higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T860(E)(J21)T
AUGUST EXAMINATION

NATIONAL CERTIFICATE

LOGIC SYSTEMS N4

(8080284)

21 July 2014 (Y-Paper)
13:00–16:00

Calculators may NOT be used.

This question paper consists of 5 pages.

ENGINEERING

Copyright reserved

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.

ENGINEERING

QUESTION 1

1.1 Write down the symbols of the number system used by computers. (1)

1.2 Give the biggest symbol of the OCTAL system. (1)

1.3 Write down the positions where parity bits are inserted in a seven-bit Hamming code word. (1)

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

1.5 Calculate the TWO's complement of $1110,100_2$ (1)

1.6 Give the symbol, truth table and Boolean expression for a three-input NAND gate. (3)

1.7 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.7.1–1.7.5) in the ANSWER BOOK.

1.7.1 The bistable flip-flop can be used as a memory element.

1.7.2 The astable flip-flop can be used as a clock pulse generator.

1.7.3 The RS flip-flop has a natural toggle action.

1.7.4 The exclusive OR gate functions as an equality comparator.

1.7.5 Grouping may not overlap on a Karnaugh map.

(5 x 1) (5)

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

1.9 Draw the truth tables of the following master/slave flip-flops:

1.9.1 RS

1.9.2 JK

1.9.3 D-type

(3 x 2) (6)

[24]

ENGINEERING

Copyright reserved

QUESTION 2

2.1 Do the following calculations in the binary system. Clearly show ALL conversions and calculations.

$13,4_8 - E,8_{16}$

Make use of the ONE's complement method and convert the final answer to the DECIMAL number system. (6)

2.2 $B,5_{16} \div 6,5_{10}$

Convert the final answer to the OCTAL number system. (6)

2.3 $7,125_{10} \times 6,4_8$

Convert the final answer to the HEXADECIMAL number system. (6)

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

2.5 Write $46,3_{10}$ in the following codes:

2.5.1 2421-BCD

2.5.2 Excess-3 BCD

(2 x 3) (6)

[30]

QUESTION 3

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

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

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 $\overline{A}BC + \overline{AC} + AB\overline{CD} + ABD + ABC\overline{D} = F$ (8)

3.2.2 $\overline{\overline{(AB\overline{C} + AB\overline{C})}\,\overline{(\overline{A}BC + \overline{A}BC)}} = F$ (4)

[18]

ENGINEERING

Copyright reserved

QUESTION 4

Design a code converter which will convert the 8421 code (A, B, C, D) to the X-3 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 JK-type master/slave flip-flop which consists of only NAND gates. **[8]**

TOTAL: 100

ENGINEERING

Copyright reserved