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071506T4MTP**MECHANICAL TECHNOLOGY LEVEL 6****ENG/OS/ME/CC/06/6**Printed By: Technical And Vocational College **Apply Material**

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Science and Perform Metallurgical Processes July/August**2025**

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

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WRITTEN ASSESSMENT**Time: 3 HOURS**

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INSTRUCTIONS TO CANDIDATE

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1. This paper consists of **TWO** sections: **A and B**.

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2. Attempt **ALL** questions in section **A** and **ANY THREE (3)** questions in section **B**.

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3. Marks for each question are indicated in the brackets.

4. Candidates are provided with a booklet

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5. Do not write on the question paper.
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This paper consists of FOUR printed pages

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

SECTION A (40 MARKS)***Attempt ALL the questions in this section.***

1. When operating a furnace observed due to the high risk involved. State FOUR safety precautions observed. (4Marks)
2. Engineering materials are used to manufacture products using different processes. State used in engineering. (4 Marks)
3. Metals are extracted from the mines in form of ores. State FOUR steps in the extraction process. (4 Marks)
4. Cast iron is obtained by re-melting pig iron in a cupola furnace. Name FOUR types of cast iron. (4 Marks)
5. Pig iron is produced in a blast furnace. State THREE materials charged. (3 Marks)
6. Ceramics are formed by combining naturally occurring raw materials, earthen minerals and water. Name THREE types of ceramic materials. (3 Marks)
7. Combine two or more materials with different physical and chemical properties. State TWO components of composites. (2 Marks)
8. Alloying elements are added to steel to improve their mechanical properties. List THREE types of these elements. (3 Marks)
9. Advancement of engineering material has seen a rise in use of ceramic materials engineering applications. State FOUR applications of ceramics. (4 Marks)
10. Corrosion in metals. State FOUR methods used to prevent corrosion. (4 Marks)
11. State THREE care and maintenance practices carried out on material testing equipment. (3 Marks)
12. After extraction of iron in a blast furnace, slags and other by-products have to be disposed in the right way to conserve the environment. List TWO ways of disposing these by-products. (2 Marks)

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

13.

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- a. Engineering material possess various mechanical properties that determine their behavior under different loads and conditions. Define the following properties;

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i. Toughness

iii. Malleability

iv. Hardness

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(4 Marks)

- b. Engineering materials are made up of different crystalline structures. With the aid of sketches, describe the following structural arrangement in metals.

i. Face centered cubic (FCC),

ii. Body centered cubic.

(8 Marks)

- c. Metal testing is done for the purpose of estimating their behavior under loading. With sketches, describe the following methods of material testing

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i. Brinell Hardness Test,

ii. Tensile testing.

(8 Marks)

14.

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a.

- i. Plastics are made from synthetic materials which are classified into two types. List

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ii. Plastic products have a wide range of properties which make them suitable for

many uses. State TWO applications of plastics.

(2 Marks)

- b. Pig iron ore is used to produce steel through several processes. With the aid of a

sketch, describe the operation of the basic oxygen process.

(10 Mark)

- c. Alloy steel is steel in which elements other than carbon are added in sufficient quantity, in order to obtain special properties. Explain TWO effects of alloying elements in steel.

(4 Marks)

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- a. Composite materials are made of different compounds, mixed together to make better than those of individual parts. State TWO types of composites.

(2 Marks)

- b. Heat treatment processes involve controlled heating and cooling of metals to change their mechanical properties. Explain the following heat treatment process;

(8 Marks)

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i. Annealing

ii. Normalizing

iii. Case hardening

iv. Tempering

- c. An alloy is a mixture of two or more metals. Explain the process of extracting the following alloys;

i. Solder,

ii. Brass.

(8 Marks)

- d. State TWO properties of aluminium-based alloys.

(2 Marks)

16.

- a. Ceramics are materials formed through a process called ceramic processing. Describe the process of producing ceramic materials. (5 Marks)
- b. Alloy steel, is steel in which elements other than carbon are added in sufficient quantity, in order to obtain special properties. Explain THREE effects of alloying elements in steel.

(6 Marks)

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- c. Discuss TWO factors that influence the hardness of steel after heat treatment.

(4 Marks)

- d. In material testing, liquid dye penetrant is one of the methods used. With the aid of sketches, describe this procedure.

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