higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N5

(8080365)

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09:00–12:00

This question paper consists of 6 pages.

191Q1A2009

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
DIGITAL ELECTRONICS N5
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. Start each section on a new page.
5. Use only a black or blue pen.
6. All calculations and answers must be given to three fractional radix spaces, for example $10{,}011_2$.
7. Write neatly and legibly.

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QUESTION 1

Convert the following numbers to their binary equivalent and complete the calculation in the binary number system as follows:

1.1 $21,5_{10} - A1,C_{16}$

Use 1's complement to convert the answer to decimal (6)

1.2 $237,7_8 \div A,7_{16}$

Convert the answer to octal (6)

1.3 $11,2_8 \times 10,125_{10}$

Convert the answer to hexadecimal (6)

[18]

QUESTION 2

The output of a synchronous counter is indicated in TABLE 1.

Design and draw the circuit which consist of J-K flip-flops only. Show ALL the steps leading to the solution.

TABLE 1

A	B	C
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

[22]

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QUESTION 3

3.1 Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–I) next to the question number (3.1.1–3.1.7) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	The power used by a gate during operation	A	noise margin
3.1.2	The time lapse between an input change and an output change	B	switching speed
3.1.3	The maximum input voltage a TTL circuit can withstand without a false change in the output	C	noise immunity
3.1.4	Input into a gate that is driven by other logic gates	D	threshold voltage
3.1.5	This is the maximum number of inputs which can be served by an output	E	propagation delay
3.1.6	The rate of change from logic 0 to 1 or from logic 1 to 0	F	fan-in
3.1.7	The input voltage at which a gate must switch from high to low or from low to high	G	power dissipation
		H	fan-out
		I	power consumed

(7 × 1) (7)

3.2 IF V_{OH} = 20 V, V_{OL} = 0,5 V, V_{IH} = 3,0 V and V_{IL} = 0,9 V, determine the low level and high-level noise margins. (2)

3.3 3.3.1 Make a neat, labelled sketch of an open-collector TTL circuit. (3)

3.3.2 Explain the purpose of the pull-up resistor. (3)

[15]

QUESTION 4

4.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (4.1.1–4.1.2) in the ANSWER BOOK.

4.1.1 Resolution is the reciprocal of the number of discrete steps in the output signal or the number of bits that are converted. ✱

4.1.2 Accuracy of a D/A convertor is the comparison between the actual output and the expected output.

(2 × 1) (2)

4.2 Draw the circuit diagram of a digital-to-analogue convertor into which a digital code may be fed serially. (5)

4.3 Determine the output voltage if the circuit, mentioned in QUESTION 4.2, has the following values:

Resistor = 100 kΩ
Input voltage = 2 V ✱
Time = 2 ms
Capacitance = 100 F
Digital code (N) = $2\ 560_{10}$ (3)
[10]

QUESTION 5

5.1 Discuss the typical arrangement of data on a floppy or stiffy disk. (3)

5.2 Write out the following acronyms in full:

5.2.1 EEPROM

5.2.2 PROM

5.2.3 RAM

5.2.4 ROM

5.2.5 EPROM

✱ (5 × 2) (10)

5.3 With reference to semiconductor memories, define the term *masked programmable read-only memory*. (2)
[15]

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QUESTION 6

6.1 Briefly describe the working principles of the following:

6.1.1 Electrostatic printer

6.1.2 Thermal printer

6.1.3 Ink-jet printer

(3 × 3) (9)

6.2 State TWO disadvantages of an electrothermal printer. (2)

[11]

QUESTION 7

Make a neat, fully labelled sketch of the functional block diagram of a modem. **[9]**

TOTAL: 100

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