(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

YEAR ONE SEMESTER TWO

FOR THE DEGREE OF (COMPUTER SCIENCE)

COURSE CODE: CSC122

COURSE TITLE: DIGITAL ELECTRONICS II

DATE: 11/5/2022 **TIME: 09.00 A.M – 11.00 A.M**

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 state its Binary Coded Decimal (BCD) code. [5marks]

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

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

c) 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:

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

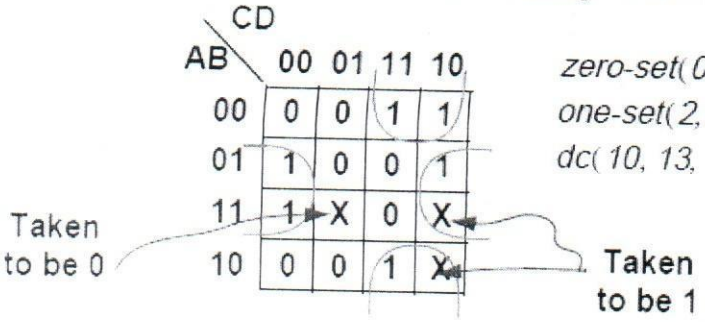
[6marks]

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]



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)

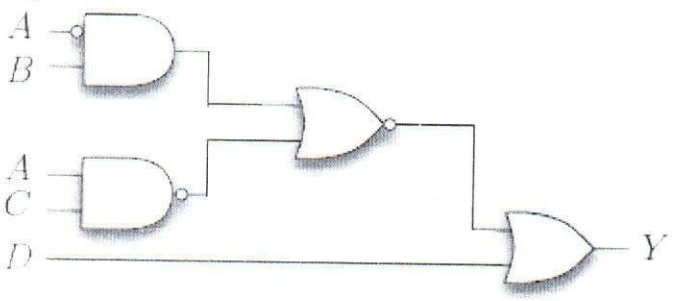
i) Fully label and complete the Karnaugh map below with Y as given above. Then derive a minimized POS expression for Y = f(w, x, y, z). [10marks]

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]

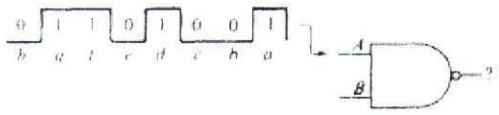


Figure 1

c) Explain any two types of number systems [6marks]

d) Perform the following calculations: [5marks]

(i) $1101_2+1011_2=11000$

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