



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

(8080354)

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09:00–12:00

This question paper consists of 5 pages.

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 $A + 1$

- A 1
- B B
- C 0
- D A

1.1.2 $AB + \underline{A} B$

- A A
- B $A + B$
- C B
- D 1



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

- A 0
- B A
- C $\frac{1}{B + \overline{A}}$
- D $\overline{B} + \overline{A}$



1.1.4 $\overline{AC} + A$

- A $\underline{AC}$
- B A
- C A
- D $A + C$

1.1.5 $1 + X + XYZ$

- A 1
- B XY
- C X
- D YZ



(5 × 1)

(5)

- 1.2 Choose a description from COLUMN B that matches an item 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	
1.2.1	Mark period 	A	percentage expression of the mark period to the full-cycle period
1.2.2	Space period	B	the mark period plus the space period
1.2.3	Pulse repetition frequency	C	the period during which the pulse is active
1.2.4	Full-cycle period	D	the period during which the pulse is idle
1.2.5	Duty cycle	E	the ratio of mark period to space period 
		F	the number of pulses generated in one second

(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 The clock pulse is used to switch flip-flop circuits in computers.

1.3.2 The 2421 code is a self-complementing code.

1.3.3  The hexadecimal system has a base of 8.

1.3.4 The Hamming code is an error detection code.

1.3.5 The switch tail counter is a circulating register.

(5 × 1)

(5)

- 1.4 Compute the following in binary:

1.4.1 Convert 100111_2 to 2's complement

1.4.2 Convert 10011_2 to Gray code

1.4.3 $D_{16} + B_{16}$



(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 instructions in bracket).

2.1 D, $7_{16} - 3, 6_8$ (1's complement method and convert the final answer to decimal) 

2.2 $7C, B_{16} \div 6, 5_8$ (Convert final answer to octal)

2.3 $86, E_{16} \times 7, 5_{10}$ (Convert final answer to decimal)

(3 × 6) **[18]**

QUESTION 3

Simplify the following Boolean expressions:

3.1 $F = \overline{A} \overline{B} \overline{C} + \overline{A} B \overline{C} + ABC + \overline{A} B C$

3.2 $F = \overline{\overline{A} \overline{B} + AB + A B}$ 

3.3 $F = \overline{\overline{A} \overline{B} \overline{C} \oplus B C + AC}$

3.4 $F = \overline{ABC \oplus AB} \oplus BC = F$

(4 × 6) **[24]**

QUESTION 4

4.1 Draw the circuit diagram of the parallel binary adder.  (10)

4.2 Make a sketch of a double 3 line to 8 lines demultiplexer. (9)
[19]

QUESTION 5

5.1 Draw a 3-bit asynchronous D-type up counter. (8)

5.2 Draw the gate circuit of the JK master/slave flip-flop using only NAND gates. Also provide the truth table.  (10)
[18]

TOTAL: 100