KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
SECOND/THIRD YEAR, FIRST/SECOND SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE
KCS 206 – DIGITAL LOGIC AND DESIGN

Date: 09TH AUGUST 2023
Time: 8:30AM – 10:30AM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS
QUESTION ONE (30 MARKS)

a) Express the following Boolean expression in canonical form sum of products notation and draw a truth table. (6 Marks)

$$f(a,b,c) = \bar{a}.\bar{b}c + \bar{a}.b.c. + \bar{a}.\bar{b}.\bar{c} + \bar{a}.b.\bar{c}$$

b) A computer manipulates information in digital form or more precisely, binary form. Explain (4 Marks)

c) Draw a system diagram and generate a truth table for the function, $f(x,y,z) = x.y + y.z + \bar{z}.y$. (6 Marks)

d) Explain difference between one's complement and two's complement as used in subtraction operations in digital computers. (4 Marks)

e) Write the 2's complement for each of the following 5-bit binary numbers.

   i) 01001

   ii) 01011

   iii) 00111 (6 Marks)

f) Define the following (4 Marks)

   i) Latches

   ii) Flip-flops

QUESTION TWO (20 MARKS)

a) State and explain any three advantages of digital system over analog systems. (6 Marks)

b) Explain the meaning of product of sums(POS) and sum of products(SOP). (4 Marks)

c)   Using the truth table below, show the SOP expression and then minimize it using a K-map and draw the minimized circuit.   (10 Marks)

x	y	z	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

QUESTIONS THREE (20 MARKS)

a)   Convert the following numbers into their equivalent binary number.

   i) 227_{10} (4 Marks)

   ii) 27.125_{10} (3 Marks)

   iii) $8B3_{16}$ (3 Marks)

b)   A digital circuit has three inputs **A, B** and **C**. Inputs **A** and **B** are applied to an **OR** gate. The output of the gate is applied to one input of **AND** gate. Input **C** is passed through a **NOT** gate before being applied to the other input of the **AND** gate. Draw the logic diagram and show the output expression of the **AND** gate.   (6 Marks)

c)   Develop a truth table for the logic diagram in b above.   (4 Marks)

QUESTION FOUR (20 MARKS)

a)   Sequential circuits are classified into two types, with the help of a well labelled diagram, explain each one of them.   (8 Marks)

b)   What is the main difference between Static RAM (SRAM) and Dynamic RAM (DRAM). (2 Marks)

c)   Simplify and draw a logic diagram for the following Boolean expression.

   i) $A + A\overline{B} = A + B$

   ii) $(A + B)(A + C) = A + BC$ (10 Marks)

QUESTION FIVE (20 MARKS)

a)   Explain the following terminologies as used in K-Maps methodology for minimizing logical expressions.

    i)   An implicant

    ii)   A prime implicant   (4 Marks)

b)   Briefly explain the difference between min- terms and max-terms as used in canonical and standard form of functions.   (4 Marks)

c)   Describe four differences between flip-flops and latches   (4 Marks)

d)   The following figure shows a logic circuit diagram.
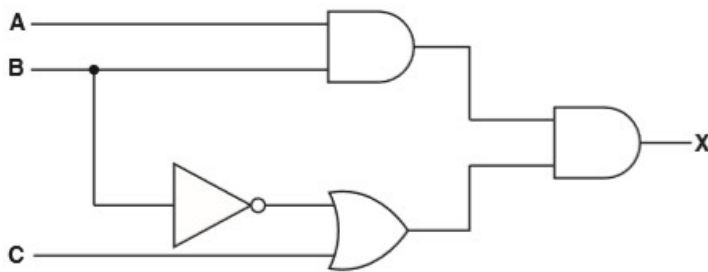
    i)   Write logic expressed for the above circuit.   (4 Marks)

    ii)   Prepare truth table.   (4 Marks)