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

Qualification Code **:** **071606T4MCT**

Qualification **:** **Mechatronics Technician Level 6**

Unit Code **:** **ENG/OS/MC/CC/04/6**

Unit of Competency **:** **Apply Electrical and Electronics Principles**

INSTRUCTIONS TO CANDIDATE

1. You have **THREE** hours to answer all the questions.
2. Marks for each question are indicated in the brackets.
3. The paper consists of **TWO** sections: A and B.
4. Do not write on the question paper.
5. A separate answer booklet will be provided.

SECTION A: SHORT ANSWER QUESTIONS (40 MARKS)

Attempt ALL questions in this section.

1. A charge of 35 mC is transferred between two points in a circuit in a time of 20 ms. Calculate the value of current flowing. (3 Marks)

2. A 10Ω resistor, a 20Ω resistor and a 30Ω resistor are connected (a) in series, and then (b) in parallel with each other. Calculate the total resistance for each of the two connections

   (6 Marks)

3. A current of 5.5 mA flows through a $33k\Omega$ resistor. Calculate the p.d. thus developed across it. (3 Marks)

4. A battery of emf 6 V has an internal resistance of 0.15Ω. Calculate its terminal p.d. when delivering a current of (a) 0.5 A, (b) 2 A, and (c) 10 A. (6 Marks)

5. A current of 200 mA flows through a resistance of 750Ω for a time of 5 minutes. Calculate (a) the p.d. developed, and (b) the energy dissipated. (4 Marks)

6. The resistance of a sample of material depends upon four factors. Which are these factors?

   (3 Marks)

7. There are various basic quantities and their SI units as used in engineering and science. State four of these basic quantities and give its corresponding SI units? (4 Marks)

8. Determine using Kirchoff's Laws, each branch current for the network shown: (6 Marks)
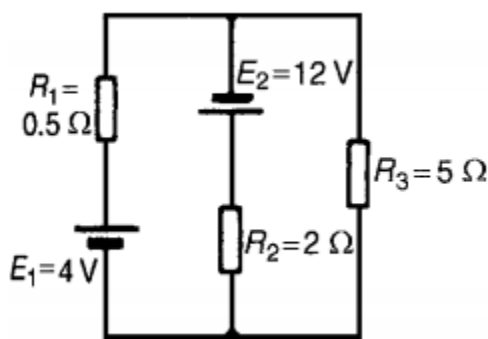
9. Modern mechatronics systems are fitted with power protection devices. State three of these devices. (3 Marks)

10. Differentiate between an electric motor and a generator. (2 Marks).

SECTION B: EXTENDED ANSWER QUESTIONS (60 MARKS)

Attempt ANY THREE questions in this section.

11. **i).** A moving coil meter has a figure of merit of 10 kΩ / V. The coil has a resistance of 50Ω. Calculate the value of multiplier required for

   (a) the 10 V d.c. range,

   (b) the 10 V a.c. range.   (12 Marks)

   ii). You are asked by your technical supervisor to carry out maintenance of the company earthing system. Briefly explain by *'earthing'* and describe *any three* components of an earthing system.   (8 Marks)

12. **i).** The resistance of the field winding of a shunt generator is 200Ω. When the machine is delivering 80 kW the generated emf and terminal voltage are 475 V and 450 V respectively. Calculate

   (a) the armature resistance, and   (4 marks)

   (b) the value of generated emf when the output is 50 kW, the terminal voltage then being 460 V.   (12 Marks)

ii) Give any two differences between a series-wound dc motor and a shunt wound dc motor.

(4marks)

iii). List any four applications where you can use a shunt dc motor.   (4marks)

13.

   a) With the aid of a diagram briefly describe bridge rectification with pie filter   (10 Marks)

   b) In the network shown in figure 1, find using thevenin's theorem the current following in the 10 Ω resistor.   (10 marks)

14. A 415V three phase, 50Hz, 4 pole star connected induction motor runs at 24rev/s on full load. The rotor resistance and reactance per phase are 0.35Ω and 3.5Ω respectively and the effective rotor stator turns ratio is 0.85:1. Determine;

   i. The synchronous speed
  ii. The slip
 iii. The full load torques
  iv. Output power, including friction losses,
   v. The maximum torque   (20 marks)