higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

STORED PROGRAMME SYSTEMS
NQF LEVEL 4

(10040154)

1 December 2020 (X-paper)
09:00–12:00

This question paper consists of 5 pages.

169Q1N2001

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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. Diagrams should be neat and fully labelled.
5. Symbols should be drawn to the IEC standards.
6. All terminal numbering should be shown.
7. Use only a black or blue pen.
8. Write neatly and legibly.

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QUESTION 1

1.1 Signals that are generated from a measuring sensor may have an inadequate low voltage, carry noise (interference) or may generate dangerous high voltages and therefore signal conditioning maximizes the accuracy of the system.

State FIVE instances where signals can be used or applied. (5)

1.2 Data communication refers to computer-to-computer communication between two or more computer-based mechatronic systems.

Different types of communication mediums are used for data communication and one such medium is fibre-optic cables.

Give FIVE reasons why fibre-optic cables are used for communication between two or more mechatronic systems. (5)

1.3 Draw a block diagram that will show how a SCADA system can be used to monitor and control large, complex production systems using a distributed network host PC. (10)
[20]

QUESTION 2

2.1 After installing a PROFIBUS network, it needs to be commissioned and an installation compliance documentation should be submitted.

Draw up a check list that will show EIGHT steps of the commissioning process of PROFIBUS. (10)

2.2 Ethernet hardware is simple and robust and once the network has been commissioned by a certified installer the network should be trouble-free.

Name FOUR areas that should be checked on a faulty Ethernet system. (4)

2.3 The manufacturing industry requires that production systems and office information systems must be integrated to work in a computer-integrated manufacturing (CIM) system.

State FIVE advantages to the company that uses a computer-integrated manufacturing (CIM) system. (5)

2.4 Explain the acronym *ASIC*. (1)
[20]

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QUESTION 3

3.1 To serve expanding machine and industrial control system development needs, leading automation companies have created a new class of industrial controllers known as Programmable Automation Controllers.

3.1.1 Briefly explain what a PAC system is. (2)

3.1.2 State FIVE characteristics that define a PAC. (5)

3.2 Draw a diagram to show how a PAC forms the heart of the communication required for motion, process and sequence control. (5)

3.3 Draw a centralised control system that shows how all aspects of the processing are monitored and controlled from the control room by means of a PAC. All the field devices are to be connected via a communication network. (8)

[20]

QUESTION 4

4.1 Differentiate between a *schematic drawing* and a *line diagram*. (2)

4.2 Draw a block diagram that represents the flow of information in a mechatronic system. (8)

4.3 Name and briefly explain the THREE most common characteristics that are shared by mechatronic systems. (3 × 2) (6)

4.4 Mechatronic automated systems are represented by means of a graphical language in the form of integrated electrical and mechanical technical drawings that make up stored program system documentation.

Give ONE example of each of the following electro-technical drawings:

4.4.1 Location-related

4.4.2 Wiring-related

4.4.3 Function-related

(3 × 1) (3)

4.5 What is a *timing diagram*? (1)

[20]

QUESTION 5

5.1 There are common types of faults that one may encounter in a stored program system employing a PLC-controlled application.

Name THREE common types of PLC faults. (3)

5.2 Troubleshooting is to isolate and eliminate faults systematically.

Give the steps in the FIVE-step approach that can be used to perform troubleshooting on a PLC control installation. (5)

5.3 PLC output interfaces contain certain indicators that provide useful troubleshooting information.

Draw a troubleshooting flow chart that can be used to troubleshoot a PLC when an output does not energise. (12)
[20]

TOTAL: 100

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