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
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: JULY 2025

TIME: 2 HOURS

PAPER 2
Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **four** questions.
Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

QUESTION ONE (COMULSORY) 30 Marks

a) Briefly explain the scope and importance of water supply engineering. **(4 Marks)**
b) Adequacy and reliability are important factors that influence the choice of a water source for a water supply project. Discuss. **(4 Marks)**
c) Discuss the advantages and disadvantages of a groundwater source. **(4 Marks)**
d) State the function(s) of a grit chamber in a water treatment plant. **(2 Marks)**
e) A retired teacher is intending to establish a private boarding primary school in a high potential rural area. One of his basic consideration is how to source adequate, clean and potable water for the school. There is no piped water in the area. You have been hired as a water supply consultant, to advice this investor on how to get water for the school. Explain step by step on how you will go about this assignment. **(6 Marks)**
f) Derive a formula on how to calculate the yield of a well in an unconfined aquifer. **(5 Marks)**
g) The diameter of a tube well is 30cm and the depth of the uncofined aquifer is 15m. The radius of the circle of influence is 135m. the coefficient of permeability of the soil is 30m/day. Calculate the drawdown of the well when the yield of the well is 2000m^3/day. . **(5 Marks)**

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

a. Explain the necessity of accurate water demand projections during the planning and design of a water supply project. **(4 Marks)**
b. Internal water requirement is one of the water requirements taken into account during water demand projection. Explain what internal water requirement is and how it is calculated. **(4 Marks)**

c. Explain the meaning of "water consumption per capita". **(2 Marks)**
d. Describe the procedure of carrying out jar test in the laboratory. Explain the significance of jar test in water quality control. **(6 Marks)**
e. A tourist town in Kenya is experiencing chronic water shortages which have affected most businesses including hotels. One of the high class hotels is contemplating putting up its own water supply. If the hotel has a bed capacity of 600 beds, calculate its water demand. Use the table provided for water consumption rates. **(4 Marks)**

QUESTION THREE (20 Marks)

a. Discuss the disadvantages of conveying water in open channels for public water supply. **(4 Marks)**
b. Water pipes are made of various materials such as steel, plastic, concrete and others. Treated water, is almost exclusively conveyed through pipelines laid underground. What are the factors, which are considered in choosing the appropriate pipe material? **(4 Marks)**
c. Differentiate between temporary and permanent hardness. **(4 Marks)**

d. Explain the differences between slow and rapid sand water filters. **(4 Marks).**
e. Design a slow sand filtration unit for a treatment plant handling 1,500 m^3/d. Assume a filtration rate of 0.2 $m^3/h/m^2$. **(4 Marks)**

QUESTION FOUR (20 Marks)

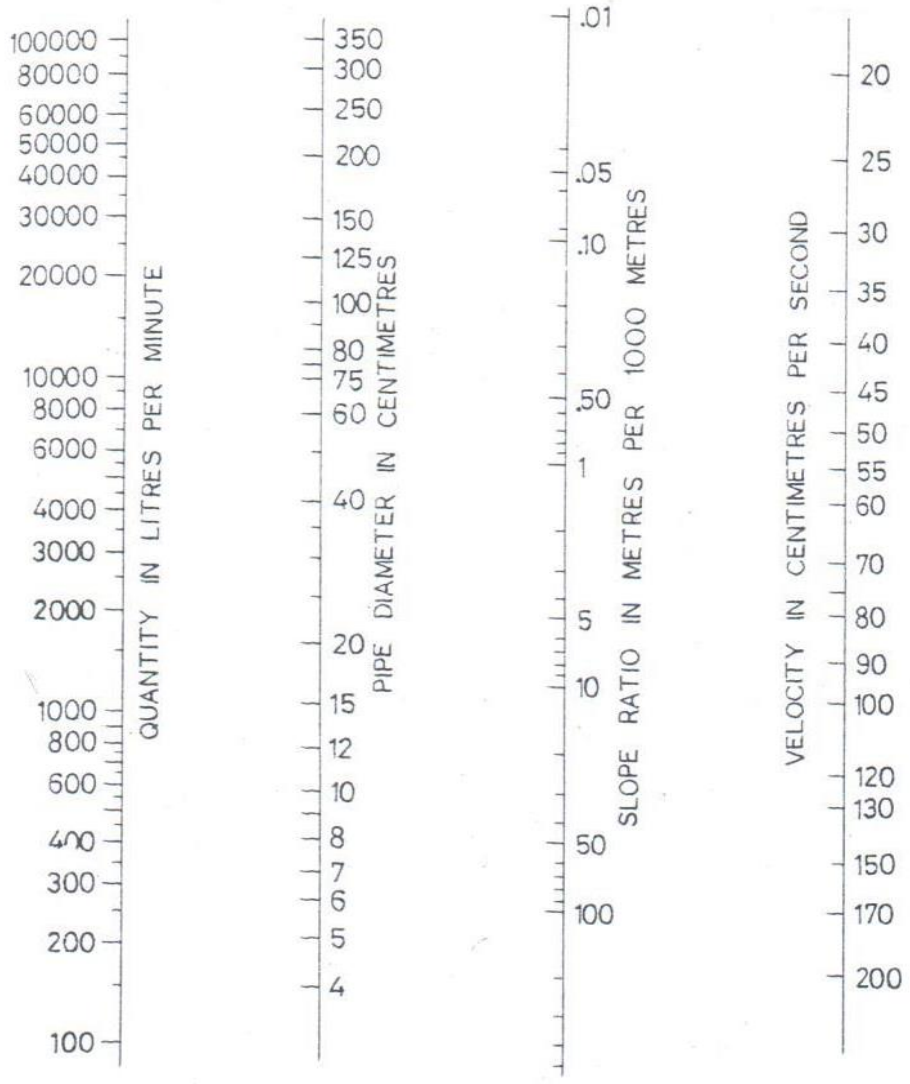
a. Explain the functions of the following components of a water supply:

   i. Transmission pipeline
   ii. Water storage
   iii. Water distribution main
   (6 Marks)

b. Section valves are very important pipefittings in the conveyance and distribution of water as well as operation and maintenance of the pipelines. Explain in detail, the function(s) of section valves in facilitating proper functioning of a water supply system. **(4 Marks)**
c. State the reason(s) for providing fire hydrants within the water distribution networks. **(4 Marks)**
d. In the design of a water distribution system, velocity is a very important design parameter. Discuss why this is so. **(2 Marks)**
e. A water pipe has a flow of 2000 litres per minute and a slope of 3 metre per 1000 metres. The Manning's roughness coefficient, η of the pipe is 0.013. Using the Nomogram based on Manning's formula provided, determine the following:
   i. The diameter of the pipe
   ii. The velocity of flow in the pipe
   (4 Marks)

Consumption Rates

CONSUMER	UNIT	RURAL AREAS			URBAN AREAS		
		High potential	Medium potential	Low potential	High Class Housing	Medium Class Housing	Low Class Housing
People with individual connections	l/head/ day	60	50	40	250	150	75
People without connections	l/head/ day	20	15	10	-	-	20
Livestock unit	l/head/ day	50			-		
Boarding schools	l/head/ day	50					
Day schools with WC without WC	l/head/ day	25 5					
Hospitals Regional District other	l/bed/ day	400 200 100			+ 20 l per outpatient and day (minimum 5000 l/day)		
Dispensary and Health Centre	l/day	5000					
Hotels High Class Medium Class Low Class	l/bed/ day	600 300 50					
Administrative offices	l/head/ day	25					
Bars	l/day	500					
Shops	l/day	100					
Unspecified industry	l/ha/day				20,000		
Coffee pulping factories	l/kg coffee	25 (when re-circulation of water is used).					



Nomogram based on Manning's formula for circular pipes (for n=0.013) running full