



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2021 / 2022 ACADEMIC YEAR**

**FOURTH YEAR FIRST SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE  
IN CIVIL AND STRUCTURAL ENGINEERING**

**COURSE CODE: CSE 431**

**COURSE TITLE: ENVIRONMENTAL ENGINEERING**

**DATE: FRIDAY 29<sup>TH</sup> APRIL 2022 TIME: 8.00 – 10.00 AM**

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**INSTRUCTIONS:**

1. This Paper Consists of FOUR Questions
2. Attempt Question ONE and any other TWO Questions
3. It is to the best interest of the candidate to write legible
4. Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

**QUESTION ONE (Compulsory) [30 Marks]**

a) The ultimate BOD of a sample is 120 mg/l. The BOD decay constant for the waste is 0.28/day at 20 °C. How much of the BOD is exerted and how much remains after the following time intervals

- i) 3 days ii) 5 days iii) 10 days

Comment on the answers above [7 marks]

b) If the experiment in a) was conducted at 25°C, what would the decay rate? Why do such differences in reaction rates occur? [4 marks]

c) Using relevant examples, explain the applications of redox reactions in water engineering [4 marks]

d) You have been contracted by the County Government of Vihiga to provide sanitation facilities in a mixed residential scheme which consists of formal and informal settlements. Outline the criteria you will use to select suitable sanitation technologies for the area [5 marks]

e) The following data describes the removal of fluoride from a treatment plant treating groundwater.

|                      |     |     |    |    |     |      |
|----------------------|-----|-----|----|----|-----|------|
| Time (hours)         | 0   | 0.5 | 1  | 2  | 3   | 5    |
| Concentration (mg/l) | 100 | 61  | 37 | 14 | 5.0 | 0.67 |

Confirm whether the reaction follows first or second order kinetics and find the reaction rate constant [10 marks]

**QUESTION TWO [20 marks]**

a) A waste water from a factory having pH = 9 contains KOH only. Find the total quantity of KOH per day if the wastewater discharge is 100 m<sup>3</sup>/d [5 marks]

b) Explain the public health significance of alkalinity data in water supply [5 marks]

c) Why are the analysis of the following of interest in water quality control? [4 marks]

- i) Total dissolved solids in municipal water supplies

- ii) Settleable solids in domestic wastewater

d) "Water is at the centre of human health" Justify this statement [6 marks]

**QUESTION THREE [20 marks]**

a) Sustainable development programmes in Kenya are championed through various legal and institutional mechanisms. However, the legal and institutional framework is riddled with challenges and bottlenecks. Describe these challenges and bottlenecks [10 marks]

b) Outline the application of sedimentation theory in water and wastewater treatment [5 marks]

c) Outline the environmental impact areas of a water resource project [5 marks]

**QUESTION FOUR [20 marks]**

a) The day after a heavy rain washed a great deal of cattle feedlot waste into a farm pond, the following counts of bacteria were obtained:

|                                       |      |      |      |      |       |       |       |      |      |
|---------------------------------------|------|------|------|------|-------|-------|-------|------|------|
| Time                                  | 6 am | 7 am | 8 am | 9 am | 10 am | 11 am | 12 am | 1 pm | 2 pm |
| Viable cells per mL ( $\times 10^3$ ) | 0.10 | 0.11 | 0.13 | 0.16 | 0.20  | 0.40  | 0.80  | 1.6  | 3.20 |

To which stage of the bacterial growth curve, does this time span correspond? Explain the main features of this phase [8 marks]

b) Technology is both a blessing and a curse in matters environment. Justify this statement using relevant examples [12 marks]

-----END OF QUESTION PAPER-----