

061906T4TEL

TELECOMMUNICATION ENGINEERING LEVEL 6

ENG/OS/TLE/CC/02/6

Apply Electrical Principles

March/April 2026



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

WRITTEN ASSESSMENT

Time: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. The 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 as indicated in the brackets.
4. Candidates are provided with a separate answer booklet.
5. Do not write on the question paper.

This paper consists FIVE (5) 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. Quantities are measured in SI units. State the SI units of the following electrical quantities: (4 Marks)
 - i. Charge
 - ii. Current
 - iii. Capacitance
 - iv. Inductance
2. Flow of electric current in a conductor causes electric effects. State THREE effects of electric current. (3 Marks)
3. Aluminium and Copper are commonly used conductors. List THREE advantages of aluminium conductor over copper conductor of similar cross section area. (3 Marks)
4. Some copper wire has a resistance of $200\ \Omega$ at 20°C . A current is passed through the wire and the temperature rises to 90°C . Determine the resistance of the wire at 90°C , correct to the nearest ohm, assuming that the temperature coefficient of resistance is $0.004/^{\circ}\text{C}$ at 0°C . (4 Marks)
5. An immersion heater is connected to 240V AC supply. An electric current of 10 A flows through it. If the conducting wires have negligible resistance, calculate the resistance of the heater. (2 Marks)
6. Faraday's laws govern electromagnetic phenomenon. State TWO Faraday's laws as applied in electromagnetic induction. (2 Marks)
7. Power in AC circuits are of different types. State THREE types of AC power. (3 Marks)
8. Resistance is the measure of a conductor's opposition to flow of electric current. State FOUR factors affecting resistance of a conductor. (4 Marks)
9. Circuit elements are connected in parallel or series arrangement. List THREE advantages of parallel connection over series connection in electric circuits. (3 Marks)
10. AC power supply has different quantities. Define the following quantities as used in AC power supply. (4 Marks)
 - i. rms value
 - ii. Peak value
 - iii. Average value
 - iv. Impedance

11. The capacitance of a parallel plate capacitor depends on several factors. State TWO factors that affect the capacitance of a parallel-plate capacitor. (2 Marks)
12. A transformer is a static electrical device that transfers electrical energy from one circuit to another by electromagnetic induction at the same frequency. State THREE functions of a transformer. (3 Marks)
13. A moving-coil instrument gives a full scale deflection when the current is 40mA and its resistance is 25 ohms. Calculate the value of the shunt to be connected in parallel with the meter to enable it to be used as an ammeter for measuring currents up to 50A. (3 Marks)

SECTION B: (60 MARKS)*Answer any THREE questions in this section*

14.

- a) Power factor correction is essential in power distribution networks. Explain FIVE benefits of power factor correction in a power distribution system. (10 Marks)
- b) An industrial load consumes 100 kW at a power factor of 0.75 lagging from a 415 V, 50 Hz, three-phase supply. (10 Marks)
- Determine the initial line current.
 - Calculate the reactive power (kVAR) drawn by the load.
 - Find the kVAR rating of the capacitor bank required to improve the power factor to 0.95 lagging.
 - Determine the new line current after power factor correction.

15.

- a) A series RLC circuit has the following parameters: $R = 20 \, \Omega$, $L = 0.5 \, \text{H}$, $C = 100 \, \mu\text{F}$, DC supply voltage, $V = 50 \, \text{V}$. The switch is closed at time $t = 0$. (12 Marks)
- Determine the type of transient response of the circuit.
 - Calculate the damped angular frequency.
 - Obtain the expression for current growth $i(t)$.
 - Determine the current at $t = 0.1 \, \text{s}$.
- b) DC motors have industrial advantages over AC motors. Describe FOUR advantages of DC motor over AC motors. (8 Marks)

16. A balanced three-phase, 415 V, 50 Hz supply feeds three identical impedances, each having a resistance of $20 \, \Omega$ and an inductive reactance of $15 \, \Omega$.

- a) When the load is connected in Star (Y), determine: (13 Marks)
- Phase impedance
 - Phase current
 - Line current
 - Power factor
 - Total power absorbed
- b) If the same load is reconnected in Delta (Δ), determine; (7 Marks)
- Phase current

- ii. Line current
- iii. Total power absorbed

17. Maxwell's equations form the basis for analysis of any electromagnetic phenomena.

- a) Outline Maxwell's FOUR equations in differential form. (8 Marks)
- b) Explain TWO ways in which Maxwell's equations predict the existence of electromagnetic waves. (6 Marks)
- c) Using Maxwell's equations, derive the expression for the velocity of electromagnetic waves in free space. (6 Marks)