higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T460**(E)**(A7)T

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

(8080354)

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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. Write neatly and legibly.

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QUESTION 1

1.1 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 (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 $AB + \overline{AB}$

A 1
B A
C 0
D AB

1.1.2 $A + \overline{A}\,B$

A A
B A + B
C B
D 1

1.1.3 $A + A\overline{B} + \overline{A}$

A 0
B A
C $\underline{1}$
D $\overline{B}$

1.1.4 $\overline{A} + A\,BC$

A $\underline{A}BC$
B $\overline{A} + BC$
C AB
D A

1.1.5 $XY + X + XYZ$

A X
B XYZ
C XY
D YZ

(5 × 1) (5)

1.2 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–F) next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1.1	Fan out	A	group of flip-flops used for storing data in binary code
1.1.2	Clear	B	maximum number of standard inputs that can reliably be driven by one output.
1.2.3	Propagation delay	C	minimum and maximum voltage levels which determine the logic state
1.2.4	Threshold voltage	D	supply voltage
1.2.5	Register	E	time it takes a sequel to move through a system
		F	input that forces the Q output of a memory element to zero

(5 × 1) (5)

1.3 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.3.1–1.3.5) in the ANSWER BOOK.

1.3.1 Multiplexing means sending various different signals through a single communication channel.

1.3.2 The ramp-type is used for D/A conversion.

1.3.3 Flip-flops are monostable vibrators with memory characteristics.

1.3.4 The 8421-code is a self-complimenting code.

1.3.5 A module 10-counter counts 9 positions.

(5 × 1) (5)

1.4 Compute the following in binary:

1.4.1 A, B_{16} + $7,5_{10}$

1.4.2 10011 gray

1.4.3 C_{16} – B_{16}

(3 × 2) (6)

[21]

QUESTION 2

Convert each of the following numbers to their binary equivalents and complete the calculation in the binary number system (follow the instruction in brackets):

2.1 F, $A_{16} - 5,7_8$ (use the 2's complement method and convert final answer to decimal.) (6)

2.2 $8,5_{10} - 6,2_8$ (use 1's complement and convert final answer to decimal.) (5)

2.3 E, $B_{16} \div 7,5_8$ (convert final answer to octal.) (6)

2.4 C, $1A_{16} \times 6,5_8$ (convert final answer to hexadecimal.) (6)
[23]

QUESTION 3

3.1 Simplify the following Boolean expressions:

3.1.1 $F = ABC + AB\overline{C} + A\overline{B}C + A\overline{B}\,\overline{C}$ (6)

3.1.2 $F = X(X + Y)(X + Y + Z)$ (5)

3.2 3.2.1 $F = \overline{\overline{A\,B} \oplus \overline{B\,C} + \overline{ABC}}$ (6)

3.2.2 $F = \overline{\overline{A + BC} \oplus AB}$ (5)
[22]

QUESTION 4

4.1 Draw the equivalent gate circuit of the D latch and also give its truth table. (8)

4.2 Make a sketch of the SR master/slave flip-flop and explain its operation. (10)
[18]

QUESTION 5

5.1 Draw the circuitry of the successive approximation analogue-to-digital converter. (8)

5.2 Draw the circuit of the 4-lines to 1-line multiplexer. (8)
[16]

TOTAL: 100

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