higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N5

(8080365)

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This question paper consists of 6 pages.

155Q1E2019

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
DIGITAL ELECTRONICS N5
TIME: 3 HOURS
MARKS: 150

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 blue or black ink.
6. All calculations and answers must be given in 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 follow the instructions given in brackets to complete the calculation in the binary number system:

1.1 $E6,F_{16} \div 43,5_8$ (convert the answer to hexadecimal) (6)

1.2 $96,E_{16} \times 53,2_8$ (convert the answer to octal) (6)

1.3 $122,3_8 - 122,B_{16}$ (use two's complement to convert the answer to decimal) (6)

[18]

QUESTION 2

Design a synchronous binary counter that can count from 0 to 9 ($0000_2 - 1001_2$). Use J-K a flip-flop only and draw the circuit.

Show ALL the steps leading to the solution. **[23]**

QUESTION 3

3.1 Draw a two-input complementary CMOS NAND gate. Show the input and output connections. (6)

3.2 Study FIGURE below and answer the questions.

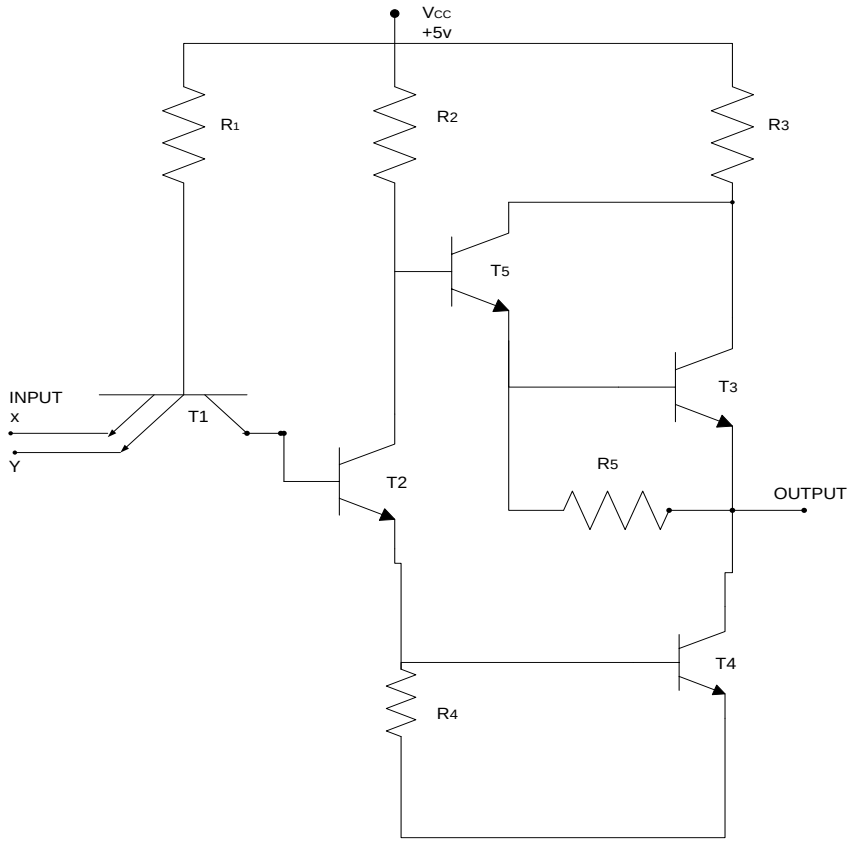


FIGURE 1

3.2.1 Identify the transistor that forms the totem pole and describe the function of this arrangement. (4)

3.2.2 Identify the transistors that form the Darlington pair and describe the function of the Darlington pair. (4)

3.3 Compare the speed, packing density and power of the TTL with that of the C-MOS. (3)
[17]

QUESTION 4

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 (4.1–4.10) in the ANSWER BOOK.

4.1 A precaution when handling MOS devices:

A Do not connect unused inputs.
B Always connect a MOS device with the power on.
C Connect all pins and benches to V_{CC}.
D Always use conductive foam to store MOS devices.

4.2 With A/D converters, threshold voltage refers to …

A minimum and maximum voltage levels which determine a logic state
B the voltage at which the converter has a thermal breakdown
C an error voltage that deviates from an A/D converter's ideal output
D a difference in voltage owing to the time required to change from input state to output

4.3 A printer projects the desired image on a selenium drum. A photoconductor changes the optical image into electrical pulses. This printer is a/an …

A thermal printer.
B electrostatic printer.
C ink-jet printer.
D xerographic printer.

4.4 The following codes are given:

X = 001010 Y = 101010
The odd parity bits for codes X and Y are:

A 1 and 0 respectively
B 0 and 1 respectively
C 1 and 1
D 0 and 0

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4.5 Shottky transistors …

A increase the packaging density of circuits.
B increase the switching speed of circuits.
C prevent current spikes.
D are used as a totem pole output for a NAND function.

4.6 The ASCII code for NX is:

A 1001001 10011001
B 1000001 1001111
C 1000001 1010000
D 1001110 1011000

4.7 Given: the Gray code $11010_{gray.}$
This code converted to binary yields:

A 10010_2
B 10100_2
C 11010_2
D 11101_2

4.8 A PROM's memory is erased …

A if ultra-violet light shines onto the window of the EPROM.
B by an electric pulse.
C by inserting a code onto the EPROM pins.
D if a fuse is blown.

4.9 EPROM refers to:

A Erasable programmable read only memory
B Electrostatically programmable read only memory
C Electrically erasable programmable random-only memory
D Electrostatically erasable programmable random-access memory

4.10 Current is sourced when an output establishes a current path …

A from the input of the following gate to the ground of the preceding gate.
B from the Vcc of the preceding gate to the input of the following gate.
C from both the preceding gate and the following gate to the ground.
D from a reliable power source.

(10 × 1) **[10]**

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QUESTION 5

5.1 What is the difference between *volatile memory* and *non-volatile memory*? (2)

5.2 Draw a block diagram of a computer organisation and show ALL the links amongst the units. (13)
[15]

QUESTION 6

6.1 Briefly define the term *modem* and state its application. (4)

6.2 Briefly describe the function and working of a UART. (3)
[7]

QUESTION 7

Draw a three-digital BCD-to-analogue converter that makes use of a weighted resistor ladder.

Assume the largest value of the available resistor is 1 MΩ. **[10]**

TOTAL: 100

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