



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

**Qualification Code : 071606T4MCT**  
**Qualification : Mechatronic Technician Level 6**  
**Unit Code : ENG/OS/MC/CR/05/6/A**  
**Unit of Competency : Carry out mechatronic programming**

**WRITTEN ASSESMENT**

**INSTRUCTIONS TO CANDIDATE:**

1. You have **TWO HOURS** to attempt all the questions.
2. Marks for each section are indicated in the brackets
3. The paper consists of **TWO** sections: **A** and **B**.
4. Attempt **ALL** questions from section **A** and **ANY THREE** questions from section **B**.
5. You are required to provide your responses on the answer booklet provided.

**SECTION A: SHORT ANSWER QUESTIONS (40 MARKS)**

*(Attempt ALL the questions from this section. Marks are indicated on each question)*

1. List **four** advantages of a PLC over relays. (4 marks)
2. Explain why ladder logic outputs are coils. (2 marks)
3. Write the equivalent Instruction List program for the Ladder Logic in Figure 1 below. (4 marks)

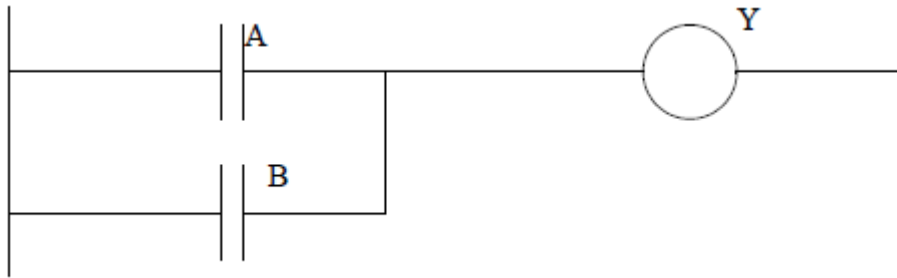


Figure 1

4. In the Figure 2 below, identify the state of the power for the output on the first rung and on the second rung. (2 marks)

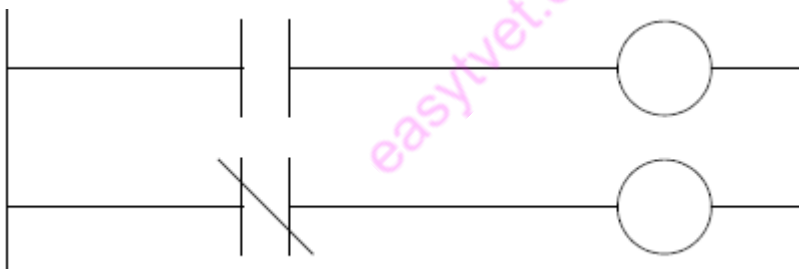


Figure 2

5. State **five** advantages of using structured design and documentation techniques on PLC. (5 marks)
6. Describe **four** tasks performed by a discrete input module. (4 marks)
7. The PLC, like all digital equipment, operates on the binary principle. Explain the binary principle. (3 marks)
8. Outline the sequence of events involved in a PLC scan cycle. (4 marks)
9. Identify **two** matrix limitations that may apply to certain PLCs. (2 marks)
10. Briefly describe each of the following PLC modes of operation: (6 marks)
  - i. Program
  - ii. Test

iii. Run

11. Explain the **two** broad categories of memory space of a typical PLC processor.

(4 marks)

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## SECTION B: EXTENDED ANSWER QUESTIONS (60 MARKS)

(Attempt **ANY THREE** questions from this section. Each question carries 20 marks)

12. Given the components on Figure 3, the following operations are expected;

- When the (Preparation) switch (X001) is turned ON, the (Ready indicator lamp) (Y000) turns ON and latched. When the (Preparation cancel) switch (X003) is turned ON, the (Ready indicator lamp) (Y000) turns OFF and unlatched.
- When the (Fan start/stop) switch is pressed while the (Ready) indicator lamp (Y000) is ON, the electromagnetic contactor for the fan (Y002) is actuated and the fan starts or stops. The wind velocity of the fan can be selected by the selector switch (X005/X006).
  - When X005 is ON: The weak wind output (Y001) is ON.
  - When X006 is ON: The strong wind output (Y003) is ON.
  - The weak and strong output are interlocked

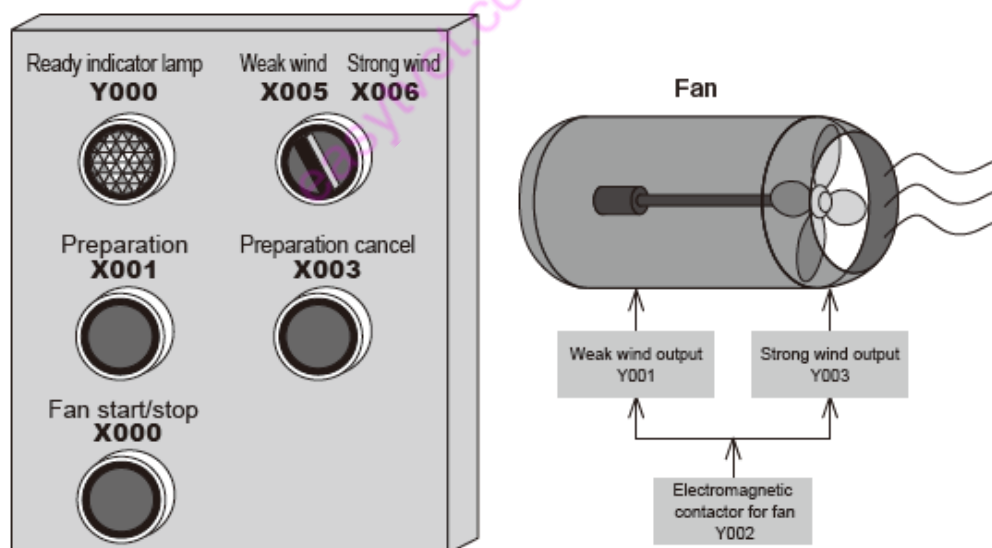


Figure 3

- i. Prepare an input correspondence table. (5 marks)
- ii. Write a ladder diagram program to accomplish the operations stated. (15 marks)

13.

- i. With the aid of a well labeled diagram, explain the circuitry of an AC input to PLC. (10 marks)
- ii. Documentation is the main guide used by everyday users, including for troubleshooting and fault finding with PLCs. Illustrate **five** items that should be included in documentation for a PLC installation. (10 marks)

14.

- i. A manager of a certain company is of the idea of programming newly obtained PLCs internally in the company. He however has no any basic knowledge on any technique to use and therefore called upon you to advice. Base your explanation on the standard International Electrotechnical Commission (IEC) 61131 techniques. (10 marks)
  - ii. A very commonly used method of programming PLCs is based on the use of ladder diagrams. Discuss **five** conventions adopted in drawing ladder diagrams. (10 marks)
15. A motor is controlled to run in forward and reverse direction by two buttons S1 and S2 respectively. The motor should run on respective direction even when the switch is released. Also, the motor should not run when both buttons are pressed.
- i. Draw the ladder diagram for this control. (11 marks)
  - ii. Write the equivalent instruction list program for the ladder diagram. (9 marks)