



(University of Choice)

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

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

FOURTH YEAR SECOND SEMESTER EXAMINATIONS

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

COURSE CODE: CSE 452

COURSE TITLE: WATER SUPPLY AND SYSTEMS

DATE: 25TH APRIL 2023

TIME: 8 – 10 A.M

INSTRUCTIONS:

1. This paper contains FOUR Questions
2. Answer Question ONE and any other TWO Questions
3. Marks for each question are indicated in the parenthesis.
4. It is in the best interest of the student 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 [Compulsory]**[30 Marks]**

a) Determine the water demand of a town for the design year 2031 given the census data are as follows:

Year	1971	1981	1991	2001
Population	40,000	45,000	55,000	62,000

Assume the following;

Per capita water demand = 112 lit/c/d

Firefighting demand = 1 lit/c/day

Losses = 15% of total demand

Population forecast method = geometric

[8 marks]

b) A 30-cm well completely penetrates an unconfined aquifer of saturated depth 40 m. After a long period of pumping at a steady rate of 1500 Lit/min the drawdown in two observation wells 25 and 75 m from the pumping well were found to be 3.5 and 2.0 m respectively. Determine the transmissivity of the aquifer and the drawdown at the pumping well

[6 marks]

c) Briefly describe increasing block water tariff structure and how it can be operationalized to take care of the poor

[5 marks]

d) Chlorine usage in the treatment of 20000 cubic meter of water per day is 8 kg/day. The residual chlorine after 10 minutes contact time is 0.2 mg/lit. Calculate the dosage of chlorine in mg/lit and the chlorine demand of water

[4 marks]

e) Give reasons why chlorination is preferred over other methods of disinfections

[4 marks]

f) Outline the functions of balancing reservoirs

[3 marks]

QUESTION TWO**[20 marks]**

a) Design a rectangular sedimentation tank using the following data.

Population 100,000

Overflow rate of 25 m/day.

Depth of tank = 3.2 m.

Length = 4 times breadth

Per capita demand = 200 L/c/d

[8 marks]

b) Privatization of water supply services is an important strategy in attaining sustainable development goal number 6. Briefly discuss this statement

[6 marks]

c) Outline the typical components of a water supply scheme located in rural mountainous area

[6 marks]

QUESTION THREE**[20 marks]**

a) Determine the dimensions of a set of rapid sand filters from the following data:

Population to be served = 200,000

Average rate of demand = 150 lpcd

Rate of filtration = 5000lit/hr/m²

Length = 1.3 times breadth

Number of rapid sand filters = space allows for maximum of 3 No. filters

Maintenance= Allow one rapid sand filter as standby

Assume maximum demand as 1.8 times average daily demand. [8 marks]

b) The water works of town of population 25,000 has to meet its water demand at the rate of 135 lit/c/d. If the disinfection is to be done by the bleaching powder having 45% available chlorine, determine the quantity of bleaching powder required per year. The required dose of chlorine is 0.3 ppm for disinfection

[5 marks]

c) Describe the process of spring intake constructed in a rural area with a neat sketch

[7 marks]

QUESTION FOUR**[20 Marks]**

a) Water is to be supplied to a municipality in Kakamega County with forecasted population of 150,000 with per capita water demand of 110 lit/c/d. the variations in water demand is shown in the table. Determine the capacity of service reservoir considering uniform pumping at 6 am - 9 am and 6 pm to 9 pm respectively. Neglect fire demand and use analytical method

[10 marks]

Time	6 am - 9 am	9 am - 12 pm	12 pm - 3 pm	3 pm - 6 pm	6 pm - 9 pm	9 pm - 6 am
Demand (%)	30	10	10	20	25	5

b) Design FOUR slow sand filter beds from the following data for the water works of a town of population 75,000; Per capita demand = 135 litres/day/capita. Rate of filtration = 210 litres/hour/m². Assume length of slow sand filter is 2.5 times its breadth and maximum daily demand as 1.5 times the average demand.

[6 marks]

c) Briefly explain the use of natural coagulants in water treatment [4 marks]

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

