 20% shares, D owns 25% shares and E 15% shares of the total shares. For the adoption of the particular policy to be passed in the board's meeting more than 66% should vote in favour of the policy. The weightage to the votes depend upon the percentage shares owned by the directors. In the board's room each director has a switch which he turns ON if votes in favour of policy. Design a switching circuit to ring a bell if policy is accepted in the board's meeting. Only the NAND gates should be used to realize the circuit.