

**071606T4IMT**

**INDUSTRIAL MECHATRONICS TECHNOLOGY LEVEL 6**

**ENG/OS/IMT/CR/01/6/A**

**DESIGN ELECTROMECHANICAL SYSTEMS**

**July/August 2024**



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION  
COUNCIL (TVET CDACC)**

**WRITTEN ASSESSMENT**

**TIME: 3 HOURS**

**INSTRUCTIONS TO CANDIDATE:**

1. This paper has **TWO** sections: **A** and **B**.
2. Answer **ALL** questions in section **A** and any **THREE** questions from section **B**.
3. You are provided with a separate answer booklet.
4. Marks for each question are as indicated.
5. Do not write on the question paper.

**This paper consists of FOUR (4) printed pages.**

**Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.**

**SECTION A: (40 MARKS)**

*Answer ALL the questions in this section*

1. Identify FOUR standards frequently referenced in the design of electromechanical systems. (4 marks)
2. State FOUR reasons for conducting need analysis during design process. (4 marks)
3. Identify THREE analysis done on a literature review. (3 marks)
4. Name FOUR factors to consider when selecting the right type of sensor to use in the design of electro-mechanical systems. (4 marks)
5. List TWO primary functions of industrial embedded systems in industrial automation. (2 marks)
6. Enumerate FOUR programming languages that that be used in PLC controlled systems. (4 marks)
7. Distinguish between “monitoring” and “evaluation” as used in design of electromechanical systems. (4 marks)
8. List TWO important economic and market analysis done during the design process. (2 marks)
9. Highlight THREE activities carried out during the design phase of mechatronic system. (3 marks)
10. List THREE types of information which are typically included in drawing diagrams in design of electromechanical systems. (3 marks)
11. State FOUR reasons why it is essential to document electromechanical components according to the system design specifications. (4 marks)
12. In the initial stages of the design process, it is essential to gather pertinent information related to the problem at hand. List THREE sources from which you can collect this information. (3 marks)

**SECTION B: (60 MARKS)**

Answer any **THREE** questions from this section.

13.

- a. Brainstorming is a method used by individuals or groups to generate multiple inventive ideas or solutions for a particular issue or subject. Describe FIVE brainstorming methods that can help for efficient problem-solving in design for electromechanical systems. (10 marks)
- b. Company XYZ is a manufacturer specializing in the production of proximity sensors for industrial automation. The company is committed to integrating design ergonomic principles into its product development process. Discuss FIVE aspects of ergonomics which the company should consider in its product development. (10 marks)

14.

- a. Apart from design ergonomics, explain FOUR factors taken into consideration in the design of electromechanical systems. (8 marks)
- b. Describe the following methods of testing and implementing the solution as part of the final stage of product development lifecycle. (8 marks)
  - i. prototyping;
  - ii. concurrent engineering;
  - iii. documentation;
  - iv. Patenting.
- c. Explain TWO limitations of using simulation software in the design of electromechanical systems. (4 marks)

15.

- a. A simulation is a model that mimics the operation of an existing or proposed system, providing evidence for decision-making by being able to test different scenarios or process changes. Explain FIVE advantages of using simulation as part of product life cycle development. (10 marks)
- b. You have been assigned the responsibility designing a hydraulic cylinder for industrial use. Describe FIVE technical considerations you would take into account in order to ensure optimal performance and reliability. (10 marks)

16.

- a. You have been tasked to design a helical spring for use in a final-year mechatronic project. Use a flowchart to visually depict the steps involved in the mechanical design of the spring. (10 marks)
- b. Describe FIVE essential components of a report when documenting an electromechanical system design. (10 marks)

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