



**JARAMOGI OGINGA ODONGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL
OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
(SCIENCE)**

MAIN

COURSE CODE: SPB 9320

COURSE TITLE: DIGITAL ELECTRONICS 1

EXAM VENUE: STREAM: (BED SCI)

DATE: EXAM SESSION:

TIME: 2:00HRS

- 1. Instructions: Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A

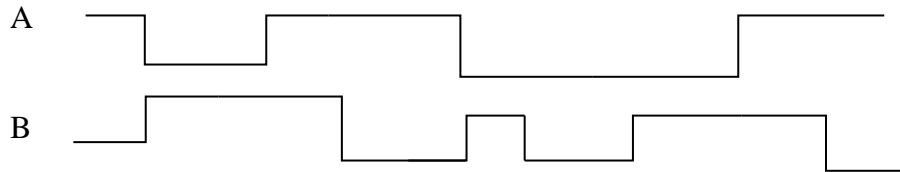
QUESTION ONE

a. An arbitrary number system of has its basic digits represented by

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, G, H, J, K, L

- i) What is the radix of this number system **(1 mark)**
- ii) Write down the numbers that lie in the 50th to 59th position in this number system. **(2 marks)**
- iii) Convert the number (CAB.KA) of this number system to decimal number system **(3 marks)**

b. For a two-input NAND gate, the inputs A and B are represented in square waveform diagram as shown below. Plot the corresponding waveform diagram of the OUTPUT Fon the same scale. **(3 marks)**



F

- c. Define a universal gate and name the two types of universal gates known to you **(3 marks)**
- d. A combinational circuit diagram has its logic equation given as

$$Y = \overline{[AB + \bar{A}B\bar{C}]} \left[\overline{(\bar{A}B\bar{C})} (A + \bar{B} + C) \right]$$

- i. Draw the combinational logic circuit diagram **(4 marks)**
- ii. Construct its truth table **(4 marks)**
- iii. From the truth table above, Deduce the logic operation of the circuit **(2 marks)**

e. The following map is a Karnaugh map for a Boolean equation

	AB	AB	AB	AB
CD	0	1	1	0
CD	0	1	1	0
CD	1	1	1	1
CD	0	1	1	0

- i) Write down the non-simplified Boolean equation that was used to map out the Karnaugh map above **(2 marks)**

- ii) Write down the simplified form of the equation as per the Karnaugh map above. **(3marks)**
- iii) Draw the logic gate combination that implements the simplified version above **(3 marks)**

SECTION B

QUESTION TWO

a. Perform the following Number Systems conversions (15 marks)

- i) $(1027.015625)_{10}$ to Binary
- ii) $(100056.03125)_{10}$ to Hexadecimal
- iii) $(BABE.C001)_{16}$ to Octal
- iv) $(101001011100.1001)_{BCD}$ to Excess-3 code

b. A livestock farmer has the following number of different stock in his farm:

Cows: $BEAD_{16}$
 Goats 777634_8
 Sheep 11100101011101_2

Express each type of livestock as a percentage of the total number of livestock. (5 marks)

QUESTION 3

a. Write down the complement and the dual of the following Boolean expression

$$Y = [A\bar{B}(C + BD) + \bar{A}\bar{B}]C \quad (3 \text{ marks})$$

b. Simplify the following logic equations using the Boolean theorems

i. $Y = AB + A(B + C) + B(B + C)$ (2 marks)

ii. $Y = ABC + ABC\bar{C} + A\bar{B}C + A\bar{B}\bar{C} + \bar{A}BC + \bar{A}B\bar{C} + \bar{A}\bar{B}C + \bar{A}\bar{B}\bar{C}$ (3 marks)

iii. $Y = \bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$ (3 marks)

c. Simplify the following logic functions using De Morgans theorems

i) $Q = \overline{A + B\bar{C}} + D(\overline{E + \bar{F}})$ (3 marks)

ii) $R = \overline{\overline{A\bar{B}C} + \overline{ACD} + B\bar{C}}$ (3 marks)

d. Simplify the following logic functions using Karnaugh maps technique

i) $Y = \overline{A\bar{B}C\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{ABC\bar{D}} + \overline{ABC\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{ABC\bar{D}} + \overline{ABC\bar{D}}$

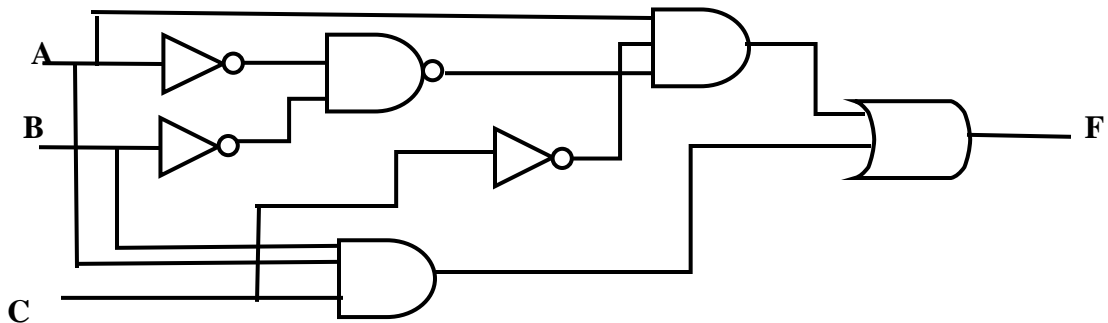
ii) $Y = \overline{A\bar{B}C\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{A\bar{B}C\bar{D}} + \overline{ABC\bar{D}} + \overline{ABC\bar{D}}$ (3 marks)

QUESTION 4

- a. Draw the circuit diagrams of the following bipolar devices
 - i. DL, ii. RTL, iii. DTL **(6 marks)**
- b. Draw the schematic circuit diagram of the standard transistor transistor logic and explain how it works **(8 marks)**
- c. Briefly describe the following classes of MOS families
 - i. PMOS ii. NMOS iii. CMOS **(6 marks)**

QUESTION 5

- a. For the logic circuit diagram below, write down the logic function, construct its truth table hence deduce its logic operation (12 marks)



- a. For a student to graduate from JOOUST he must satisfy ALL of the first three conditions AND ANY one of condition iv and v.
 - i. He must pass all the course units
 - ii. He must clear the fee balance
 - iii. He must undergo an industrial attachment or write down a research paper
 - iv. He must not appear before the disciplinary committee for any indiscipline case
 - v. Her must be either a Muslim or a Christian.

Design a logic circuit diagram to implement the above set of rules (8 marks)