higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

LOGIC SYSTEMS N6

(8080306)

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09:00–12:00

Drawing instruments may be used

This question paper consists of 6 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N6
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. Write neatly and legibly.

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK. Give a short explanation in support of each of your answers.

1.1 Cell-phone signal multiplexing and switching is accomplished by analogue systems.

1.2 The bus is the interface between the computer and an output peripheral like a computer screen.

1.3 An input/output interfacing on a computer must always incorporate an A/D or D/A conversion.

1.4 During the READ cycle, data is read from the accumulator.

1.5 The instruction register holds only the operand address of the next instruction.

1.6 The program counter stores a memory address.

1.7 Computer operations are synchronised with the program counter.

1.8 Both machine-code and assembler are classified as LOW-LEVEL languages.

1.9 The accumulator stores results of computations.

1.10 Instructions are broken up into smaller instructions.

(10 × 2) **[20]**

QUESTION 2

2.1 You as resident electronics technician has been asked to draw up a new design concept regarding the replacing of an obsolete operational amplifier control system with an alternative modern method of control using up-to-date digital computer control.

Your task is the following:

Draw a large, neat, fully labelled block diagram to show the interfacing of input/output ports of the computer as used to monitor and control the new system. The labels of the blocks in the diagram must appear on the block diagram itself. Clearly show the configuration of each input/output port. All interfacing and process functions needed to monitor and control the system must be shown. Show signal directions. Show the configuration of all input and output ports. Label the input and output ports and feedback and action loop clearly. (10)

2.2 Computers use a bus structure or system to link the various components within the system.

Name the THREE different types of busses and then make a sketch clearly showing the connections and directions of these three busses in a simple computer system block diagram. Label all components and busses clearly. (10)
[20]

QUESTION 3

3.1 Most modern digital multimeters make use of the successive approximation method of A/D conversion and counting. Illustrate this conversion method by means of a neatly labelled flow chart. (8)

3.2 A Schmitt-trigger can be used to eliminate long rise and fall times in signal switching. Answer the following questions:

3.2.1 Draw an operational amplifier circuit with all connections which will function as a Schmitt-trigger. (4)

3.2.2 Draw as input (to the circuit in QUESTION 5.2.1) a 1 kHz sine wave synchronised on a timing diagram with the resultant output. Clearly show any upper and lower trip levels on the sine wave. (5)

3.2.3 Briefly illustrate the operation of the above circuit. (3)
[20]

QUESTION 4

4.1 Large scale integration (LSI) is used to construct digital multimeters. Describe the internal integrated circuit functions. State which ones are analogue or digital and which ones use operational amplifiers or both.

Use the following headings:

4.1.1 INPUT CIRCUITS (5)

4.1.2 PROCESSING CIRCUITS (3)

4.1.3 OUTPUT CIRCUITS (2)

4.2 Draw a neat fully labelled block diagram of the dual-slope integrating analogue-to-digital converter (ADC) and also show a representation of the comparison between the two integrations below your diagram. (10)
[20]

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QUESTION 5

5.1 PROGRAMMING INSTRUCTION PROCEDURE

The following instruction set is available:

OP-CODE	DESCRIPTION
LOAD	Load into accumulator
ADDA	Add to accumulator
SUBT	Subtract from accumulator
MULT	Multiply
DIV	Divide
BRAN	Branch if the accumulator is negative
BRAP	Branch if the accumulator is positive
STOR	Store
OUTP	Output the contents of the accumulator
HALT	Stop processing (non-memory referenced instruction)

Note the following specification and information when writing the program:

- All mathematical operations done before coding must be shown.
- The first program address with which the program counter is loaded is: DCAA (HEXADECIMAL).
- Case sensitivity: Operands must be lower case.
- Case sensitivity: Addresses must be upper case.
- You may NOT enlarge the instruction set.
- The program must stop processing if after any mathematical operation the contents of the accumulator is positive. (NOTE: Positive).
- The correct delimiter must be used after delivering the output so that memory use is limited to program lines.

The operands r, s, t, u v, w, x, y and z are stored in consecutive hexadecimal addresses:

Operand r is stored in address E1C1.
Operand s is stored in address E1C2.
Operand t is stored in address E1C3.
Operand u is stored in address E1C4 - and so on, in sequence.

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The correct programming fields appear below:

INSTRUCTION LOCATION	INSTRUCTION WORD		DESCRIPTION
	OP-CODE	ADDRESS	

Use the correct programming fields to write a program to calculate the value of z if:

$z = wt + x - 2y$

You may simplify the equation before writing your program. (10)

5.2 In micro-processor-based systems, interrupts are used for urgent data transfer between the peripherals and the micro-processor.

Briefly describe the differences in operation between:

5.2.1 Hardware interrupts (8)

5.2.2 Software interrupts (2)

[20]

TOTAL: 100

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