higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T960**(E)**(J27)T

NATIONAL CERTIFICATE

LOGIC SYSTEMS N6

(8080306)

27 July 2018 (X-Paper)
09:00–12:00

Calculators 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. Write neatly and legibly.

NOTICE TO CANDIDATES

The lives and safety of people depend on logic systems. Logic systems form an integral part of intrinsic safety in equipment. Logic signalling systems prevent trains from colliding. Logic systems keep people safe in aircraft and in hospital intensive-care units. Your work, programming and designs, must be properly planned and presented at this diploma-level examination. Standards must be maintained for the safety of the public and safe operation of machinery.

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 The series digital-to-analogue converter works basically as a differentiator.

1.2 A Programmable Logic Controller ('PLC') contains a microprocessor.

1.3 The computer used to program a PLC contains a microprocessor.

1.4 The Schmitt-trigger produces a pulse-type waveform as output.

1.5 The instruction register holds both the op-code and the operand address of the current instruction.

1.6 The program counter stores a count of all the programs stored in RAM.

1.7 Computer operations are synchronised with the 50 Hz from the power-station.

1.8 Cell-phone switching is accomplished by relay logic.

1.9 The bus is the interface between the computer and an output peripheral like a printer.

1.10 Input/Output interfacing always incorporates an A/D or D/A conversion.

(10 × 2) **[20]**

QUESTION 2

2.1 A Summing-amplifier can be constructed using an operational amplifier. Answer the following questions:

2.1.1 Draw a neat fully labelled 4-input Summing-amplifier circuit which uses an operational amplifier. (6)

2.1.2 Assuming that the input resistors of the summing amplifier equals the feedback resistor, calculate the output voltage for the following inputs:

V1 = +10 mV
V2 = - 25 mV
V3 = +300 mv
V4 = - 100 mV (4)

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2.2 Specialised signal functions such as differentiation and integration can be performed by an operational amplifier. Answer the following questions:

2.2.1 Draw a fully labelled operational-amplifier circuit which will function as a differentiator.

2.2.2 Draw a fully labelled operational-amplifier circuit which will function as an integrator.

(2 × 5) (10)
[20]

QUESTION 3

3.1 You are required to find a fault in an ignition system. Within the circuitry is an inverting operational amplifier which is part of a circuit which is used to amplify the input signal of +1Volt. All external connections to the operational amplifier are good and correctly connected. Voltages over the operational amplifier are as follows:

Supply: ±15 volts

Input: +1 volt

Output: +6 volts

Explain, concisely, why it is necessary to replace the operational amplifier. (5)

3.2 Most modern digital multi meters make use of the dual-slope integrating technique when measuring input voltages.

Make a neat block diagram drawing to illustrate the working of this type of analogue to digital converter. (8)

3.3 The successive approximation analogue to digital converter is preferred because of its ability to measure input voltages very fast.

Illustrate how this is achieved in only 4 steps when an input voltage of +13 volt is measured with 1 volt resolution. (7)
[20]

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QUESTION 4

4.1 Computers store large amounts of data in hard disk drives. When multiple disk drives are connected to a computer either radial interfacing or daisy chain interfacing can be used.

4.1.1 Draw a small block diagram to illustrate how radial interfacing on 3 external disk drives is done.

4.1.2 Draw a small block diagram to illustrate how daisy chain interfacing on 3 external disk drives is done.

(2 × 4) (8)

4.2 PROGRAMMING INSTRUCTION PROCEDURE

The following instruction set is available:

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

Note the following specific 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: BAAA (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 are negative. (NOTE: NEGATIVE)
- The correct delimiter must be used after delivering the output so that memory use is limited to program lines.

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

Operand r is stored in address F1B1
Operand s is stored in address F1B2
Operand t is stored in address F1B3
Operand u is stored in address F1B4 – and so on.

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 = v(t - u) (8)

4.3 Briefly describe the RS-232 protocol when transmitting data between computers and also other peripheral devices. (4)
[20]

QUESTION 5

5.1 Initially two types of micro-processor architecture were developed.

Concisely explain the major differences between Von Neumann computer architecture and Harvard computer architecture. (5 × 2) (10)

5.2 Draw a fully labelled block diagram of an 8-bit or 16-bit Von Neumann-architecture microprocessor. (NOT A COMPUTER BLOCK DIAGRAM).

Name the manufacturer and identify the microprocessor by name or by model number. (10)
[20]

TOTAL: 100

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