

071305T4EIN

ELECTRICAL INSTALLATION

LEVEL 5 ENG/OS/EI/CR/03/5

**Perform Testing of Electrical
Installation July/August 2024**

Time: 3 Hours



TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION

COUNCIL (TVET CDACC)

WRITTEN ASSESSMENT

Answers

SECTION A (40 MARKS)

1. Parts Exempt from Earth Connection:

- Double insulated equipment.
- Non-metallic enclosures.

2. How Earthing Provides Protection:

- It prevents electric shock by providing a low-resistance path for fault currents to flow to the ground, reducing the risk of electric shock.
- It helps in the operation of protective devices (like circuit breakers) by ensuring that fault currents are high enough to trip the device quickly.

3. Reasons for Testing New Electrical Installations:

- To ensure compliance with safety regulations and standards.

- To verify the integrity of the installation.
- To detect any potential faults or issues before use.
- To provide documentation for future reference and maintenance.

4. **Items for Visual Inspection Before Testing:**

- Condition of wiring and insulation.
- Proper labeling of circuits and equipment.
- Integrity of protective devices (fuses, circuit breakers).
- Secure mounting of electrical equipment and enclosures.

5. **Effects of Sustained Overloading:**

- Overheating of wiring can lead to insulation failure, resulting in short circuits or electrical fires.
- Damage to connected equipment due to excessive current flow.

6. **Earth Fault Loop Resistance Calculation:** a) Maximum allowed resistance (RR) can be calculated using Ohm's Law: $R = \frac{V}{I} = \frac{240V}{50A} = 4.8 \Omega$ $R = \frac{V}{I} = \frac{50A}{240V} = 4.8 \Omega$

b) If the recorded value exceeds this, it indicates inadequate earthing, which could lead to unsafe conditions and failure of protective devices.

7. **Uses of a Digital Oscilloscope:**

- To visualize and analyze waveforms in electrical circuits, allowing for the identification of signal distortions and anomalies.
- To measure voltage levels and frequency of electrical signals accurately.

8. **Color Coding Scheme Used in Kenya:**

- Live: Brown
- Neutral: Blue
- Earth: Green/Yellow stripes

9. **Importance of Documentation of Electrical Installation Inspection:**

- Provides a record of compliance with safety standards.
- Assists in future maintenance and troubleshooting.
- Helps in verifying that installations meet regulatory requirements.
- Facilitates accountability and traceability in installation practices.

10. **Methods of Disposing Electrical Waste:**

- Recycling of electronic components.
- Donation of functioning appliances to charities.

- Disposal at designated e-waste collection points.
- Safe landfill disposal according to local regulations.
- Incineration in controlled facilities for non-recyclable materials.

SECTION B (60 MARKS)

11. a) Types of Tests Conducted on Electrical Installations:

- Insulation resistance test.
- Continuity test.
- Earth fault loop impedance test.
- Polarity test.

b) Reasons for Conducting Each Test:

- **Insulation Resistance Test:** To ensure that insulation is intact and prevents leakage currents.
- **Continuity Test:** To verify that all connections in the circuit are secure and that there are no breaks.
- **Earth Fault Loop Impedance Test:** To ensure that the earthing system is effective and can safely clear faults.
- **Polarity Test:** To confirm that the live and neutral connections are correctly wired.

c) Typical Satisfactory Results for Each Test:

- **Insulation Resistance Test:** Should be greater than 1 M Ω .
- **Continuity Test:** Resistance should be less than 1 Ω for circuit connections.
- **Earth Fault Loop Impedance Test:** Should be less than the calculated maximum allowable resistance.
- **Polarity Test:** Should show correct polarity in all circuits.

12. a) Safe Working Procedures: (i) Your Own Safety:

- Always wear appropriate personal protective equipment (PPE).
- Ensure tools are insulated and in good condition.

(ii) Safety of Others:

- Maintain a safe working distance from live circuits.
- Use barriers or warning signs to keep unauthorized personnel away.

(iii) Systems/Equipment:

- Regularly inspect and maintain tools and equipment.
- De-energize systems before working on them.

b) **Insulation Resistance Tests to Locate Fault:**

- **Insulation Resistance Test:** Measure the resistance between live conductors and earth to identify low-resistance faults.
 - **Continuity Test:** Check continuity of the neutral and earth conductors to locate the fault.
13. a) i. **Reason for Electrocution:** The damp cloth created a conductive path, allowing current to flow even when the lamp was switched off.
- ii. **Rectification:** Disconnect the lamp from the power source before cleaning it.
- iii. **Solution:** Implement a practice of always disconnecting electrical appliances from the socket before cleaning or servicing.

b) **Equipment/Instruments Used in Electrical Installation Tests:**

- Multimeter.
- Insulation resistance tester.
- Earth fault loop impedance tester.

c) **IEE Regulations Requirements for Final Circuits:**

- Circuit protection must be provided (fuses or circuit breakers).
- Proper labeling of circuits must be done.
- Adequate cable sizing to prevent overheating.
- Compliance with earthing and bonding requirements.

14. a) **Sequence of Electrical Tests:**

- Visual inspection of the installation.
- Continuity tests of conductors.
- Insulation resistance tests.
- Polarity tests.
- Earth fault loop impedance tests.
- Functional tests of circuits and equipment.

b) **Procedure for Carrying Out a Continuity Test:**

- Disconnect the circuit from any power source.
- Use a multimeter set to measure resistance.
- Connect the probes to the ends of the circuit conductors.
- Observe the reading; a low resistance indicates continuity, while infinite resistance indicates a break in the circuit.

