



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
FIFTH YEAR SECOND SEMESTER EXAMINATION
BACHELOR OF SCIENCE (CIVIL ENGINEERING)
ECV 511: PUBLIC HEALTH ENGINEERING IV

DATE: 24/5/2019

TIME: 11.00-1.00 PM

INSTRUCTIONS

- (i) QUESTION ONE IS COMPULSORY**
- (ii) ATTEMPT ANY OTHER TWO QUESTIONS**
- (iii) REASONABLE ASSUMPTIONS SHOULD BE MADE WHERE NECESSARY**

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) The pipelines of a distribution system can be divided into three functional categories. State these categories and discuss their design requirement with the respect to the consumption demand they are to convey (10 marks)
- b) Service levels are the standards of supply which a water undertaking affords its customers. In Kenya the service targets are set by the Water services regulatory authority (WASREB). In connection with this, discuss the three principal levels of service which relate to the performance of distribution systems (10 marks)
- c) Discuss the principles and guidelines followed when undertaking pipeline planning in distribution system establishment (10 marks)

A spun precast concrete pipe is required to carry a storm wastewater discharge of 650 l/s when laid at a gradient of 1 in 430. Determine its size. Relevant chart is provided (20 marks)

$$\begin{aligned} Q &= 950 \text{ l/s} \\ S &= 0.00232 \\ k &= 0.6 \text{ mm} \end{aligned}$$

Figure question 3 below shows a supply scheme in which existing sources (1), (2) and (3) feed water into the principal network shown. A new source (4) is proposed to bring, say, another 80 ml/day into the urban area via pipeline AB. Possible areas of substantial growth of demand are labelled D1, D2, ..., D5. Discuss the most practicable and efficient way of laying the new pipeline to serve the anticipated increase in demand. Clearly state your assumptions.



QUESTION FOUR

- a) Discuss 3 common methods used at the feasibility study stage in cost comparison of capital projects whose implementation is to be phased (10 marks)
- b) Describe the principles followed in the design of a gravity main for water supply. List the key elements of the main (10 marks)

QUESTION FIVE

Design a rising main given the following data;

- a) The daily average flow = 100,000 l/d
- b) Static lift = 40m
- c) Friction factor $k = 0.6$
- d) Peak flow factors

Pipe category	Diameter	Peak factor
A	≤ 300 mm	2.5
B	> 300 mm < 600 mm	2.0
C	600 mm or more	1.5

Outputs

1. Determine the most optimum pipe size
2. Compute pump size
3. Compute power requirement