



**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

WRITTEN ASSESSMENT

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 [40MARKS]

Attempt **ALL** questions from this section.

1. List four factors that affect resistance of an electrical conductor. (4 marks)
2. When a current flows in a resistive circuit, power is dissipated. Name two electrical measuring equipment used to calculate of power dissipated. (2 marks)
3. A filament lamp drawing a current of 3 Amperes is observed to get hot when touched. Show the amount of electrical energy dissipated when it is switched on for 2hours if the resistance of the filament is 80Ω (5 marks)
4. A charge of 300 Coulombs is to be transferred from a capacitor in 2 minutes. What is the current flowing? (4 marks)
5. A technician lifts oil jerrican of 20N through a height of 2metres. What is the total work done by the technician? (4 marks)
6. One method of protecting against lightning strikes is by erecting lightening arresters. List three main parts of a lightening arresters. (3 marks)
7. What is the main reason behind connecting lamps in parallel? (2 marks)
8. An electrical technician connected two resistances R_1 and R_2 in series as shown in **fig.1** and measured the cumulative total resistance R_T . What was his observation? (2 marks)

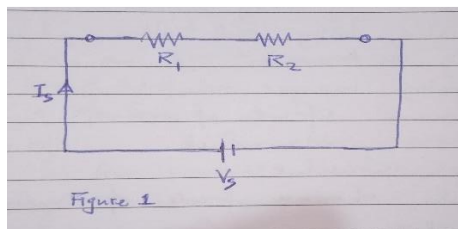


Figure 1

9. The armature of a DC generator has a resistance of 0.5Ω . If a voltage of 200V causes a current of 30A to flow. Calculate the generated voltage. (5 marks)

10. An electrical technician wanted to construct a smoothing circuit for a power supply. List any four types of smoothing circuits. (4 marks)
11. An electric single phase induction motor driving a posho mill was abnormally getting hot. Give four reasons for that. (4 marks)
12. A smoothing circuit must be used in the last stage of power supply construction. List its importance. (2 marks)

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SECTION B: EXTENDED ANSWER QUESTIONS [60MARKS]

Attempt any **THREE** questions from this section.

13. a) The rotor of a squirrel cage induction motor is skewed. Give three reasons why it is done.

(6 Marks)

- (b) A water pump is driven by 440-V, 3- ϕ , 50-Hz, 4-pole, Y-connected induction motor which has a full-load speed of 1425 rpm. The rotor has an impedance of $(0.4 + j4)$ ohm and rotor/stator turn ratio of 0.8. Calculate:

- (i) Full-load torque;
- (ii) Rotor current and full-load rotor Cu loss;
- (iii) Power output if windage and friction losses amount to 500 W;
- (iv) Maximum torque and the speed at which it occurs;
- (v) Starting current;
- (vi) Starting torque.

(14 Marks)

14. A student asked an electrical engineer at **Jamji Power Station** why they connect alternators in parallel. Explain three reason he might have given. (6 Marks)

Two generators used in olkaria Power station A and B operate in parallel and supply a load of 10 MW at 0.8 p.f. lagging.

- i. By adjusting steam supply of A, its power output is adjusted to 6,000 kW and by changing its excitation, its p.f. is adjusted to 0.92 lag. Find the p.f. of generator B. (7marks)
- ii. If steam supply of both machines is left unchanged, but excitation of B is reduced so that its p.f. becomes 0.92 lead, find new p.f. of A

(7 Marks)

15. a). A three-phase synchronous motor is an example of a synchronous machine. Explain any four unique features associated with it. (8marks)

b). A synchronous motor absorbing 60 kW is connected in parallel with a factory load of 240kW having a lagging p.f. of 0.8. If the combined load has a p.f. of 0.9,

- (i) What is the value of the leading kVAR supplied by the motor?
- (ii) At what p.f. is it working.

(12 Marks)

16.

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

(4 Marks)

- b) List any four applications where you can use a shunt dc motor.

(4 Marks)

- c) Routine maintenance is necessary to keep machines in good working conditions. List any two maintenances carried out on dc motors.

(2 Marks)

- d) In a tube mill factory, a 220-V, d.c. shunt motor takes 4 A at no-load when running at 700 r.p.m. The field resistance is 100 Ω . The resistance of armature at standstill gives a drop of 6 volts across armature terminals when 10 A were passed through it. Calculate:

- i. Speed on load;
- ii. Torque in N-m;
- iii. Efficiency. The normal input of the motor is 8 kW.

(10 Marks)

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