NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF CIVIL AND WATER ENGINEERING

Water Quality and Treatment

TCW 5101

Supplementary Examination Paper

2024

This examination question paper consists of 3 pages.

Time Allowed: **3 Hours**

Total Marks: **100**

Examiner's Name: **J.Chimhundi/ T. T. Hungwe**

INSTRUCTIONS

1. Answer **ALL** questions.
2. Use of calculators is permissible.

Special Requirements

Graph Paper

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
TOTAL POSSIBLE MARKS	100

QUESTION 1

a. List and explain the key elements of a water quality management plan. **[7marks]**

b. With neat sketches describe the terms, lake stratification and turnover and their application in water quality management. **[8 marks]**

c. Ruwa Town Council is to install rapid sand filters downstream of the clarifiers. The design loading rate is 160 $m^3/(m^2 \cdot d)$. The design capacity of the waterworks is 0.35 m^3/s. The maximum surface per filter is limited to 50 m^2. Determine the number, and size of filters and calculate the normal filtration rate. **[10marks]**

QUESTION 2

a. What is disinfection in water quality and treatment? List any 4 disinfection methods. Discuss the advantages and disadvantages of these methods. **[15 marks]**

b. Why is control of turbidity considered important for disinfection of drinking water? **[2 marks]**

c. What is the purpose of the jar test? Explain the procedure of the jar test. **[5 marks]**

d. An adequate chlorine concentration for disinfection is often achieved before the chlorine "breakpoint." Why then is the breakpoint concentration used rather than a lesser concentration? **[3 marks]**

QUESTION 3

a. The Bulawayo City Council (BCC) Criterion Water Works employs the breakpoint chlorination to disinfect the water supply.

i. Explain the concept of breakpoint chlorination and list any 2 factors that influence the breakpoint chlorination process. **[5 marks]**

ii. Elaborate on the importance of residual chlorine management in maintaining water quality **[5 marks]**

iii. Critically evaluate the use of chloramines as an alternative to free chlorine disinfection **[5 marks]**

iv. Discuss the advantages and disadvantages of using chloramines in water treatment. **[5marks]**

b. Results of chlorine demand test on a raw water are given below. Determine the break-point dosage and the chlorine demand. **[5marks]**

Sample no.	Chlorine dosage mg/L	Residual chlorine after 10mins contact.(mg/L)
1	0.2	0.18
2	0.4	0.34
3	0.6	0.48
4	0.8	0.46
5	0.9	0.27
6	1.0	0.18
7	1.2	0.38
8	1.4	0.58
9	1.6	0.78

QUESTION 4

a. Explain the objectives of water treatment. **[5 marks]**

b. Discuss the complete sequence of water treatment plant with a flow diagram. **[10 marks]**

c. Differentiate between slow sand filters and rapid sand filters. **[6 marks]**

d. What are the characteristics of a good coagulant? **[4 marks]**

The End