

071306T4EEN

Electrical Engineering (Power Option) Level 6

ENG/OS/PO/CC/02/6

Apply Electrical Principles

July/August 2024

Time: 3 Hours



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

WRITTEN ASSESSMENT

3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of **TWO** sections **A** and **B**.
2. Answer **ALL** questions in section **A** and **THREE** questions in section **B** in the booklet provided.
3. Marks for each question are indicated in the brackets.
4. Do not write on this question paper.
5. Answer the questions in **English**.

This paper consists of FOUR (4) printed pages.

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

SECTION A (40 Marks)

Answer ALL questions in this section.

1. A current of 0.5A transfers 80 coulombs of charge. Calculate the time for which the current flowed. (3 marks)
2. Three resistors 10Ω , 20Ω and 30Ω are connected in two ways. Calculate the total resistance in;
 - a) Series (3 marks)
 - b) Parallel (3 marks)
3. A 100V battery is connected across a resistor and causes a current of 5mA to flow. Calculate the resistance of the resistor. If the voltage is now reduced to 25V, what will be the new value of the current flowing. (4 marks)
4. A battery of electromotive force (emf) 6V has an internal resistance of 0.15Ω . Calculate its terminal potential difference (p.d) when delivering a current of:
 - a) 0.5A; (2 marks)
 - b) 2A; (2 marks)
 - c) 10A. (2 marks)
5. Rectifying armature reaction in motors is crucial for efficient motor operations. State **two** methods of rectifying armature reaction in motors. (2 marks)
6. Kirchhoff's laws are fundamental principles used to analyze voltages and current in DC circuits. State Kirchhoff's current and voltage laws. (4 marks)
7. The variation in resistance with temperature in conductors and semiconductors exhibits distinct behaviours due to their electronic properties. Differentiate variation in resistance with temperature in conductors and semiconductors. (4 marks)
8. The basic quantities in electrical engineering serves as building blocks for understanding and measuring various phenomena. State **four** basic quantities used in engineering and science and indicate their corresponding SI units. (4 marks)
9. Single-phase electrical machines are widely used in residential and industrial applications which are typically powered by single-phase AC power sources. List **five** types of Single phase machines which can be found in a training workshop. (5 marks)
10. Most power system installations in both domestic and industrial are connected in parallel. Explain why lights in power systems are connect in parallel. (4 marks)

SECTION B (60 marks)

Answer **three** questions in this section.

11. (a) A moving coil meter is rated $10 \text{ k}\Omega/\text{V}$. The coil has a resistance of 50Ω . Calculate the value of multiplier required for: (6 marks)
- The 10V d.c. range;
 - The 10V a.c. range. (6 marks)
- (b) You are asked by your technical supervisor to carry out maintenance of the company earthing system.
- List **three** components of an earthing system. (3 marks)
 - Outline the procedure you would use to carry out 'insulation resistance test'. (5 marks)
12. (a) The resistance of the field winding of a shunt generator is 200Ω . When the machine is delivering 80kW the generated emf and terminal voltage are 475V and 450V respectively. Calculate:
- The armature resistance; (6 marks)
 - The value of generated e.m.f when the output is 50kW , the terminal voltage then being 460V . (6 marks)
- (b) Classify D.C machines according to methods of excitation. (8 marks)
13. (a) List **three** methods of power factor correction. (3 marks)
- (a) A coil of resistance 5Ω and inductance 120mH in series with a $100\mu\text{F}$ capacitor, is connected to a 300V , 50 Hz supply. Calculate the current flowing in the circuit. (6 marks)
- (c) In the network shown in figure 1, find using Thevenin's theorem the current flowing in the 10Ω resistor. (11 marks)

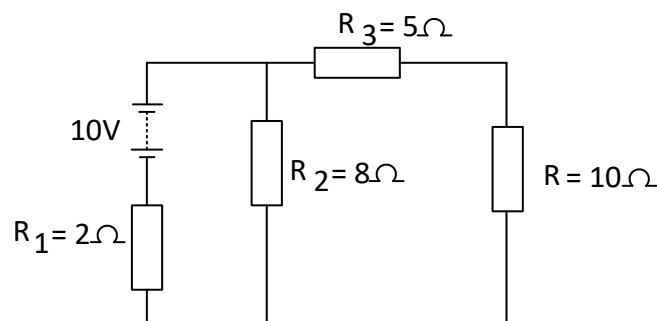


Figure 1.

14. (a) Define the term 'lightning arrester' and explain **five** types of lightning arrestors.

(10 marks)

(b) A series motor has an armature resistance of 0.2Ω and a series field resistance of 0.3Ω . It is connected to a 240V supply and at a particular load runs at 1440 r.p.m when drawing 15 A from the supply.

i. Determine the back e.m.f at this load. (4 marks)

ii. Calculate the speed of motor when the load is changed such that the current is increased to 30A (assume that this causes a doubling of flux). (6 marks)

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