(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY SPECIAL/SUPPLEMENTARY EXAMINATIONS

2022/2023 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: CSC122

COURSE TITLE: DIGITAL ELECTRONICS

DATE: 10/08/2023   **TIME: 8.00AM-10AM**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO (2)
QUESTIONS

QUESTION ONE (COMPULSORY) [30 MARKS]

a) Evaluate the following:
   i) Convert to hex: 11001001.1011_2 [2marks]

   ii) Convert to decimal: 110101.01_2 [2marks]

   iii) Convert to binary: 98.25_{10} [2marks]

b) Convert $(95)_{10}$ into its binary equivalent value and give its Binary Coded Decimal (BCD) code.   [5marks]

c) Consider the following logic units and give the graphical symbol and truth table for each   [10marks]

   (i)   OR
   (ii)   AND
   (iii)   NOT
   (iv)   NAND
   (v)   NOR

d) i) Write the abbreviation ASCII in full   [3marks]
   ii) Briefly describe ASCII Character Code   [6marks]

QUESTION TWO [20MARKS]

a) Design a logic circuit with three inputs A, B, C and one output F such that F=1 only when a majority of the inputs is equal to 1.   [6marks]

b) Simplify the following Boolean expression using De Morgan's theorem and/or Boolean algebra.
   i)

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

                                               [5marks]

   ii)

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

                                               [3marks]

c) Convert the following expression to standard product-of-sums forms:

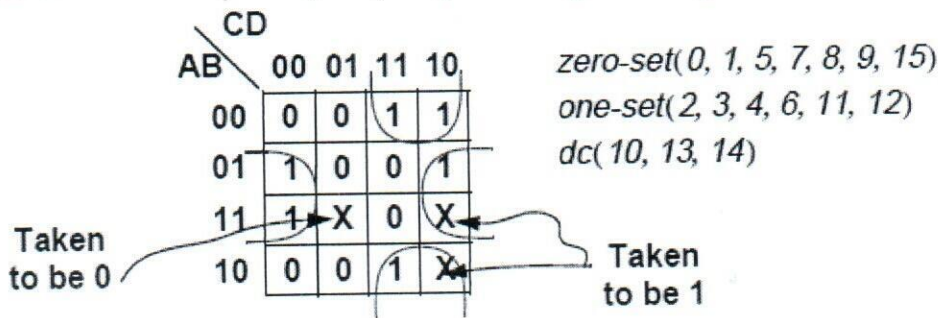$$(A + C)(AD + A\overline{D}) + AC + C$$

[6marks]

QUESTION THREE [20MARKS]

a) Simplify the following Boolean expression as far as possible, using the postulates and theorems of Boolean algebra. DO NOT use a Karnaugh map except possibly to check your work. You do not have to justify each step by stating the theorem or postulate used, but you must show each step in your simplification. [10marks]

$$f(w, x, y) = w\overline{x}y + wx + w\overline{y} + wx\overline{y}$$

b) Find the Sum of Products (SOP) simplification for the following Karnaugh map[4marks]

CD

	AB	00	01	11	10
00		0	0	1	1
01		1	0	0	1
11		1	X	0	X
10		0	0	1	X

Taken to be 0

Taken to be 1

zero-set(0, 1, 5, 7, 8, 9, 15)
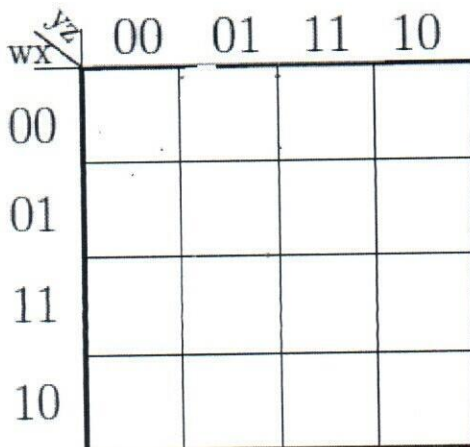one-set(2, 3, 4, 6, 11, 12)
dc(10, 13, 14)

c) i) What is a universal gate
    ii)Prove that NOR is a universal gate   [6marks]

QUESTION FOUR [20 MARKS]

a) For Y = f(w, x, y, z) = QM(0, 1, 3, 5, 13)
    i) Fully label and complete the Karnaugh map below with Y as given above. Then derive a minimized POS expression for Y = f(w, x, y, z). [10marks]

WX \ YZ	00	01	11	10
00				
01				
11				
10				

ii) Simplify the following Boolean function using K-map   [7marks]

$$F(A, B, C) = \sum m(0, 1, 4, 6, 7) = \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + A\overline{B}\overline{C} + AB\overline{C} + ABC$$

b) Write the Boolean expression equivalent to the following logic circuit. Do not simplify
                                                                    [3marks]
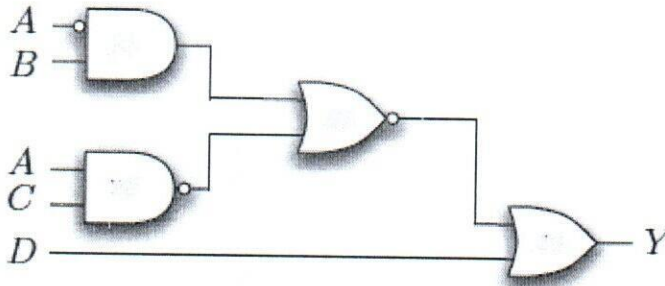
QUESTION FIVE [20 MARKS]

a) Draw the truth table for a 3-input NOR gate   [3marks]

b) What would the output pulse train shown in Fig. **1** look like if
   i) Input **B** was 0?   [2marks]
   ii) Input **B** was 1?   [4marks]
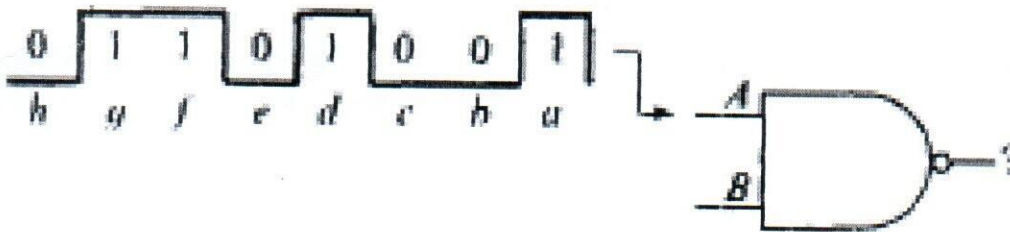

Figure 1

iii) Explain any two types of number systems   [6marks]
iv) Perform the following calculations: [5marks]
   (i) $1101_2 + 1011_2 = 11000$

   (ii) $ABC_{16} + 20F16 = CCB$