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AGRICULTURAL ENGINEERING LEVEL 6

ENG/OS/AGR/CC/06/6

Apply Material Science and Metallurgical Processes

November/December 2025

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

WRITTEN ASSESSMENT

TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of **TWO** sections: **A** and **B**.
2. Answer **ALL** questions in section A and **ANY THREE** (3) questions in section B.
3. Marks for each question are indicated in the brackets.
4. Candidates are provided with a separate answer booklet.
5. Do not write on the question paper.

This paper consists of THREE (3) 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** questions in this section.*

1. Define the following terms as applied in materials and metallurgy. (4 Marks)
   a. Machinabil
   b. Creep.
   c. Non-ferrous metal.
   d. The g plastics.

2. Surface hardening is performed to improve resistance to wear and tear of engineering materials and components. List FOUR surface har. (4 Marks)

3. Plastics are highly resistant to corrosion and have high dimensional stability. State FOUR applications of plastics in engineering. (4 Marks)
4. Ceramics are inorganic, non-metallic materials hardened by heat or firing process. State FOUR characteristics of ceramics. (4 Marks)
5. The selection between an alloy and a composite is critical for designing engineering components. Distinguish between an alloy and a composite. (2 Marks)
6. Is a natural plastic used in applications such as power transmission belting. State THREE characteristics of rubber. (3 Marks)

7. Heat treatment of steel is used to obtain certain desirable characteristics without change in chemical composition of the metal. Outline FOUR aims of heat treatment. (4 Marks)

8. Wood is a natural and versatile material that comes from the trunks, branches, and roots of trebs. State THREE characteristics of wood that make it an important material in engineering applications. (3 Marks)

9. Steel which has its properties mainly due to carbon content with low concentrations of silicon and manganese. List FOUR types of carbon steels. (4 Marks)
10. To ensure compliance with OSHA, safety procedures must be observed. Outline FOUR safety procedures followed when performing ore extraction. (4 Marks)

11. Re-melting pig iron with coke and limestone in a cupola furnace produces cast iron. State FOUR characteristics of cast iron. (4 Marks)

SECTION B (60 MARKS)

*Attempt **ANY THREE** questions in this section.*

12. When metals solid often state, the atoms arrange themselves into various orderly configurations called crystals.

    a. Using illustrations, describe THREE basic atomic structures. (12 Marks)

    b. Describe FOUR heat treatment processes. (8 Marks)

13. Examining properties and performance of materials and components under various conditions is achieved through material testing.

    a. Differentiate between destructive and non-destructive tests. (2 Marks)

    b. State FOUR advantages of Rockwell hardness testing. (4 Marks)

    c. Explain FOUR non-destructive material tests. (8 Marks)

    d. Describe THREE types of alloys. (6 Marks)

14. Corrosion is the gradual deterioration of a metal through chemical or electrochemical reaction with its environment.

    a. Describe FOUR types of corrosion. (8 Marks)

    b. Explain FOUR methods of preventing corrosion. (8 Marks)

    c. Outline FOUR effects of corrosion on agricultural engineering structures. (4 Marks)

15. Ores are naturally occurring mineral from which are extracted profitably and conveniently.

    a. State FOUR types of iron ores. (4 Marks)

    b. Describe TWO methods of extracting non-ferrous metals. (4 Marks)

    c. With aid of an illustration, describe the working of a cupola furnace. (12 Marks)

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