



(University of Choice)

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

MAIN CAMPUS

**UNIVERSITY SPECIAL/SUPPLEMENTARY
EXAMINATIONS
2021/2022 ACADEMIC YEAR**

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL
ENGINEERING/
BACHELOR OF TECHNOLOGY EDUCATION
(CIVIL AND STRUCTURAL ENGINEERING)**

COURSE CODE: CSE 452/TEB 403

**COURSE TITLE: WATER SUPPLY AND SYSTEMS/
WATER SUPPLY TECHNOLOGY**

DATE: 6TH OCTOBER 2022

TIME: 3 – 5 P.M

INSTRUCTIONS:

1. This paper contains FIVE Questions
2. Answer FOUR Questions only
3. Marks for each question are indicated in the parenthesis.
4. It is in the best interest of the candidate to write legibly
5. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE

- a) Explain how design period is determined in water supply system [5 marks]
- b) Why is it necessary to treat water [5 marks]
- c) A sample of raw water contains 100 mg/ alkalinity, 30 mg/l hardness as CaCl_2 and 50 mg/l hardness as MgSO_4 . Compute the quantities of lime and soda required to treat 1000 m^3 of water. If slaked lime of 90% purity is available in place of pure lime, what will be the required quantity of slaked lime? [10 marks]

QUESTION TWO

- a) A service reservoir receives water from an impounding reservoir, a distance of 50 km. The difference in levels of the two reservoirs is 100 m. The two reservoirs are connected by a single pipe designed to carry a maximum daily requirement of 15000 m^3/d . Determine the diameter of the pipe. (Use Hazen-Williams formula with $C = 120$). Hint: Hazen-Williams, $V = 0.354 CD^{0.63}S^{0.54}$ [6 marks]
- b) IWRM principles require that water be treated as both social and economic good. Describe the types of water tariff systems applied in water pricing [14 marks]

QUESTION THREE

- a) Briefly describe the methods that can be used for the removal of the following impurities in water supply [10 marks]
- i) Colloidal matter
 - ii) Faecal coliforms
 - iii) Turbidity
 - iv) Magnesium Sulphate
- b) Well of diameter 30 cm fully penetrates a confined aquifer of thickness 20 m. When pumped at a steady rate of 30 litres per second, the drawdowns observed in wells at radial distances of 10 m and 40 m, are 1.5 and 1.0 m respectively. Compute the radius of influence, the permeability, the transmissibility and the drawdown at the well [10 marks]

QUESTION FOUR

- a) Two million litres of water per day is passing through a sedimentation tank which is 6m wide, 15m long and having a water depth of 3m. (i) Find the detention time for the tank, (ii) What is the average flow velocity through the tank? (iii) If 60 ppm is the concentration of suspended solids present in turbid raw water, how

much dry solids will be deposited per day in the tank, assuming 70% removal in the basin, and average specific gravity of the deposit as 2 and (iv) Compute the overflow rate. [12 marks]

b) Outline the factors that affect the efficiency of sedimentation tank [8 marks]

QUESTION FIVE

a) Describe the adsorption process of water treatment [8 marks]

b) A pumping station, situated at an elevation of 500 m uses pumps which require 30 kPa NPSH when delivering water. Determine the allowable suction lift of these pumps if the entrance and friction losses are 10 kPa. Take barometric pressure at 500 m altitude as 90 kPa and vapour pressure of water as 2 kPa. [6 marks]

c) Outline factors that affect UV disinfection process in water treatment system [6 marks]

END OF QUESTION PAPER

