073206T4CEN

CIVIL ENGINEERING LEVEL 6

CON/OS/CET/CC/07/6/A

APPLY WATER AND WASTEWATER TECHNOLOGY LEVEL 6

July/August 2024

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. Answer ALL the questions as guided in each section.
3. You are provided with a separate answer booklet.
4. Marks for each question are indicated in the brackets.
5. Do not write on the question paper.

This paper consists FOUR (4) printed pages.

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

SECTION A (40 MARKS)

Answer ALL questions.

1. Water demand and use is vital in determination of the source. Outline THREE examples of how water source selection influences be demand and use. (3 Marks)
2. In the construction of a sewer, appurtenances must be can be installed or constructed along the sewer. Outline THREE sewer appurtenances and their function (6 Marks)
3. When discussing the importance of connecting the sewer system, it's crucial to understand the difference between sewerage and sewage. Explain the difference between sewerage and sewage. (4 Marks)
4. We utilize water for various purposes in Kenya. List FOUR of these uses. (4 Marks)
5. As a site engineer you have advised a client to construct a separate sewerage system. Outline FOUR advantages of separate sewerage system to your client. (4 Marks)
6. In waste management, digestion of sludge plays a vital role. Explain the term 'sludge digestion' (2 Marks)
7. In Kenya irrigation is carried in some areas to ensure food security. Outline SIX irrigation methods based on the type of crop, type of soil and quality of water. (6 Marks)
8. Water treatment involves removal pathogenic micro-organisms from water which plays a key role in the prevention of infections. Sketch and label a flow chart showing steps involved in water treatment. (5 Marks)
9. In the sludge digestion process, different processes are involved including 'acid regression' and 'acid fermentation'. Distinguish 'acid regression' and 'acid fermentation'. (4 Marks)
10. In Kenya, various regions obtain water from different sources. List TWO of these sources. (2 Marks)

SECTION B: (60 MARKS)

Answer any THREE questions.

11.

a. Calculating water demand involves estimating the total amount of water required for a specific area or population over a certain period. The calculation is essential for designing efficient water supply systems, ensuring sustainable water management, and meeting the needs of all users. Explain FIVE factors you will consider in your calculation. (10 Marks)

b. Water abstraction refers to the process of withdrawing water from its natural source. There are different methods of water abstraction. Describe TWO methods of water abstraction based on each of the following water sources.

i. Surface Water (5 Marks)

ii. Groundwater. (5 Marks)

12. Wastewater treatment is the process of removing contaminants and pollutants from wastewater, such as domestic sewage or industrial effluents, before it is discharged back into the environment or reused for various purposes. The treatment process typically involves several stages.

a. Sketch and label a flow chart showing the waste water treatment process. (8 Marks)

b. Explain THREE water treatment processes based on each of the following water characteristics and quality

i. Turbidity. (6 Marks)

ii. Microbiological contamination. (6 Marks)

13.

a. Sub-surface drainage manages excess water in the soil profile, typically found beneath the ground surface, hence there are different types of subsurface drainage. Explain TWO methods of sub-surface drainage. (4 Marks)

b. Table 1 shows the details for a crop. Using Blaney-Cridle equation and a crop factor k=0.75, If no leaching requirement is needed and the latitude of the area is 30° N.

Determine the average for each of the following;

i. Crop water requirement

ii. Preliminary net irrigation requirement for the Month of May

iii. Field irrigation requirement if water application efficiency is 0.9.

Table 1: Details for a crop

Month	Mean monthly temp °C	Monthly percentage of daytime hours (%)	Effective rainfall, Peff (cm)
April	38	14.38	70
May	22	10.55	30

(16 Marks)

14.

a. Disposal of digested sludge is essential for environmental protection, public health, regulatory compliance and wastewater treatment efficiency; hence there are various methods of disposing digested sludge. Explain FOUR of these methods. (8 Marks)

b. The capacity of a circular settling tank unit for the primary treatment of sewage is $40.5x10^3$ m3/day. The detention period is 4 hours and the surface loading rate is $90m^3/m^2$ of the tank area per day. Given the effective diameter of the tank is 7.5m, determine:

i. The diameter of the tank.

ii. Surface overflow rate per day and check if the design is satisfactory.

iii. Discharge per day.

(12 Marks)

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