higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

(8080354)

12 August 2021 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 7 pages.

286Q1G2112

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
DIGITAL ELECTRONICS N4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Only use a black or blue pen.
6. Write neatly and legibly.

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SECTION A

QUESTION 1

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 $10 + 10_2 =$

A 1010_2
B 1010_{10}
C 1100_2
D 1110_{10}

1.2 $10_8 + 10_2 =$

A 10
B 1010
C 20
D 20_8

1.3 $10{,}01_2 - 2_{16} =$

A 0,5
B 0,25
C 0,75
D 1

1.4 $10{,}01_2 \times 4_{16} =$

A 1001_2
B 1001_8
C 1001_{10}
D 1001_{16}

1.5 $11_8 \div 2{,}4_{16} =$

A 100_2
B $100{,}11_2$
C $100{,}01_2$
D $11{,}11_2$

(5 × 2) **[10]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.8) in the ANSWER BOOK. Give ONE reason for each answer.

2.1 $A + A + 1 = 1$

2.2 $A + \overline{A} + 1 = 1$

2.3 $A + \overline{A} + 0 = 1$

2.4 $A \bullet A \bullet 1 = 1$

2.5 $A \bullet \overline{A} \bullet 1 = 1$

2.6 $A \bullet \overline{A} \bullet 0 = 1$

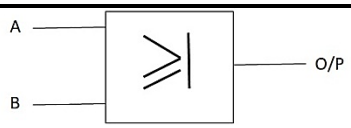
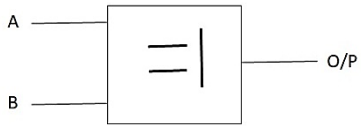
2.7 $\overline{A \bullet B} = \overline{A} + \overline{B}$

2.8 $\overline{A \bullet B} = \overline{\overline{A} + \overline{B}}$

(8 × 1) **[8]**

QUESTION 3

Choose a term from COLUMN B that matches an item in COLUMN A. Write only the letter (A–G) next to the question number (3.1–3.7) in the ANSWER BOOK.

COLUMN A		COLUMN B
3.1		A AND GATE
3.2		B OR GATE
3.3		C EXCLUSIVE OR GATE
3.4	A B O/P 0 0 0 0 1 0 1 0 0 1 1 1	D NOT GATE ☆
3.5	A B O/P 0 0 1 0 1 0 1 0 0 1 1 0 ☆	E NAND GATE
3.6	A B O/P 0 0 1 0 1 0 1 0 0 1 1 1	F NOR GATE
3.7	$A = \overline{A}$	G EXCLUSIVE NOR GATE

(7 × 1) **[7]**

TOTAL SECTION A: 25

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SECTION B

QUESTION 4

Complete the following calculation in the binary number system. All steps must be indicated clearly.

4.1 $1001{,}01_2 - 10{,}0101_2$ (Make use of the 1's complement method)

4.2 $1001{,}01_2 - 11100{,}011_2$ (Make use of the 2's complement method)

4.3 $10010{,}01_2 \times 1011{,}1_2$

4.4 $10000{,}01_2 \div 100{,}0001_2$

(4 × 5) **[20]**

QUESTION 5

Draw the circuit diagrams of the Boolean expressions below. Do not change or simplify the expressions:

5.1 $\overline{\overline{A}B + \overline{\overline{A}} + B + \overline{AB} + C}$

5.2 $\overline{(BC + AB)}\,\overline{(B + C + \overline{A} + B)}$

5.3 $\overline{\overline{(A \oplus B + C)}(A + \overline{B \oplus C})}$

(3 × 5) **[15]**

QUESTION 6

Simplify the following Boolean expressions:

6.1 $\overline{A}BC + A\overline{B}C + \overline{A}B\overline{C} + \overline{A}C\overline{B}$

6.2 $C(\overline{A} + \overline{B}) + \overline{A}(B + \overline{C}) + \overline{A}B$

(2 × 5) **[10]**

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QUESTION 7

7.1 Draw the circuit diagram of a master-slave JK flip-flop making use of NAND gates. (10)

7.2 Discuss the purpose of the set and reset lines on a flip-flop. (4)

7.3 Explain why a master-slave flip-flop clocks on the trailing edge. (6)

7.4 Draw the circuit of a module-8 down-counter and draw the timing diagram. (10)
[30]

TOTAL SECTION B: 75
GRAND TOTAL: 100

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