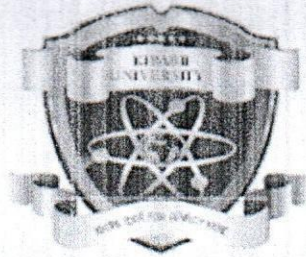


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(KNOWLEDGE FOR DEVELOPMENT)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS

YEAR ONE SEMESTER TWO EXAMINATIONS

**FOR THE DEGREE OF
(COMPUTER SCIENCE)**

COURSE CODE: CSC 122.

COURSE TITLE: DIGITAL ELECTRONICS I

DATE: 01 / 10 / 2021 TIME: 11.00 A.M – 01.00 P.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO (2) QUESTIONS

QUESTION ONE (COMPULSORY) [30 MARKS]

- a) State three classifications of materials. On what factor does this classification depend? [4 marks]
- b) State two most important semiconductors used in the electronics industry. [2 marks]
- c) Sketch a graph showing the variation of temperature with each of the categories of materials. [4 marks]
- d) State four characteristics of integrated circuits used to compare their performance [4 marks]
- e) Briefly differentiate between the following logic devices
 - (i) OR and AND gates [2 marks]
 - (ii) Buffer and NOT gates [2 marks]
 - (iii) NAND and NOR gates [2 marks]
- f) Copy and complete the truth table 1 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						

- g) State the functional difference between a multiplexer and a demultiplexer [2 marks]
- h) Convert 101011101_2 to octal [2 marks]

QUESTION TWO [20 MARKS]

a) Using the truth table 2 below

[2 marks]

i) Write the Boolean expression

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

[3 marks]

iii) Draw the logic circuit represented by the simplified expression using AND, NOT and OR

gates.

[5 marks]

Table 2

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

- b) With relevant examples, state the following
- i) De Morgan's theorems. [2 marks]
 - ii) Associativity theorem [2 marks]
- c) Draw the truth table for a 3-input NOR gate [3 marks]
- d) Convert the following expression to standard sum-of-products form [3 marks]

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

QUESTION THREE [20 MARKS]

- a) Explain how the 2's complement representation can be used to describe signed binary numbers, using 4-bit words as an example. [3 marks]
- b) Convert the following expression to standard sum-of-products form and draw the circuit diagram using basic logic gates assuming the complemented variables are available.

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

[10 marks]

- c) Construct a truth table for the following problem

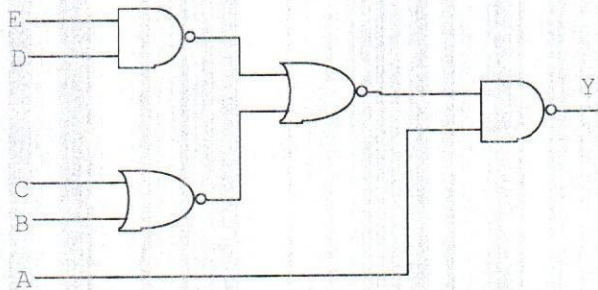
- (i) There are four buttons A, B, C, D [1 mark]
- (ii) The output is on if any two buttons are pushed. [1 mark]
- (iii) If C is pressed the output will always turn on. [1 mark]
- (iv) Develop a Boolean expression from the truth table. [4 marks]

QUESTION FOUR [20 MARKS]

a) Perform the following binary addition, subtraction and multiplication. Show all your work for full credit. Assume the numbers are all unsigned binary. [6 marks]

(i) 11101.011 + 11111.111 <u>10011.111</u>	(ii) 11100001 - <u>10010111</u>	(iii) 1001.101 X <u>10.001</u>
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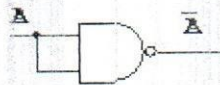
b) Derive the logic equation for the following circuit. Show all intermediate terms as both complemented and uncomplemented. Do not simplify. [5 marks]



c) Use De Morgan's theorem to simplify Boolean equation obtained in b) above. [6 marks]

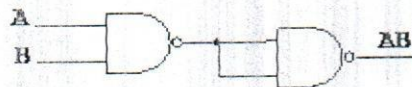
d) State which basic logic gate is represented by the following NAND gate [3 marks]

i)



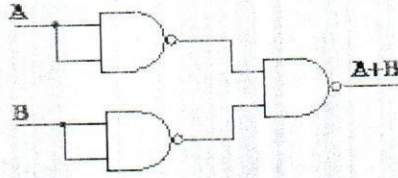
[1 mark]

ii)



[1 mark]

iii)



[1 mark]

QUESTION FIVE [20 MARKS]

a) With the aid of relevant diagrams differentiate between the following terms:

(i) Analogue representation and digital representation

[4 marks]

b) Simplify the equation below with De Morgan's theorem to find the MSOP.

[6 marks]

$$Y = \overline{(A + C)(A * B)(A * \overline{B} * C)}$$

c) Draw a circuit represented by the following Boolean equation using only 2 NOR gates.

[10 marks]

$$Y = \overline{(\overline{W} + X)(\overline{W} + \overline{Z})}$$