higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MECHATRONIC SYSTEMS
NQF LEVEL 4

(6040334)

28 November 2023 (X-paper)
09:00–12:00

This question paper consists of 5 pages.

477Q1N2328

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
MECHATRONIC SYSTEMS
NQF LEVEL 4
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. Use only a black or blue pen.
5. Diagrams and symbols should be clear and neat and a pencil may be used.
6. Write neatly and legibly.

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QUESTION 1

1.1 Explain what is meant by the following terms:

1.1.1 Action plan

1.1.2 Analysis

(2 × 2) (4)

1.2 Study the following design brief and write down the words used in the brief that relate to the terms below. Write only the answer next to the question number (1.2.1–1.2.3) in the ANSWER BOOK.

DESIGN BRIEF Design a modern-looking electro-pneumatic can-opener that is not expensive to manufacture.

1.2.1 Ergonomics

1.2.2 Energy

1.2.3 Budget

(3 × 2) (6)

[10]

QUESTION 2

2.1 Explain the term *criteria*. (2)

2.2 Explain the term *designing*. (2)

2.3 Study the following design brief and answer the questions:

DESIGN BRIEF Conveyor-belt sorting system: The conveyor-belt system must be able to run in a forward direction driven by a geared DC motor, powered by 24 V DC. It must have two sorting sensors for metal and plastic workpieces, be able to sort out metal workpieces and have an electro-pneumatic ejector. Control must be achieved by a programmable logic controller (PLC).

2.3.1 Explain the process of *brainstorming* to meet the outcomes of the design brief. (2)

2.3.2 A research function is part of the design process.

State THREE main areas that should be researched for related information. (3)

2.3.3 Use the design brief given in QUESTION 2.3 to draw a spider diagram of the materials and services needed to meet the design requirements. Include the input devices, output devices, control devices and power devices. (12 × 1) (12)

2.3.4 Explain the difference between the following:

(a) Budget

(b) Manufacturing costs

(2 × 2) (4)
[25]

QUESTION 3

3.1 Explain the difference between the following types of drawings:

3.1.1 Technical drawings

3.1.2 Engineering drawings

(2 × 2) (4)

3.2 Name the THREE elements that make up an action plan and give the relevant question to be asked to determine the detail of each element. (3)

3.3 What is a time chart? (2)

3.4 State FOUR main tasks or requirements in the planning process. (4)

3.5 Name TWO types of sequence diagrams. (2)

3.6 Draw the electrical wiring diagram of the PLC that represents the design brief given in QUESTION 2.3 and the information that you developed in the spider diagram in QUESTION 2.3.3. (15)
[30]

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QUESTION 4

4.1 Name and briefly explain the THREE main commissioning activities. (3)

4.2 State FOUR types of information that are found in a systems manual. (4 × 1) (4)

4.3 Draw the following related fully labelled IEC symbols:

4.3.1 Push button (NC)

4.3.2 Indication lamp

4.3.3 Control relay

4.3.4 Inductive sensor (4 × 1) (4)

4.4 Draw a latching-type wiring diagram, using the symbols drawn by you in QUESTION 4.3. (4 × 1) (4)

[15]

QUESTION 5

5.1 Explain the black-box method of testing. (2)

5.2 State the output-input through the circuit sequence test on an electrical motor control circuit. (4 × 1) (4)

5.3 Draw up the index that you would use for the technical manual for the design task given in QUESTION 2.3. (10 × 1) (10)

5.4 Explain the difference between *dead-circuit testing* and *live-circuit testing* with regard to safety procedures. (2 × 2) (4)

[20]

TOTAL: 100

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