(KNOWLEDGE FOR DEVELOPMENT)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS

YEAR ONE SEMESTER TWO EXAMINATIONS

FOR THE BACHELORS OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: CSC 122

COURSE TITLE: DIGITAL ELECTRONICS I

DATE: 01/02/2021 TIME: 2.00 P.M – 4.00 P.M

INSTRUCTIONS TO CANDIDATES

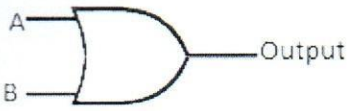
ANSWER QUESTION ONE AND ANY OTHER TWO (2) QUESTIONS

QUESTION ONE [COMPUSORY] [30MARKS]

a) Explain what is meant by radix (or base) of a number system. [2 Marks]

b) Explain what is meant by LSB and MSB as used with number systems. [2 Marks]

c) The diagram below shows the symbol for one type of logic gate.



i) Name the logic gate [1 Mark]

ii) Draw the truth table for this logic gate. [3 Marks]

d) Simplify the following Boolean expressions using De Morgan's theorem and/or Boolean algebra

$A\overline{B}C + BC + A\overline{C}$ [6 Marks]

e) Copy and complete the truth table for each of the logic gate [6 Marks]

Inputs		Truth Table Outputs for 2-input Logic Gates					
B	A	AND	NAND	OR	NOR	EX-OR	EX-NOR
0	0						
0	1						
1	0						
1	1						

i) Complete the output column Q in the truth table for this logic circuit[4Marks]

A	B	S	Q
0	0	0	
0	1	0	
1	0	0	
1	1	0	
0	0	1	
0	1	1	
1	0	1	
1	1	1	

f) Convert the following expression to standard sum-of-products form [2 Marks]

$$F = B + B[AC + (B + \overline{C})A]$$

g) Simplify the following Boolean equation, in sum-of-products form, using Karnaugh map. Give the logic implementation of the simplified function in SOP form using suitable gates.

$f = AB\overline{C}\,\overline{D} + B\overline{C}D + \overline{A}BCD + ABD + \overline{A}\,\overline{B}C\overline{D} + A\overline{B}C\overline{D}$ [8 Marks]

QUESTION TWO [20MARKS]

a) Using NAND gates only show how the following gates are obtained [5 Marks]

(i) NOT
(ii) OR
(iii) AND

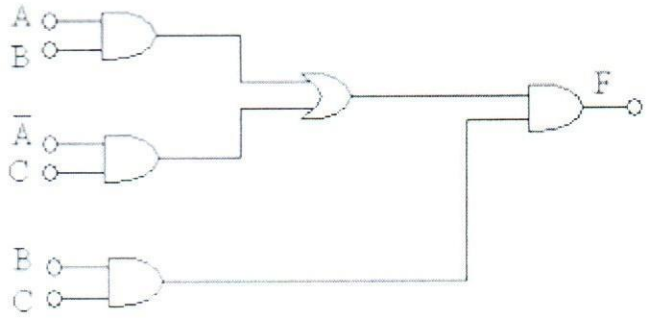
b) 0, 1, 3 and X are the independent digits/symbols of an arbitrary number system. What is the radix/base of this number system? List the first 16 numbers in this number system.[4Marks]

c) For the logic expression $Z = \overline{A}B + A\overline{B}$

i) Obtain the truth table. [3Marks]
ii) Realize this operation using AND, OR, NOT gates [4Marks]
iii) Implement using only NAND gates [4Marks]

QUESTION THREE [20 MARKS]

a) Consider the logic circuit below. Prepare the truth table for the output 'F' and write the standard SOP expression for F. [10Marks]



b) Find the octal equivalent of $(73.75)_{10}$ [6Marks]

c) Map the standard SOP expression onto K-map [4Marks]

$$AB\overline{C}D + \overline{A}B\overline{C}D + A\overline{B}\overline{C}D + \overline{A}\overline{B}\overline{C}D$$

QUESTION FOUR [20 MARKS]

a) For the function below, draw its truth-table hence minimize the function using K-map. Draw the logic diagram using gates of your choice to realize the minimized function.

$f(A,B,C) = AB\overline{C} + ABC + A\overline{B}C$ [10Marks]

b) Simplify the following Boolean equation, in product-of- sum form, using Karnaugh map.

$f = \overline{A}B + AB\overline{C}\,\overline{D} + BC + A\overline{B}D$ [10Marks]

QUESTION FIVE [20 MARKS]

a) Convert $\mathbf{57.4801}_{10}$ to its binary equivalent to 14-bit accuracy. [6Marks]

b) Simplify the following expression using Boolean algebra technique

$Z = AB + A(B + C) + B(B + C)$ [4Marks]

c) Using the truth table 1 below

i) Write the Boolean expression

ii) Transfer the input-output specification given for F to 3 variable Karnaugh map

iii) Draw the logic circuit represented by the simplified expression using AND, NOT and OR gates. [10mks]

Table 1: Truth table

Inputs			Output
A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0