higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

ENGINEERING

T860(E)(M24)T
APRIL-EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

(8080284)

24 March 2014 (Y-Paper)
13:00–16:00

Calculators may be used.

This question paper consists of 5 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS 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. Keep subsections of questions together.
5. Rough calculations may be done at the back of the ANSWER BOOK.
6. Write neatly and legibly.

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QUESTION 1

1.1 Write down the symbols of the hexadecimal system. (1)

1.2 Give the biggest symbol of the decimal number system. (1)

1.3 What is the function of the Hamming code? (2)

1.4 Give the name of a non-weighed self-complementing code. (1)

1.5 Give the two's complement of $1001,101_2$. (1)

1.6 Give the symbol, truth table and Boolean expression for an exclusive OR gate. (3)

1.7 Give the simplest form of the Boolean expressions below:

1.7.1 $1+\overline{A}B+A+B$

1.7.2 $\overline{A}A+A\overline{B}+B\overline{B}$

1.7.3 $\overline{A}+A\overline{B}+B$

1.7.4 $A\overline{A}+1+\overline{B}B+\overline{C}C$

(4 × 1) (4)

1.8 State FIVE conditions that grouping on a Karnaugh map must comply with. (5)

1.9 Draw the symbols of the following master/slave flip-flops and clearly indicate the external connections necessary to make each one toggle.

1.9.1 RS

1.9.2 JK

1.9.3 D-TYPE

(3 × 2) (6)
[24]

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QUESTION 2

2.1 Do the following calculations in the binary system. Show ALL conversions and calculations clearly.

2.1.1 $14{,}5_8 - E{,}6_{16}$

Make use of the two's complement method and convert the final answer to the decimal system. (6)

2.1.2 $2C{,}5_{16} \div 6{,}25_{10}$

Convert the final answer to the octal system. (6)

2.1.3 $12{,}125_{10} \times 5{,}4_8$

Convert the final answer to the hexadecimal system. (6)

2.2 Draw a coding table and show all the steps for coding 5_{10} for transmission in the Hamming code. (6)

2.3 Write $27{,}9_{10}$ in the following codes:

2.3.1 2421-BCD

2.3.2 Excess-3 BCD (6)

[30]

QUESTION 3

3.1 Draw the circuit diagram of the Boolean expression below without changing or simplifying it:

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

3.2 Simplify the Boolean expressions below by using Boolean algebra. Then draw the gate circuit diagrams by using only NAND gates.

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

3.2.2 $\overline{\overline{(AB\overline{C} + ABC)}\,\overline{(\overline{A}BC + A\overline{B}C)}} = F$ (6)

[18]

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QUESTION 4

Design a code converter which will convert the 8421 code (A,B,C,D) to the 2421 BCD code (F1,F2,F3,F4). Use Karnaugh maps and show the conversion to NAND gates. Then draw the circuit diagram using NAND gates only. [20]

QUESTION 5

Make a neat labelled sketch of a D-type master/slave flip-flop which consists of only NAND gates. [8]

TOTAL: 100

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