

071606T4MCT

MECHATRONIC TECHNICIAN LEVEL 6

ENG/OS/MC/CR/05/6/A

Carry Out Mechatronic Programming

July/August 2023



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

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INSTRUCTIONS TO CANDIDATE:

1. This paper consists of TWO sections: **A** and **B**.
2. Answer ALL questions in sections A and B in the answer booklet provided.
3. Marks for each question are indicated in brackets.
4. Do not write on this question paper.

This paper consists of FOUR printed pages.

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

SECTION A: (40 Marks)

*Attempt **all** the questions in this section.*

1. Name THREE basic parts of a microprocessor system (3 Marks)
2. Briefly explain the difference between open architecture and closed architecture of a PLC. (2 Marks)
3. Distinguish between a machine code and a mnemonic code. (2 marks)
4. Identify FOUR basic components of a PLC system and their functions. (4 marks)
5. Differentiate between operation panel and control panel. (4 marks)
6. Identify FOUR devices that can be inputs to a PLC. (4 Marks)
7. Distinguish between volatile and non-volatile memory as used in mechatronic programming. (2 marks)
8. Differentiate between a compact and modular PLC. (2 marks)
9. Give TWO applications areas of PLC. (2 marks)
10. Give THREE programming language by the standard International Electrotechnical Commission (IEC) 6 (3 marks)
11. Highlight any THREE advantages of d system. (3 marks)
12. Convert the octal number 462 to a bin (2 marks)
13. Develop a logic gate circuit from the Boolean expression $Y = A(BC + D)$. (3 marks)
14. Explain the working principle of the following types of sensors. (4 marks)
 - a. Inductive Sensor
 - b. Capacitive sensor

SECTION B: (60 Marks)*Attempt any **three** questions in this section*

15.

- a. Explain FIVE components of assembly language programs (10 marks)
- b. Draw the ladder rungs to represent the following:
 - i. Two switches are normally open and both have to be closed for a motor to operate (3 marks)
 - ii. Either of two, normally open, switches have to be closed for a coil to be energized and operate an actuator (3 marks)
 - iii. A motor is switched on by pressing a spring-return push-button start switch, and the motor remains on until another spring-return push-button stop switch is pressed. (4 marks)

16.

- a. With the aid of a diagram explain the even open loop and closed loop types of control systems. (4 marks)
- b. There are FOUR basic steps in the o LCs. With the aid of a well labelled diagram, elaborate on the steps for a c m scan cycle. (8 marks)
- c. Design a ladder implementation for a car that considers the variables below to control the Motor (M). Also, add a second output that uses any outputs not used for motor control to start an alarm that goes Bing to warn that the keys are still in the car. (8 Marks)
 - i. Door Closed (D)
 - ii. Keys in Ignition (K)
 - iii. Motor Running (M)
 - iv. Transmission in Park (P)
 - v. Ignition start (I)

17.

- a. Define the term tag as used in PLC systems. (3 marks)
- b. Describe FOUR different types of tags used in PLC system (8 marks)
- c. There are three machines, each with its own start and stop buttons. Any two machines may run at one time (also, any one may run by itself). Each start button is to have a sealing circuit. Construct a PLC circuit with appropriate interlocking for this problem (9 Marks)

18.

- a. Programmable controllers offer several advantages over a conventional relay type of control. Highlight and explain SIX such advantages. (12 marks)
- b. A processor has basically various modes of operation. The number of different operating modes and the method of accessing them varies with the manufacturer. Highlight and discuss FOUR common operating modes. (8 marks)

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