

071605T4MCT

MECHATRONICS TECHNICIAN LEVEL 5

ENG/OS/MC/CR/03/5/A

Maintain Mechatronic Systems Instrumentation and Control

July/August 2023



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

**WRITTEN
TEST**

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INSTRUCTIONS TO CANDIDATES

1. This paper consists of THREE sections; **A**, **B** and **C**.
2. You are provided with a separate answer booklet.
3. Marks for each question are as indicated.
4. Do not write on the question paper.

This paper consists of SEVEN printed pages.

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

SECTION A: (20 MARKS)

Each correct answer is 1 mark.

1. What is the advantage of Instrumentation in a mechatronic system?
 - A. Greater safety of operation
 - B. Better quality of product
 - C. Greater operation economy
 - D. All of the above
2. What is entitled in Health and Safety at Work Act 1974?
 - A. Places all the responsibilities for health and safety on the employer.
 - B. Places all the responsibilities for health and safety on the employee.
 - C. Shares responsibility for healthy safety of employer and the employee.
 - D. Shares responsibility for health and safety on the employer and the government.
3. Response of a linear control system for a change in set point is called?
 - A. Frequency response
 - B. Transient response
 - C. Servo problem
 - D. Regulator problem
4. Thermal wells used in temperature measurements should have_____.
 - A. High transmissivity of radiation
 - B. Polished surface
 - C. Low emissivity
 - D. Very thick walls
5. A good technical design report in mechatronic system should be?
 - A. Readable
 - B. Accurate
 - C. Long
 - D. Comprehensive
6. OSHA was created for_____.
 - A. Data analysis
 - B. Reducing risks at work places
 - C. Preserving ecological resources
 - D. Process control in systems.
7. In instrumentation and control, measurement of parameters is important. What is the use of a thermocouple?

- A. Liquid temperatures only
 - B. Very high temperatures only
 - C. Very low temperatures only.
 - D. Both high and low temperatures
8. Which of following is a sensor or transducer?
- A. Strain
 - B. Light bulb
 - C. Thermistor
 - D. Multimeter
9. When should employees be given training on maintenance of mechatronic systems?
- A. When they are given new responsibilities at work.
 - B. During job induction
 - C. At regular intervals during their day-to-day activity
 - D. All of the above
10. Which among the following is an advanced loop system?
- A. Simple in construction & design
 - B. Good feedback response analysis
 - C. No stability errors.
 - D. Requires system re-calibration from time to time.
11. Maintenance of mechatronic system instrumentation and controls requires use of appropriate tools and equipment. What is its significance?
- A. To reduce cost.
 - B. Maximize labour.
 - C. Increase life span of the tools and effectiveness.
 - D. To show expertise in the task given.
12. What does the abbreviation PLC stand for?
- A. Proportional logic controllers
 - B. Professional logic controllers
 - C. Programmable logic controllers
 - D. Programmable locational controllers.

13. What is the importance of employing automated fault diagnoses system in a mechatronic system?
- A. To improve the efficiency of systems.
 - B. To increase the required workforce.
 - C. To improve the appearance of systems.
 - D. To improve the safety
14. What is a data acquisition system as used in the instrumentation and control system?
- A. Data processing, conversion and transmission.
 - B. It increases the sensitivity of systems
 - C. Removes noise from a control system
 - D. Reduce error in a system.
15. A good control system increases the efficiency of a system. Which one of the following is a feature of a good control system?
- A. Good appearance
 - B. Slow response
 - C. Accuracy
 - D. Sufficient power handling capa
16. Which one of the following is the main element of a closed loop control system?
- A. Sensor
 - B. Controller
 - C. Process
 - D. Feedback
17. There are many causes of breakdown in control systems. Which one of the following minimizes system breakdown?
- A. Failure to replace the worn-out parts
 - B. Non application of lubricants
 - C. Regular monitoring and inspection of systems.
 - D. Continuous system use.
18. What is a transducer?
- A. A device that generates power to the system
 - B. A device that carries out an action at the output stage of the control process.
 - C. A device that controls an error in a system.
 - D. A device that can change a signal from one form of energy into another.

19. Controller is a crucial component in the mechatronic system. Which of the following is a main component of a controller?
- A. Feedback
 - B. PLC
 - C. Output
 - D. Input
20. Maintenance of instrumentation and control systems of a mechatronic system involves dynamic calibrations. What is the significance of calibration?
- A. It checks the accuracy of instruments and it determines the traceability of the measurement.
 - B. It makes the system more attractive.
 - C. It reduces the cost of the system
 - D. It increases the life span of the system.

SECTION B: (40 MARKS)

Attempt ALL questions in this section

21. Explain the meaning of the following terms as used in instrumentation and control data analysis. (4 marks)
 - a. Accuracy
 - b. Span
22. State TWO examples of force sensors as used in system control. (2 marks)
23. Differentiate between the terms accuracy and precision as used in sensors and transducers. (4 marks)
24. State the purpose of using negative feedback in a control system. (2 marks)
25. Highlight FOUR major components of pneumatic system. (4 marks)
26. Name FOUR tools used in the maintenance and repair of electrical and control systems. (4 marks)
27. Draw a block diagram representing a closed loop system. (6 marks)
28. What is the function of an actuator in a control system? (2 marks)
29. Outline FOUR safety and precaution measures when installing or maintaining a mechatronic control system. (4 marks)
30. State FOUR importance of operation and maintenance manuals used in the mechatronic control and instrumentation systems maintenance. (4 marks)
31. Differentiate between repeatability and reproducibility as used in instrumentation. (4 marks)

SECTION C: (40 MARKS)

Attempt any TWO Questions

32.

- a. List FIVE importance of properly servicing manufacturing equipment/machines. (10 marks)
- b. Discuss the three general types of errors encountered when working with instruments. (6 marks)
- c. Differentiate between microcontroller and microprocessor used in control and instrumentation of a mechatronic system. (4 marks)

33. Compare and contrast the open loop and closed loop systems by giving advantages and disadvantages of each of them. (20 marks)

34.

- a. Explain SIX objectives of plant maintenance. (12 marks)
- b. Describe the FOUR different maintenance systems adopted to suit the various types of production and control systems. (8 marks)