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: 31/1/2024 **TIME: 0830-1030 HRS**

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. 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) 100101011 11

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]

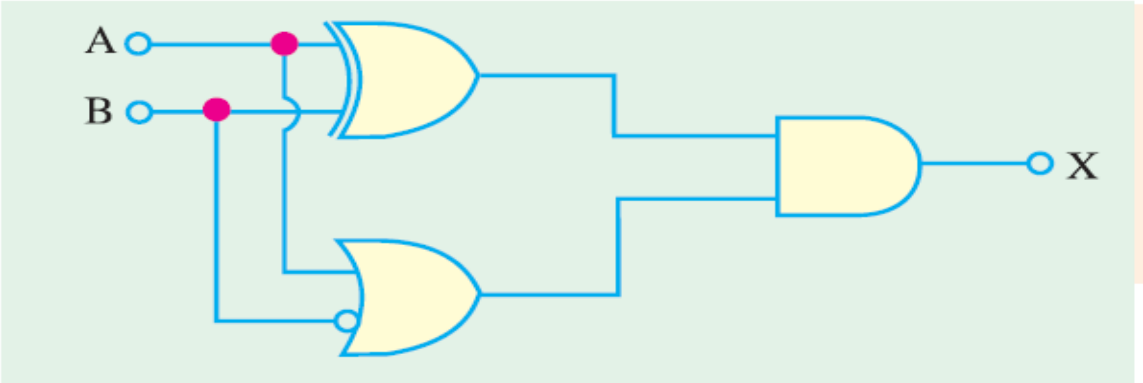
f. Find the decimal equivalent of the Hexadecimal number 3BC7.46 [3marks]

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.

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