



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of BUILDING & Civil engineering

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING

TCV 4425 : WATER & WASTE WATER SYSTEM DESIGN

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024

TIME: 2 HOURS

PAPER A

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY) 20 Marks

- a) With the aid of a sketch explain the operation of slow sand filter (12 marks)
- b) Explain the following terms as used in water treatment
 - i. Flocculation
 - ii. Coagulation (8 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

- a) With the aid of a sketch explain break point chlorination (12 marks)
- b) State the factors opposing settlement in sedimentation tank (4 marks)
- c) A water treatment plant is required to process 28800 m³/d of raw water whose density is 1000kg/m³ and dynamic viscosity of 10⁻³ NS. The rapid mixing tank imparts rapid velocity gradient of 900m⁻¹ to blend 35mg/l of Alum with the flow for detention time of 2 minutes. Determine the power input required (4marks)

QUESTION THREE (20 Marks)

- a) Use a sketch to explain the operation of biological filter(trickling filter) (10 marks)
- b) Design a septic tank for a population of 120 people. Assume a flow of sewage of 100l/h/d and a detention period of 24 hours. Take depth as 1.2m, free board as 0.3m and L : B = 1 : 3 (6 marks)
- c) Explain tertiary process in wastewater treatment (4 marks)

QUESTION FOUR (20 Marks)

- a) Design a rectangular sedimentation tank for a flow of 6 hours and velocity of flow of 20cm/min. Take depth as 4m, and sludge and free board as 0.5m each. (10 marks)
- b) Outline the effects of discharging untreated sewage to the environment (5 marks)
- c) Outline the conventional treatment of wastewater (5 marks)

QUESTION FIVE (20 Marks)

- a) State the processes of treating wastewater (4 marks)
- b) Find the settling velocity of spherical particle size 5×10^{-3} in diameter and specific gravity 2.65 Also find the rising velocity of a particle of same diameter but specific gravity of 0.8. Assume kinematic viscosity of $1.012 \times 10^{-2} \text{ cm}^2/\text{sec}$ (6 marks)
- c) Explain the activated sludge process (6 marks)
- d) Outline the following as used in water treatment
 - i. Post chlorination
 - ii. Super chlorination
 - iii. DE chlorination
 - iv. Discrete particle (4 marks)