higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T350**(E)**(N25)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N5

(8080365)

25 November 2016 (X-Paper)
09:00–12:00

This question paper consists of 5 pages.

Copyright reserved

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. Calculation processes and answers must be given in THREE fractional radix spaces, for example 10, 101_2.
5. Write neatly and legibly.

Copyright reserved

QUESTION 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 (1.1–1.10) in the ANSWER BOOK.

1.1 LCD screens and graph plotters are examples of:

A Memory units
B A/D and D/A converters
C Output devices
D Input devices

1.2 Outputs of open collector TTLs may be joined together using a ...

A pull-up resistor.
B junction capacitor.
C Darlington pair.
D totem-pole configuration.

1.3 Erasing memory in an EPROM is done by …

A blowing the fusible links on the EPROM.
B shining ultra-violet light onto the window of the EPROM.
C applying an electric pulse to the EPROM.
D inserting a code onto the EPROM pins.

1.4 The Gray equivalent of the binary number 1001011_2 is ...

A 1110001
B 1101110
C 1100110
D 1000011

1.5 A major disadvantage of the mask ROM is that it ...

A is time consuming to change the stored data when system requirements change.
B is very expensive to change the stored data when system requirements change.
C cannot be reprogrammed if stored data needs to be changed.
D has an extremely short life expectancy and requires frequent replacement.

1.6 With reference to logic families, propagation delay refers to ...

A the maximum number of inputs that can be served by an output.
B the number of output stages that can be connected to a single input.
C maximum voltage a TTL circuit can withstand without a false change in output.
D elapsing of time between an input change to an output change.

Copyright reserved

1.7 With reference to D/A converters, *settling time* refers to ...

A the time taken for a digital-to-analogue converter to settle within approximately half the LSB of its final value when a change occurs in the input code.
B the comparison between the actual output with the expected output.
C the deviation from the ideal output of a digital-to-analogue converter.
D the reciprocal of the number of discrete steps in the output signal.

1.8 A tri-state device is used ...

A for current sinking and sourcing.
B to interface digital devices such as memories to a bus.
C to filter spikes caused by switching.
D to smooth output ripples.

1.9 The BCD number for decimal 347 is ...

A 1100 1011 1000
B 0011 0100 0111
C 0011 0100 0001
D 1100 1011 0110

1.10 Static memory devices are best described as ...

A memory devices that are magnetic in nature and do not require constant refreshing.
B memory devices that are magnetic in nature and require constant refreshing.
C semiconductor memory devices in which stored data will not be retained with the power applied unless constantly refreshed.
D semiconductor memory devices in which stored data is retained as long as power is applied.

(10 × 1) **[10]**

QUESTION 2

If A = 5 E, 7_{16} ; B = 26, 5_8 ; and C = 3, 75_{10} :

2.1 Find A – B using two's complement. The calculation must be performed in binary, and the final answer converted to octal.

2.2 Find A × C. The multiplication must be performed in binary and the final answer converted to hexadecimal.

2.3 Find B ÷ C. The division must be performed in binary and the final answer converted to decimal.

(3 × 6) **[18]**

Copyright reserved

QUESTION 3

3.1 Simplify the following function with the aid of Karnaugh maps and draw the circuits using NAND gates only:

F (A,B,C,D) = $\sum$ m (1; 3; 5; 6; 7; 8; 9; 10; 11; 14; 15) (12)

3.2 Draw the circuit of the expression : $M = \overline{X}.Y + X.\overline{Y} + \overline{X.Y}$

Use NAND gates ONLY. (6)
[18]

QUESTION 4

4.1 Draw the circuit diagram of a two input C-MOS-NAND gate. (6)

4.2 Differentiate between *current sourcing* and *current sinking*, using sketches. (2 × 3) (6)

4.3 Draw a typical totem-pole arrangement and explain why it is used. (4)

4.4 What are the benefits of using a Schottky transistor in place of a bipolar transistor? (2)
[18]

QUESTION 5

5.1 A D/A converter is fed serially with a digital code, A = 3510. If the input is 2 volts, time = 1 ms, the resistance = 100 kilo-ohms, and capacitance = 100 microfarads, calculate the output voltage. (2)

5.2 A three-digit BCD-to-analogue converter uses a weighted resistor ladder, and has the largest resistor value of 10 MΩ.

Draw the circuit. (10)

5.3 Explain the difference in operation between *an inkjet printer* and *a thermal printer*. (2 × 3) (6)
[18]

QUESTION 6

6.1 Briefly describe the principle of operation of a magnetic core memory. (3)

6.2 Sketch a dynamic MOS RAM cell and briefly describe how memory is stored. (5)

6.3 Draw a block diagram of a UART. (10)
[18]

TOTAL: 100

Copyright reserved