



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of BUILDING & Civil engineering

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4313 : PUBLIC HEALTH ENGINEERING I

END OF SEMESTER EXAMINATION

SERIES: JANUARY 2025

TIME: 2 HOURS

PAPER 1

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) 30 Marks

- a) Describe the following terms using sketches where necessary.
- i. Runoff coefficient
 - ii. Water intake
 - iii. Shallow well
- (6 Marks)**
- b) Discuss the two types of water intakes. **(4 Marks)**
- c) Explain the factors, which influence the choice of a suitable water source for a public water supply. **(4 Marks)**
- d) Discuss the disadvantages of pumping system in a water supply. **(4 Marks)**
- e) Derive an expression for determining the discharge from a confined aquifer. **(6 Marks)**
- f) A 300mm diameter well fully penetrates a confined aquifer 30m thick. After pumping to steady state at a rate of $1.2\text{m}^3/\text{min}$, the draw downs in wells at 24 and 48 m from the pumping well are found to be 2.4 and 1.8 m respectively. Determine the drawdown in the pumped well. **(6 Marks)**

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

- a. Explain the importance of population projection is important in the planning and design of a water supply project. **(4 Marks).**

- b. Discuss the various uses of water, which contributes towards the overall water demand of a water supply project. **(4 Marks)**
- c. Discuss why it is important to consider hourly variation of water consumption in the design of water pipelines. **(4 Marks)**
- d. Differentiate between high and medium land potential in rural areas as applied in water demand projections. **(2 Marks)**
- e. A medium size town in Kenya has serious piped water shortages. The National government is planning a major project to rehabilitate and augment the water supply system in the town. The population of the town was 360,000 people in the last population census of 2019. The population of the town, is projected to grow at a constant rate of 3.0% from 2019 to 2050. If the “initial” year is 2028, calculate the ultimate water demand of the the town. Assume uniform water consumption per capita of 150 l/h/d. **(6 Marks)**

QUESTION THREE (20 Marks)

- a) Explain the main consideration(s) that influence the choice of a river intake site. **(4 Marks)**
- b) Discuss the limitations of using sea water as source of raw water and how these limitations can be overcome in the future. **(4 Marks)**
- c) Explain the importance of studying water microbiology to a water engineer. **(4 Marks)**
- d) Briefly describe the major function of a sedimentation tank in a water treatment plant. **(2 Marks)**
- e) Design a settling tank (coagulation-sedimentation) with a continuous flow to treat water for a population of 45,000 people with an average daily consumption of 120l/h/d. Take detention time as 4 hours and make any necessary assumptions. **(6 Marks)**
- f)

QUESTION FOUR (20 Marks)

- a. Explain the importance of water softening. **(2 marks)**
- b. Describe two methods of water softening. **(4 marks)**
- c. State the purpose of aeration in water treatment. **(2 marks)**
- d. Describe two methods aeration of water using neat sketches where appropriate. **(4 marks)**
- e. State the function(s) of the following components in a water supply system:

- i. Break pressure tank
- ii. Booster pump
- iii. Service reservoir

(3 marks)

- f. Water is supplied to a city by a gravity main. The ultimate water demand of the supply area is 24,000 m³/d. The waterworks is situated at a higher level than the distribution system with a level difference of 90 metres. Determine the size of the gravity main of which is 12km. Take friction factor in the pipe to be 0.08 and the system operates for 24 hours in a day. **(5 Marks)**

QUESTION FIVE (20 Marks)

- a. Write short notes on mass curve for calculating quantity of storage required. **(4 Marks)**
- b. Discuss the significance of peak flow factors in the design of water distribution systems. **(4 Marks)**
- c. Describe the major steps in the design of a water distribution system. **(4 Marks)**
- d. Discuss the factors, which affect head loss in the distribution system. **(4 Marks)**
- e. Determine the velocity of flow and discharge in a circular water pipe of diameter 200cm, laid on a slope of 1 in 1000 while flowing full. The pipe is made of PVC with a manning's coefficient of $n = 0.011$. **(4 Marks)**