

071306T4EEN

**ELECTRICAL TECHNICIAN (POWER
OPTION) LEVEL 6 ENG/OS/PO/CC/03/6**

Apply

Workshop Processes

July/August 2024

Time: 3 Hours



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

WRITTEN ASSESSMENT

ANSWERS

SECTION A

1. List five tools used in Electrical work. (5 marks)

- 1. Wire Strippers**
- 2. Multimeter**
- 3. Screwdrivers (Flathead and Phillips)**

4. **Pliers (Needle-nose and Lineman's)**
5. **Voltage Tester**

2. Outline three types of Eye protectors. (3 marks)

1. **Safety Goggles:** Provide a tight seal around the eyes to protect against dust, debris, and splashes.
2. **Face Shields:** Offer full-face protection from flying particles or hazardous liquids.
3. **Safety Glasses:** Designed with impact-resistant lenses to protect against flying objects while allowing ventilation.

3. Define the term Earthing. (2 marks)

- **Earthing** is the process of connecting electrical installations to the ground to ensure safety. It provides a path for fault currents to flow safely into the earth, reducing the risk of electric shock and protecting equipment from electrical surges.

4. State four IEE regulations. (4 marks)

1. **Regulation 14:** Protection against electric shock.
2. **Regulation 16:** Requirements for earthing and bonding.
3. **Regulation 18:** Inspection and testing of electrical installations.
4. **Regulation 25:** Safety measures for working on or near live conductors.

5. Highlight five categories of Electrical tools. (5 marks)

1. **Hand Tools:** Pliers, screwdrivers, wrenches.
2. **Power Tools:** Drills, saws, grinders.
3. **Measuring Tools:** Multimeters, clamp meters, measuring tapes.
4. **Cutting Tools:** Wire cutters, cable strippers.
5. **Testing Tools:** Voltage testers, insulation resistance testers.

6. State four measuring instruments. (4 marks)

1. **Multimeter**
2. **Ammeter**
3. **Voltmeter**
4. **Oscilloscope**

7. Define the term Fire. (2 marks)

- **Fire** is a chemical reaction that occurs when a combustible material reacts with oxygen in the presence of heat, producing light, heat, and various gases. It can cause destruction and is often classified as a hazard in many environments.

8. List five Causes of fire. (5 marks)

1. **Electrical Faults:** Short circuits or overloaded circuits.
2. **Open Flames:** Candles, matches, or lighters.
3. **Flammable Materials:** Improper storage of flammable liquids or gases.
4. **Cooking Equipment:** Unattended stoves or deep fryers.
5. **Heating Devices:** Malfunctioning heaters or fireplaces.

9. Outline two methods of joining parts. (2 marks)

1. **Welding:** A process that uses high heat to melt and fuse materials together.
2. **Soldering:** A method that uses a filler metal (solder) to join components, typically used in electrical work.

10. Highlight three ways of maintaining workshop tools. (5 marks)

1. **Regular Cleaning:** Keep tools free from dust, debris, and corrosion.
2. **Proper Storage:** Store tools in designated areas to prevent damage and loss.
3. **Routine Inspections:** Check tools for wear and tear, and replace or repair as needed.

11. List five classes of fire. (3 marks)

1. **Class A:** Fires involving ordinary combustibles (wood, paper, cloth).
2. **Class B:** Fires involving flammable liquids (gasoline, oil).
3. **Class C:** Fires involving electrical equipment.
4. **Class D:** Fires involving combustible metals (magnesium, sodium).
5. **Class K:** Fires involving cooking oils and fats.

12.

a) Explain the term electrical resistivity. (2 marks)

- **Electrical resistivity** is a fundamental property of a material that quantifies how strongly it resists the flow of electric current. It is defined as the resistance of a material with a uniform cross-section and unit length when an electric field is applied. The unit of resistivity is ohm-meter ($\Omega \cdot m$), and it varies with temperature and material composition.

b) Outline the steps for troubleshooting common problems with workshop equipment. (5 marks)

1. **Identify the Problem:** Gather information on the symptoms and issues reported.
2. **Check Power Supply:** Ensure that the equipment is receiving power and that all connections are secure.
3. **Inspect Components:** Examine key components for wear, damage, or misalignment.
4. **Test Functionality:** Run diagnostic tests or operate the equipment to observe its behavior.
5. **Implement Solutions:** Make necessary repairs or adjustments based on the findings, and retest the equipment.

c) Discuss the following material properties: (9 marks)

- **i. Hardness:** Hardness refers to a material's resistance to deformation, particularly permanent deformation, scratching, or indentation. It is an important property for tools and machinery, as harder materials can withstand wear and abrasion.
- **ii. Strength:** Strength is the ability of a material to withstand an applied load without failure or plastic deformation. This property is crucial in construction and manufacturing, as it determines how much stress a material can handle before breaking.
- **iii. Ductility:** Ductility is the ability of a material to deform under tensile stress, allowing it to be stretched into wires or thin sheets without breaking. Ductile materials can absorb energy and undergo significant deformation before failure, making them suitable for various applications.

d) Calculate the resistance of an electrical conductor with a 1 mm diameter and 20 meters long, whose resistivity is $2.5 \times 10^{-8} \Omega/\text{m}$. (4 marks)

- **Formula for resistance (R):**

$$R = \frac{\rho L}{A}$$

Where:

- R = resistance (Ω)
- ρ = resistivity ($\Omega \cdot \text{m}$)
- L = length of the conductor (m)
- A = cross-sectional area (m^2)

Calculate the cross-sectional area (A):

$$A = \pi r^2 = \pi \left(\frac{d}{2}\right)^2 = \pi \left(\frac{0.001}{2}\right)^2 = \pi (0.0005)^2 \approx 7.85 \times 10^{-7} \text{ m}^2$$

Substituting values:

$$R = \frac{2.5 \times 10^{-8} \times 20}{7.85 \times 10^{-7}} \approx 0.637 \Omega$$

3.

a) Distinguish between Fuses and Circuit Breakers. (8 marks)

Feature	Fuse	Circuit Breaker
Operation	Melts and breaks the circuit when current exceeds a certain limit.	Automatically switches off the circuit when an overload occurs.
Resetting	Requires replacement after blowing.	Can be reset after tripping.
Speed	Generally faster response time.	Slightly slower response time.
Maintenance	Minimal maintenance required; replace when blown.	Requires periodic testing and maintenance.

b) Explain the high rupturing capacity fuse with a well-labeled diagram. (4 marks)

- **High Rupturing Capacity (HRC) Fuse:** These fuses are designed to handle high fault currents without breaking down. They contain a fuse element that melts under overload conditions, interrupting the circuit. The fuse body is made of materials that can withstand high temperatures and pressure from an arc during operation.
- **Diagram Explanation:**
- **Fuse Element:** The thin wire that melts during overload.
- **Ceramic Body:** Provides insulation and protection against external elements.
- **End Caps:** Connect the fuse to the circuit.

c) State four parts of a cartridge Fuse. (4 marks)

1. **Fuse Element:** The wire or strip that melts to interrupt the circuit.
2. **Body:** The enclosure that houses the fuse element, often made of glass or ceramic.
3. **End Caps:** Metal ends that connect the fuse to the circuit.
4. **Labeling:** Markings that indicate the fuse rating and specifications.

14.

a) Define the term “Safety.” (2 marks)

- **Safety** is the condition of being protected from or unlikely to cause danger, risk, or injury. It encompasses practices, precautions, and regulations designed to prevent accidents and harm in various environments.

b) Discuss four types of Safety signs. (8 marks)

1. **Warning Signs:** Indicate potential hazards (e.g., slippery floor, high voltage).
2. **Prohibition Signs:** Inform about actions that are not allowed (e.g., no smoking, no entry).
3. **Mandatory Signs:** Specify actions that must be taken (e.g., wear gloves, hard hats required).
4. **Emergency Signs:** Provide information about emergency procedures (e.g., exit routes, fire extinguisher locations).

c) Explain five safety working habits. (10 marks)

1. **Always Wear PPE:** Use personal protective equipment like gloves, helmets, and goggles.
2. **Keep Work Areas Clean:** Maintain a tidy workspace to prevent accidents and hazards.
3. **Follow Procedures:** Adhere to established safety protocols and operational procedures.
4. **Report Hazards:** Immediately report any unsafe conditions or equipment malfunctions.
5. **Stay Focused:** Avoid distractions and stay attentive while working to prevent mistakes.

15.

a) Explain the function of an engineer's file. (2 marks)

- An **engineer's file** is a hand tool used for shaping, smoothing, and finishing materials, particularly metals. It consists of a hardened steel bar with a series of ridges or grooves that cut into the material, allowing for precise control over the shaping process.

b) Distinguish between precision steel rule and Center punch. (4 marks)

Feature	Precision Steel Rule	Center Punch
Function	Used for measuring lengths and dimensions accurately.	Used to create a small indentation to guide drilling.
Design	Flat, straight metal strip with measurement markings.	Pointed tip for marking, often with a handle.
Usage	Primarily for measuring and layout work.	Used to prevent drill bit slipping.

c) Discuss five safety precautions in the workshop. (10 marks)

1. **Use Tools Properly:** Always use tools according to their intended purpose and follow operating instructions.
2. **Maintain Equipment:** Regularly inspect and maintain tools and machinery to ensure they are in good working condition.
3. **Store Tools Safely:** Keep tools organized and stored properly to prevent accidents and injuries.

4. **Practice Good Housekeeping:** Keep the workshop clean and free of clutter to minimize hazards.
5. **Be Aware of Surroundings:** Stay alert to the activities of others and potential hazards in the workshop environment.

d) Explain two importance of maintenance of electrical equipment. (4 marks)

1. **Safety:** Regular maintenance helps identify and rectify potential hazards, reducing the risk of electrical fires and accidents.
2. **Efficiency:** Properly maintained equipment operates more efficiently, leading to lower energy consumption and extended service life

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