higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

(8080354)

29 November 2022 (X-paper)
09:00–12:00

Drawing instruments may be used, but calculators may NOT be used.

This question paper consists of 4 pages.

280Q1E2229

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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. All drawings must be neat and well balanced.
5. Start each question on a new page.
6. Use only a blue or black pen.
7. Write neatly and legibly.

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QUESTION 1

1.1 What is the meaning of *BCD*? (1)

1.2 Name any non-inverting weighed code. (1)

1.3 Give the symbol, truth table and Boolean expression of the NAND gate. (3)

1.4 Write down the simplest form of the Boolean expressions below:

1.4.1 $XY + X\overline{Y}$

1.4.2 $\overline{X}\ XY$

1.4.3 $X(X + Y + Z)$

1.4.4 $\overline{X} + \overline{X}$

1.4.5 $XY + YZ + 1$

(5 × 1) (5)

1.5 Briefly explain the difference between *synchronous switching* and *asynchronous switching*. (2)

1.6 Convert 0101011_2 binary to Gray code. (1)

1.7 How many selected lines are needed for a 1:4 demultiplexer? (1)

1.8 State the difference between a *full adder* and a *half adder*. (2)

[16]

QUESTION 2

2.1 Calculate the following by using the two's complement method. Write the final answer in the decimal system.

$7{,}5_8 - 9{,}125_{10}$ (6)

2.2 Calculate $14{,}125_{10} \div 6{,}4_8$. Write the final answer in the decimal system. (6)

2.3 Calculate $11{,}375_{10} \times 5{,}2_8$. Convert the final answer to the octal system. (6)

2.4 Calculate by using the one's complement method. Write the final answer in the octal system.

$-17{,}25_{10} - 14{,}75_{10}$ (6)

[24]

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QUESTION 3

3.1 Implement the following Boolean expressions. Do not change or simplify the expressions.

3.1.1 $F = AC + B\overline{C} + \overline{A}BC$ (5)

3.1.2 $F = \overline{\overline{AB} + B + \overline{C} + B \oplus C}$ (6)

3.2 Simplify the following expressions with Boolean algebra:

3.2.1 $F = \overline{AB}C + \overline{A}B\overline{C} + ABC + A\overline{BC}$ (6)

3.2.2 $F = \overline{X + \overline{X}Y + \overline{Y + Z}}$ (5)

[22]

QUESTION 4

4.1 Draw a circuit diagram of a three-bit asynchronous down-counter and give the timing diagram for three clock pulses. (10)

4.2 Make a neat, labelled sketch of a three-bit ring counter. Draw the timing diagram for six clock pulses. (8)

[18]

QUESTION 5

5.1 Draw a neat, labelled diagram of the J-K master/slave flip-flop. Explain the status of the master and slave sections during the four most important points on the clock pulse. (10)

5.2 Make a neat sketch of a simple ramp-type A/D converter (digital voltmeter). Also show the ramp voltage generated. (10)

[20]

TOTAL: 100

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