higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

STORED PROGRAMME SYSTEMS
NQF LEVEL 3

(10040103)

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09:00–12:00

This question paper consists of 5 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
STORED PROGRAMME SYSTEMS
NQF LEVEL 3
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 FULLY labelled IEC symbols when drawing electrical-related circuits.
6. Use FULLY labelled virtual symbols when writing PLC code.
7. Use only a black or blue pen.
8. Write neatly and legibly.

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QUESTION 1

1.1 List the FOUR forms of control that can be used in automation control. (4)

1.2 Explain how software control is used in an automated mechatronic application. (1)

1.3 Draw a fully labelled block diagram that represents a programmable logic controller's CPU. (6)

1.4 Explain the difference between *a programmable logic controller* and *hard-wired controller*. (2 × 2) (4)

[15]

QUESTION 2

2.1 Explain the function of a sensor in an automated controlled application. (2)

2.2 Show by means of a fully labelled IEC drawing how three-wire (NO) inductive proximity sensors are connected to a PLC unit. (3)

2.3 Explain, with the aid of drawings, the difference between the output of an *analogue sensor* and that of a *binary sensor*. (6)

2.4 Write down what sensor type to use to detect the following:

2.4.1 Pressure in a pipe

2.4.2 Coloured work pieces

2.4.3 To determine whether a safety gate is open or closed

2.4.4 A metal work piece

(4 × 1) (4)

2.5 Draw fully labelled IEC symbols of the following sensors:

2.5.1 Two-wire pressure sensor

2.5.2 Three-wire proximity sensor

(2 × 2) (4)

2.6 Name ONE disadvantage of using a mechanical-type sensor. (1)

[20]

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QUESTION 3

3.1 What information can one get from a *perception drawing*? (2)

3.2 Where would one use this information? (2)

3.3 List FIVE types of field devices that can be addressed at the PLC input module. (5 × 1) (5)

3.4 List THREE types of field devices that can be addressed at the PLC output module. (3 × 1) (3)

3.5 Draw a fully labelled PLC connection/wiring diagram that enables control of the application outcomes given below. Use IEC symbols.

When the two Start buttons are activated, a green lamp goes out, a yellow light comes on, and an electric motor will turn on and run until the Stop button is activated. (8 × 1) (8)

[20]

QUESTION 4

4.1 What are the THREE base switching functions used to design a PLC-coded control application? (3 × 1) (3)

4.2 Draw the switching functions that you named in QUESTION 4.1 in ladder logic. (3 × 2) (6)

4.3 One can use either cascaded timers or sequential timers in PLC source code.

Explain, with the aid of drawings, the difference between *cascaded* and *sequential timers*. (2 × 3) (6)

4.4 Write a PLC source code using a PLC ladder to meet the following outcomes:

The two Start buttons are activated, and an electric motor will turn on and run until the Stop button is activated. (6)

4.5 List FOUR types of special relays that can be used in PLC ladder source code. (4 × 1) (4)

4.6 What are the FIVE PLC languages used in PLC control applications? (5 × 1) (5)

[30]

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QUESTION 5

5.1 List the checks that take place when a programmable logic controller does a self-diagnostic test. (4)

5.2 What is meant by the term *program maintenance*? (2)

5.3 Where could the fault be under the following red LED I/O conditions?

5.3.1 The input LED does not illuminate when a sensor is activated.

5.3.2 The output LED is illuminated, but nothing happens at the output device.

5.3.3 The expected output LED does not illuminate when the program is being executed.

(3 × 3) (9)

[15]

TOTAL: 100

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