

MODULE III

ELECTRICAL ENGINEERING LEVEL 5, LEVEL 6

ENG/OS/EI/CC/01/5/MA

Apply Basic Electrical Principles

March/April 2026



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

WRITTEN ASSESSMENT

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of **TWO** sections: **A** and **B**.
2. Answer **ALL** questions in section A and **ANY THREE** (3) questions in section B.
3. Marks for each question are indicated in the brackets.
4. Candidates are provided with a separate answer booklet
5. Do not write on the question paper.

This paper consists of SIX (6) printed pages

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

SECTION A (40 MARKS)

Answer ALL questions in this section

1. SI units are essential in the standardization of electrical quantities. Define the following terms and state their SI unit:
 - a) Electrical power;
 - b) Electrical current. (4 marks)
2. A resistor opposes the flow of current in a circuit. State FOUR factors which affects the resistance of a conductor. (4 marks)
3. While boiling water, a purely resistive electrical heater is connected to 240VAC. An electric current of 11 A flows through it. If the conducting wires have negligible resistance, calculate the resistance of the heater. (4 marks)
4. Electrical instruments are used to measure, test, analyze, and troubleshoot electrical parameters in circuits and systems. List TWO electrical instruments used to measure current in an electric circuit. (2 marks)
5. In an electrical experiment a charge of 240 Coulombs is transferred in 2 minutes in an electric circuit, determine the amount of current flowing through it. (3 marks)
6. Capacitors are widely used in domestic and industrial electrical systems. State TWO applications of capacitors. (2 marks)
7. Capacitance is the ability of a component to store electrical energy in an electric field. State TWO factors that affect the capacitance of a parallel plate capacitor. (2 marks)
8. Ohm's law is essential in analysis of electrical and electronic circuits. State ohm's law. (2 marks)
9. As a technician, you are to install one hundred LED lamps to illuminate the upcoming Talanta stadium. Each lamp has a power rating of 20W and operates at 240V. If the lamps are to be operated for 10 hours, determine the total energy consumed in kilowatt-hours (kWh). (4 marks)
10. The Leclanché cell was invented by French engineer Georges Leclanché in 1866, it was the forerunner of the modern zinc-carbon battery and represented a major advancement in portable electrical power. Draw a labelled diagram of a Leclanché cell. (4 marks)
11. In an industrial setting, engineers must choose materials for machinery based on whether they are magnetic or non-magnetic. Differentiate between magnetic and non-magnetic materials,

giving two examples of each. (4 marks)

12. Magnetic field lines are imaginary lines that map how a magnetic force would act on a magnetic pole placed in the field. Explain TWO properties of magnetic field lines. (2 marks)

13. Proper battery care increases service life and reliability. State THREE battery maintenance practices. (3 marks)

SECTION B (60 MARKS)

Answer any THREE (3) questions in this section.

14.

- a) Kirchhoff's laws are fundamental principles in electrical circuits that describe the flow of current and voltage in a network of components. State Kirchhoff's laws. (4 marks)
- b) Figure 1 shows an electric circuit. Determine the branch currents in the circuit using the Kirchhoff's current law. (10 marks)

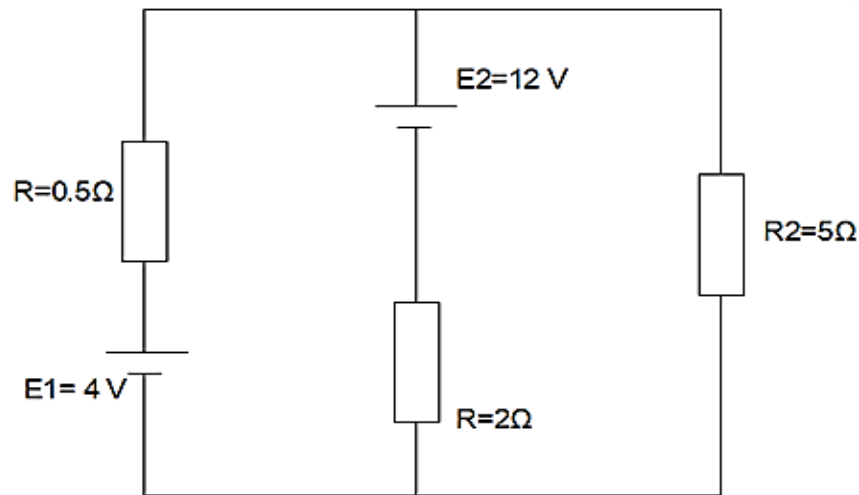


Figure 1

- c) The resistance of a copper wire, 40m in length and having a resistivity of $0.002 \times 10^{-6} \Omega\text{m}$ is 0.25Ω . Determine the radius of the wire. (4 marks)
- d) In measurement systems, pressure transducers are commonly used to convert physical pressure into an electrical signal. List TWO types of pressure transducers. (2 marks)

15.

- a) During a class on electromagnetism, the trainer discusses how certain fundamental laws help explain the behavior of electric and magnetic fields. State the following laws as used in electromagnetism:
 - i. Faraday's Law;
 - ii. Lenz's law. (4 marks)
- b) A flux of 25 mWb links with a 1500 turn coil when a current of 3A passes through the coil. Calculate the:
 - i. inductance of the coil;
 - ii. energy stored in the magnetic field;
 - iii. average e.m.f. induced if the current falls to zero in 150 ms. (6 marks)
- c) A 20 Ω resistor is connected in parallel with an inductance of 2.387 mH across a 60V, 1 kHz supply. Calculate the:
 - i. supply current;
 - ii. circuit phase angle;
 - iii. the circuit impedance;
 - iv. power consumed. (8 marks)
- d) In an electronics workshop, students are learning about different components used in electrical circuits. List TWO types of passive network components. (2 marks)

16.

- a) In electrochemical power sources, cells are classified as primary and secondary based on their reusability. Differentiate between primary and secondary cells, giving appropriate examples of each. (4 marks)
- b) A cell with an e.m.f. of 2.0 V and an internal resistance of 0.4 Ω supplies current to a 4 Ω external resistor. Calculate the:
 - i. Current;
 - ii. Terminal voltage;
 - iii. power delivered to the resistor. (6 marks)
- c) Electrical Engineering students are preparing to recharge a set of secondary cells for their robotics project. Explain THREE safety precautions to be taken when charging secondary cells. (6 marks)

- d) Ten 1.5 V cells, each having an internal resistance of 0.1Ω each are connected in series to a load of 14Ω . Determine the:
- Current flowing in the circuit;
 - Potential difference at the battery terminals. (4 marks)

17.

- a) Two capacitors are connected in series to a 110 d.c supply. If the capacitors are of capacitance $10\mu\text{F}$ and $100\mu\text{F}$, determine the:
- Total capacitance;
 - Charge in the circuit;
 - Energy stored by the $100\mu\text{F}$ capacitor. (6 marks)
- b) A technician demonstrated a capacitor with a dielectric between its plates. State FOUR properties of dielectrics. (4 marks)
- c) Table 1 shows the comparison between moving coil and moving iron measuring instruments. Copy and complete the table. (4 marks)

Table 1

Instrument characteristics	Moving coil	Moving iron
Suitable for measuring		Dc and ac currents and voltages
Scale		Non linear
Method of control	Hair springs	
Method of damping	Eddy current damping	
Frequency limits		20-200HZ

- d) With aid of a labelled diagram, explain the operation of an attraction type moving iron instrument. (6 marks)