



UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

**FIRST YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN (ICT)**

COMP 122: DIGITAL ELECTRONICS

STREAM: R

TIME: 2 HRS

DAY: FRIDAY [2.30 – 4.30 P.M]

DATE: 12/04/2024

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

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INSTRUCTIONS TO CANDIDATES

SECTION A: (Compulsory) TOTAL MARKS FOR THIS SECTION IS 30.

QUESTION ONE: (30 MARKS)

- a) Explain the following terms as used in Digital Electronics:
 - i. Digital system (2 Marks)
 - ii. Signal (2 Marks)
 - iii. Truth table (2 Marks)
 - iv. Frequency (2 Marks)
 - v. Circuit (2 Marks)
- b) Outline **FOUR** advantages of digital electronics over analog electronics (4 Marks)
- c) Distinguish between half Adder and Full Adder as used in digital electronics (4 Marks)
- d) Give **TWO** applications of Gray codes (2 Marks)
- e) Evaluate $(111.001)_2 \times (1.11)_2$ to two binary places. (3 Marks)
- f) Boolean functions are expressed in terms of AND, OR, and NOT operations, as it is easier to implement a Boolean function with these type of gates. With diagrammatic illustrations, provide a truth table for each of the above basic gates (7 Marks)

SECTION B. TOTAL MARKS FOR THIS SECTION IS 40.

ANSWER ANY TWO QUESTIONS FROM THIS SECTION. EACH QUESTION IN THIS SECTION CARRIES 20 MARKS.

QUESTION TWO: (20 MARKS)

- a) Citing examples, explain the term number systems (4 Marks)
- b) Given the two binary numbers $X = 1010101$ and $Y = 1001011$, perform the subtraction $X - Y$ using 1's complements (4 Marks)
- c) Complete the following table

Binary	Decimal	Octal	
a) 0.0110			4 Marks
b) 1011.101			4 Marks
c) 10101			4 Marks



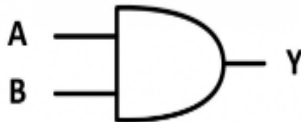
QUESTION THREE: (20 MARKS)

- a) Explain the term **base** as used in number systems. (2 Marks)
- b) Perform the following number conversions
 - (i) $(13A7)_{16}$ to decimal (3 Marks)
 - (ii) $(3F2)_{16}$ to binary (3 Marks)
 - (iii) $(19.11)_{10}$ to octal (2 Marks)
- c) Simplify the Boolean expression;

$$Y = A.B.C + A.B.\bar{C} + A.\bar{B}.C + A.\bar{B}.\bar{C} + \bar{A}.B.C + \bar{A}.B.\bar{C} + \bar{A}.\bar{B}.C + \bar{A}.\bar{B}.\bar{C}$$
(6 Marks)
- d) Draw the truth table of a full adder circuit. (4 Marks)

QUESTION FOUR: (20 MARKS)

a)



- i) State the name of the above logic gate (1 Mark)
- ii) Write down the Boolean expression for the gate (i) above and represent in a truth table (3 Marks)
- iii) Outline **FOUR** advantages of logic gates (4 Marks)
- b) Given the Boolean function: $F = xy + x'y' + y'z$
 - i. Implement it with only OR and NOT gates. (6 Marks)
 - ii. Implement it with only AND and NOT gates (6 Marks)

QUESTION FIVE: (20 MARKS)

- a) Define the term flip-flop. (2 Marks)
- b) (i) With the aid of a logic circuit and a truth table, explain the operation of an R-S flip-flop (8 Marks)
- (ii) State the limitations of the R-S flip-flop (5 Marks)
- c) Draw the truth table of a J-K flip-flop with active high inputs. (5 Marks)