higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T460**(E)**(A2)T

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

(8080354)

2 August 2018 (X-Paper)
09:00–12:00

This question paper consists of 4 pages.

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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. ALL work you do not want to be marked must be clearly crossed out.
6. Write neatly and legibly.

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QUESTION 1

1.1 What is the function of an encoder? (2)

1.2 Explain the difference between an *encoder* and a *decoder*. (2)

1.3 Explain the following terms with regard to a flip-flop:

1.3.1 Set

1.3.2 Reset

(2 × 2) (4)

1.4 What is a *self-complementing code*? (2)

1.5 Use the laws and identities of Boolean algebra to simplify the following expressions:

1.5.1 $X + XY$

1.5.2 $\overline{X} + XY$

1.5.3 $1 + XY\overline{Z}$

1.5.4 $XX + XY + XZ$

1.5.5 $\overline{X} + \overline{X}$

(5 × 1) (5)

[15]

QUESTION 2

Convert each of the following numbers to their binary equivalent and complete the calculation in the binary number system:

2.1 $17{,}5_8 - 25{,}75_{10}$

Use the 2's complement method and convert the final answer to the decimal system.

2.2 $A5{,}C_{16} \times 3{,}5_8$

Convert the final answer to the octal system.

2.3 $75{,}125_{10} \div 25{,}1_8$

Convert the final answer to the decimal system.

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2.4 $-58{,}25_{10} - 9{,}0625_{10}$

Use the 2's complement method and convert the final answer to the decimal system.

(4 × 6) **[24]**

QUESTION 3

3.1 Simplify the following Boolean expressions:

3.1.1 $\overline{A}\,C + \overline{B}\,C + A\,\overline{B} + A\,\overline{C} + \overline{A}\,B + B\,\overline{C} + A\,B\,C = F$

3.1.2 $A\,\overline{B}\,\overline{C} + \overline{A}\,B\,\overline{C} + A\,B\,C + A\,B\,\overline{C} = \overline{F}$

(2 × 6) (12)

3.2 Draw the circuit diagram of each of the Boolean expressions below. Do NOT simplify the expressions:

3.2.1 $F = X(\overline{YZ} \oplus \overline{XZ}) \oplus XYZ$

3.2.2 $F = \overline{A\,\overline{B}} + \overline{B}\,\overline{C} \oplus A\,C$

(2 × 6) (12)
[24]

QUESTION 4

4.1 Draw a circuit diagram of a clocked RS flip-flop. Include the truth table. (10)

4.2 Draw a circuit diagram of a 3-bit circulating shift register. (7)
[17]

QUESTION 5

5.1 Draw a circuit diagram of a 3-bit asynchronous down-counter and also give the timing diagram for 3 clock pulses. (10)

5.2 Draw the circuit diagram of a module 5 counter and also give its truth table. (10)
[20]

TOTAL: 100

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