



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

Qualification Code : 071606T4MCT
Qualification : Mechatronic Technician Level 6
Unit Code : ENG/OS/MC/CC/05/6/A
Unit of Competency : Apply material science principles

WRITTEN ASSESMENT

INSTRUCTIONS TO CANDIDATE:

1. You have **TWO HOURS** to attempt all the questions.
2. Marks for each section are indicated in the brackets
3. The paper consists of **TWO** sections: **A** and **B**.
4. Attempt **ALL** questions from section **A** and **ANY THREE** questions from section **B**.
5. You are required to provide your responses on the answer booklet provided.

SECTION A: SHORT ANSWER QUESTIONS (40 MARKS)

(Attempt ALL the questions from this section. Marks are indicated on each question)

1. Differentiate between atomic structure and crystal structure. (4 Marks)
2. List **four** situations in which casting is the preferred fabrication technique. (4 Marks)
3. Name **two** thermal properties of a liquid medium that will influence its quenching effectiveness. (2 Marks)
4. Cite the **two** desirable characteristics of glasses. (2 Marks)
5. List **four** popular hardness testing techniques. (4 Marks)
6. Briefly describe the two techniques that are used for galvanic protection. (4 Marks)
7. State **three** advantages of cold working processes. (3 Marks)
8. State **three** criteria are upon which design safety factor is based. (3 Marks)
9. Identify the **five** different methods through which the purposes of heat treatment may be served. (5 Marks)
10. State **six** methods widely used for control and prevention of corrosion. (6 Marks)
11. Cite **three** reasons why engineering materials are tested by engineers. (3 Marks)

SECTION B: EXTENDED ANSWER QUESTIONS (60 MARKS)

(Attempt **ANY THREE** questions from this section. Each question carries 20 marks)

12.

- i. Discuss **five** mechanical properties of materials which are always considered in engineering works. (10 Marks)
- ii. Describe **five** major defects in a metal or an alloy that may be caused by faulty heat treatment. (10 Marks)

13.

- i. Plastic polymers are widely used in many applications. Discuss **five** properties of plastic polymers that make them widely used. (10 Marks)
- ii. Fracture can be classified as either brittle or ductile. Discuss **five** comparisons of the two. (10 Marks)

14. The atomic radius of an iron atom is $1.238 \times 10^{-10} \text{ m}$. Iron crystallizes as BCC.

- i. Define atomic packing factor (A.P.F); (1 Mark)
 - ii. Calculate the lattice parameter of the unit cell, **a**; (3 Marks)
 - iii. How many atoms are contained within the BCC unit cell? Explain. (2 marks)
 - iv. Find the atomic packing factor. (6 Marks)
- b. There are several types of patterns in which metallic atoms can arrange themselves on solidification. With the aid of sketches, explain **four** most common such patterns. (8 Marks)

15. With the aid of neat and labelled diagrams, discuss the **four** forming operations.

(20 Marks)