higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MECHATRONIC SYSTEMS
NQF LEVEL 3

(6040213)

21 November 2024 (X-paper)
09:00–12:00

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
MECHATRONIC 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. Use only a black or blue pen.
5. Write neatly and legibly.

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QUESTION 1

1.1 Name THREE types of multi-vibrators. (3 × 1) (3)

1.2 Explain the purpose of a capacitor in a multi-vibrator circuit. (1 × 2) (2)

1.3 Mono-stable multi-vibrators have only one stable state and produce a single output pulse when it is triggered externally.

Draw a labelled circuit diagram of a mono-stable multi-vibrator using transistors. (1 × 7) (7)

1.4 Electronic circuits are made with a number of electronic components including resistors, capacitors, diodes and transistors.

Explain what the function, of each of the components mentioned above are, when they are in an electronic circuit. (4 × 2) (8)

1.5 What TWO conditions will cause a thyristor to switch off? (2 × 1) (2)

[22]

QUESTION 2

2.1 Mechatronic systems contain a large variety of electrical drives.

2.1.1 Explain the main function of an electric drive. (4 × 1) (4)

2.1.2 Name FIVE advantages of electrical drives. (5 × 1) (5)

2.1.3 List FOUR applications of electric drives that are used in industry. (4 × 1) (4)

2.2 Differentiate between an electric motor and an electric drive. (2 × 2) (4)

2.3 Explain why a servo motor is better than a stepper motor. (1 × 3) (3)

[20]

QUESTION 3

3.1 Explain how a counter balance valve is used. (1 × 2) (2)

3.2 List SEVEN parameters related to the selection of a hydraulic cylinder. (7 × 1) (7)

3.3 Discuss how to work safely when assembling a hydraulic system, by identifying FIVE common safety procedures that must be followed. (1 × 5) (5)

3.4 With reference to hydraulic systems, what is the difference between *open circuit* and *closed circuit*? (2 × 2) (4)

[18]

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QUESTION 4

4.1 Control is defined as a process where a group of elements are connected together so as to govern in some or other manner the power that is delivered to an application.

4.1.1 Describe what you understand *hybrid control* to be. (1 × 2) (2)

4.1.2 What is hybrid control also known as? (1)

4.1.3 List THREE other types of control in mechatronic systems besides hybrid control. (3 × 1) (3)

4.2 Differentiate between a *pressure relief valve* and a *pressure regulator*. (3 × 2) (6)

4.3 FIGURE 1 below represents an electro-hydraulic working circuit and its control circuit.

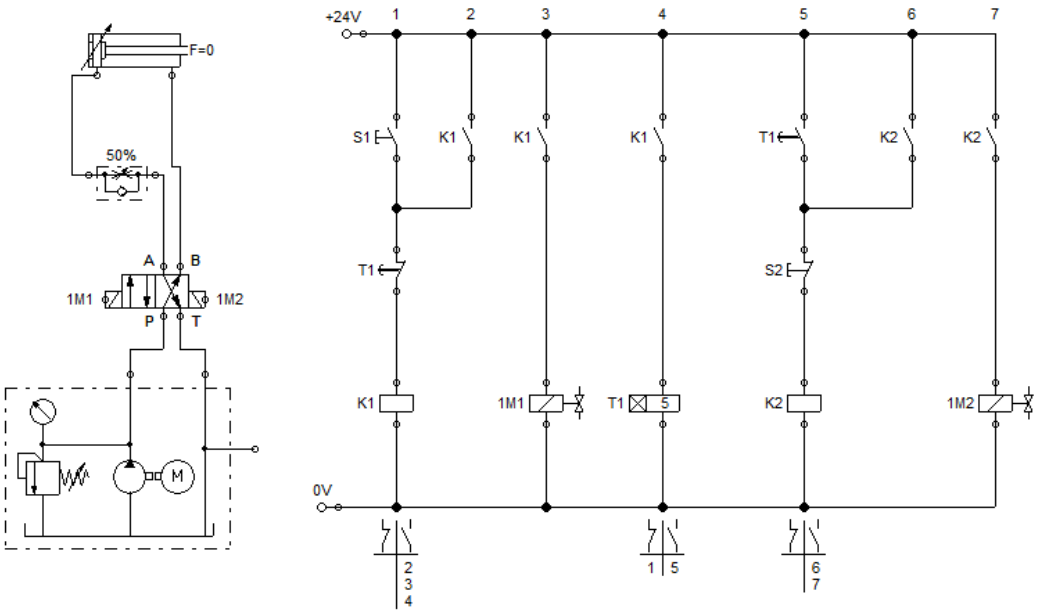

FIGURE 1

Explain the operation of the control circuit in conjunction with the working circuit in FIGURE 1 above. (1 × 8) (8)

[20]

QUESTION 5

5.1 For corrective maintenance to be effective it is necessary to have a good reporting and recording system. Describe what should be included in the report and recording documents of the following:

5.1.1 Faults (2)

5.1.2 The repairs performed (2)

5.1.3 The oil (change or replacement) (2)

5.1.4 The filters (cleaning or replacement) (2)

5.2 You have been requested to assess the condition of the hydraulic oil used in a hydraulic press and then give feedback on your findings.

Draw up a checklist using the following headings ‘Appearance, Contaminants and Possible causes’. (4 × 3) (12)

[20]

TOTAL: 100

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