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CIVIL ENGINEERING TECHNICIAN LEVEL 6

CON/OS/CET/CR/01/6A

CONDUCT MATERIAL TESTING

JULY/AUGUST 2023

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

WRITTEN ASSESSMENT

TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper has two sections **A** and **B.**
2. You are provided with a separate answer booklet.
3. Do not write on the question paper.
4. Marks for each question are indicated in the brackets ().

This paper consists of THREE (3) printed pages.

The candidate should check the question paper to ascertain that all pages are printed as indicated and that no pages are missing.

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SECTION A (40 MARKS)

Attempt all questions in this section

1. List **TWO** tests done on cement in the laboratory. (2 Marks)
2. Concrete workability is determined by the percentage of water added in the mix. State **FOUR** ways used to test workability of concrete. (4 Marks)
3. Material testing is the quantification of values associated with the properties of materials such as plastics, elastomers, metals, composites, and textiles. State **FOUR** different types of material tests. (2 Marks)
4. Explain the importance of material testing in civil engineering projects. (2 Marks)
5. State **FOUR** types of construction material tests. (4 Marks)
6. Explain the purpose of sieve analysis in construction material testing. (2 Marks)
7. State **THREE** major factors that can affect the strength of concrete. (3 Marks)
8. The moisture content of soil is described as the ratio of the mass of water held in the soil to the dry soil. List **THREE** methods of determining the moisture content of soil. (3 Marks)
9. Discuss the importance of performing concrete tests in civil engineering. (2 Marks)
10. Compressive strength is measured by breaking cylindrical concrete specimens in a compression-testing machine. Explain how a compressive strength testing of concrete is conducted. (4 Marks)
11. Non-air-entrained concrete contains between 1% and 2% of trapped air, explain **THREE** ways how air content of concrete can be determined. (3 Marks)
12. Explain how destructive testing is performed on structural timber. (2 Marks)
13. Outline **FOUR** tests carried out on bitumen. (2 Marks)
14. Analyzing and interpreting material test results is an essential step in understanding the properties and behavior of a material. Highlight the process you would use to analyze and interpret material test results in the field. (5 Marks)

SECTION B: (60 MARKS)

Attempt any THREE questions in this section.

15.

a. Timber structural tests help determine the mechanical properties, load-bearing capacity, and overall suitability of structural timber for different construction applications. It is important to conduct these tests in compliance with relevant standards and building codes to ensure the safety and reliability of timber structures. Discuss **FOUR** tests conducted on timber. (8 Marks)

b. With the aid of a well labeled sketch explain the process of carrying out a slump test on concrete. (12 Marks)

16.

a. As a civil engineer assigned to a road construction project in Nairobi city, you have been tasked to conduct material testing at each point in time as required by the engineers at the project site. Briefly describe how you will perform soil test using the California Bearing Ratio. (14 Marks)

b. Using a sketch discuss the stress verses penetration curve. (6 Marks)

17.

a. Bitumen is a material often used in road construction and as a civil engineer you require to undertake testing of each material before using it on site. With an aid of a sketch explain the procedure of conducting a penetration test on bitumen. (16 Marks)

b. State **FOUR** reasons for carrying out a viscosity test for liquid bitumen. (4 Marks)

18. Steel is a material that is well known for its good behavior in tension and hence used in the civil engineering projects. However, it is important to undertake tension testing for steel. As a civil engineering technician discuss the important of testing steel and outline the required data that you will be required to collect in order to make decisions about the test. (20 Marks)