



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING
TCV 4318 : PUBLIC HEALTH ENGINEERING I

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024

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 any **THREE** questions.

Do not write on the question paper.

QUESTION ONE (20 Marks)

- a) Describe the following terms as used in water sources using sketches where necessary.
- i. Rainwater harvesting (RWH)
 - ii. Artesian well
 - iii. deep well
- (3 Marks)**
- b) Discuss the types of rainwater harvesting systems. **(4 Marks)**
- c) Explain the factors, which affect the runoff coefficient. **(3 Marks)**
- d) Discuss the advantages and disadvantages of groundwater as a source of water for a public water supply. **(4 Marks)**
- e) Derive an expression for determining the discharge from an unconfined aquifer. **(6 Marks)**

QUESTION TWO (20 Marks)

- a. Explain the following terms as used in water supply engineering:
- Water demand projection
 - Design period
 - Water consumption per capita
- (6 Marks).**
- b. Discuss how the water losses from the distribution system influence the overall water demand of a water supply project. **(2 Marks)**
- c. State the factors, which influence water consumption per capita. **(2 Marks)**
- d. Explain briefly how the quantity of water to be used in designing a town water supply scheme is estimated. **(4 Marks)**
- e. A small town in Kenya has no piped water. The county government is planning to develop a water supply project to serve the town. The population of the town was 20,000 people in the 2019 population census. The population of the town is projected to grow at a constant rate of 2.5% from 2019 to 2050. If the “initial” year is 2030, calculate the ultimate water demand of the town. Assume uniform water consumption per capita of 120 l/h/d. **(6 Marks)**

QUESTION THREE (20 Marks)

- Explain the main consideration(s) that influence the degree to which raw water is treated for public water supply. **(4 Marks)**
- Discuss the different categories of impurities found in raw surface water and how they are removed in the treatment plant. **(4 Marks)**
- Explain what is meant by “full water treatment”. **(4 Marks)**
- Briefly describe the major function of a filter unit in a water treatment plant. **(2 Marks)**
- A town in Nakuru County has a total water demand of 15,000 m³/d. Its source of water is a river whose water is turbid and requires sedimentation before filtration. Design a horizontal flow sedimentation tank for the town’s water treatment plant. Assume a detention period of 3 hours and velocity of flow of 0.25 m/minute. **(6 Marks)**

QUESTION FOUR (20 Marks)

- State the different materials which can be used to manufacture water supply pipes. **(4 marks)**
- Describe how water pipelines are tested for water tightness after they have been laid. **(4 marks)**
- State the function(s) of the following pipe fittings in a water supply system:

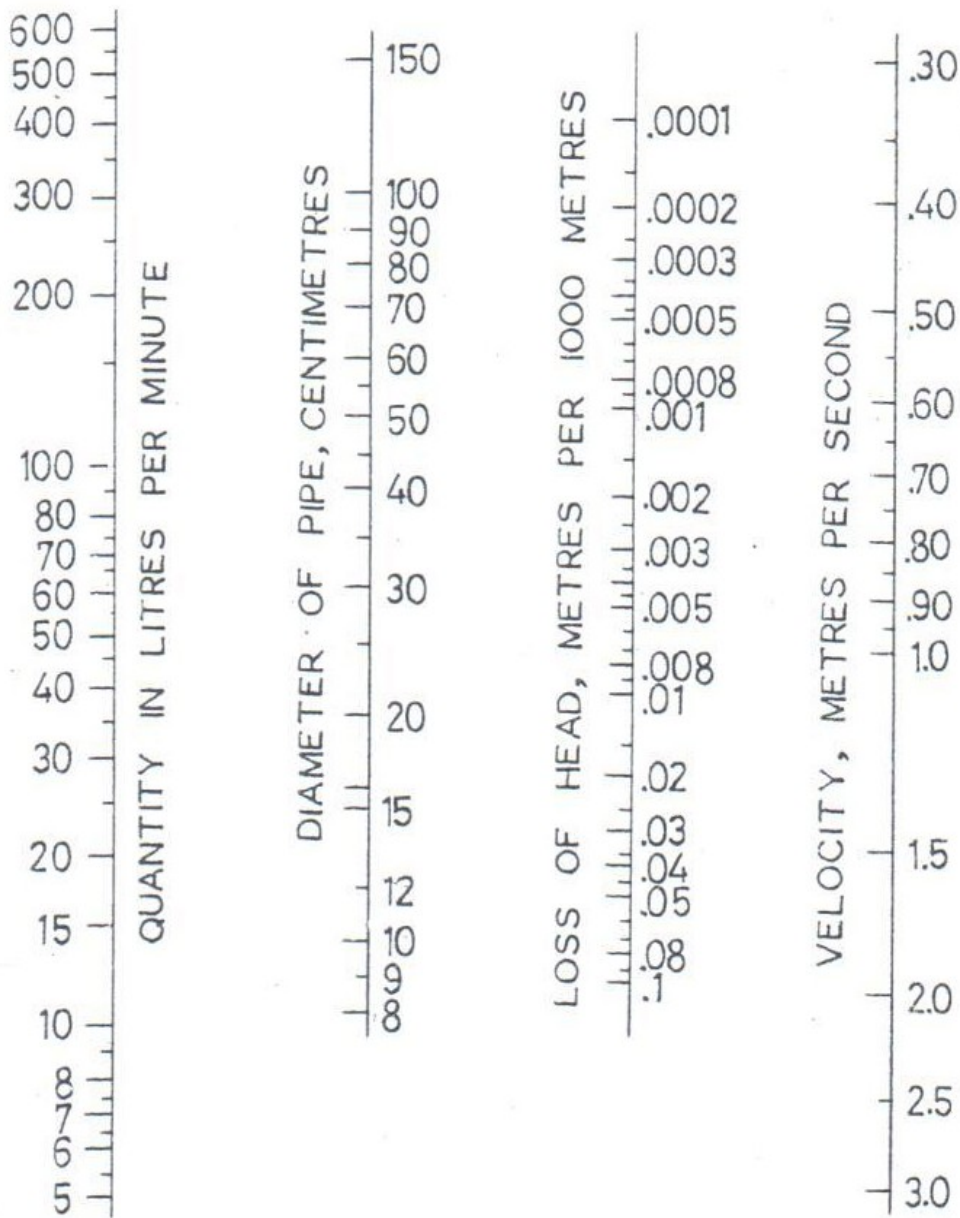
- i. Tee
- ii. Taper
- iii. Plug

(3 marks)

- d. Explain the circumstances in which an elevated service reservoir is required in a water distribution system. **(3 marks)**
- e. Water is supplied to a city by a gravity main. The with population of the city is 300,000. The waterworks is situated at a higher level than the distribution system with a level difference of 120 metres. Determine the size of the gravity main of length 15km if the per capita water consumption is 100l/h/d. Take friction factor in the pipe to be 0.06 and the system operates for 24 hours in a day. **(6 Marks)**

QUESTION FIVE (20 Marks)

- a. Write short notes on impounding reservoir. **(4 Marks)**
- b. State the different types of water distribution system and briefly describe one of them. **(4 Marks)**
- c. Explain why it is important to study carefully the hourly variation of water demand from the distribution system. **(4 Marks)**
- d. State why nomograms are preferred in determination of flow in pipes compared to formulae. **(4 Marks)**
- e. A water pipe has a flow of 200 litres per minute and a slope of 3 metre per 1000 metres. The Hazen-William's coefficient, C of the pipe is 100. Using the Nomogram based on Hazen-William's formula provided, determine the following:
 - i. The diameter of the pipe
 - ii. The velocity of flow in the pipe**(4 Marks)**



Nomogram based on Hazen-William's formula ($C=100$)