



## TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**  
**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

ECE 2313 : PUBLIC HEALTH ENGINEERING II

END OF SEMESTER EXAMINATION

**SERIES:** DECEMBER 2016

**TIME:** 2 HOURS

**DATE:** 15 Dec 2016

**Instructions to Candidates**

You should have the following for this examination

-*Answer Booklet, examination pass and student ID*

-*Drawing instruments.*

This paper consists of four questions.

Answer question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**



**QUESTION 1:**

- a) Define the following terms as used in wastewater engineering:
- i. Storm water
  - ii. Sullage
  - iii. Sewer
  - iv. Sewerage

**(8 Marks)**

- b) Differentiate between dry conservancy system and water carriage system of sewage disposal. **(6 Marks)**
- c) What are the disadvantages of using dry conservancy system in sewage disposal? **(3 Marks)**
- d) One of the factors that determine the quantity of sewage is rate of water consumption per capita. List the factors that influence the rate of water consumption per capita. **(5 Marks)**
- e) An estate in a city has a population of 20,000 people. The City Authority is in the process of planning a combined sewerage system. The estate is of high housing class with a water consumption rate of 300l/h/d. Calculate the dry weather sewage flow contribution of the estate to the total sewage flow of the city.  
What is the design sewage flow of the estate if the peak factor is 2.5? **(8 Marks)**

**QUESTION 2:**

- a) Briefly describe the following terms as used in wastewater management:
- i. Preliminary treatment of sewage
  - ii. Secondary treatment of sewage
  - iii. Disposal of sewage

**(6 Marks)**

- b) Differentiate between first stage Oxygen Demand and second stage Oxygen Demand. Use a sketch to illustrate your answer. **(4 Marks)**
- c) Design a rectangular sedimentation tank for wastewater treatment for a town with a population of 40,000 people. The expected dry weather sewage flow (DWF) is 150l/person/day and a detention time of four hours. **(8 Marks)**  
Draw a neat sketch of the tank. **(2 Marks)**

**QUESTION 3:**

- a) What method of sewage treatment will you recommend in tropical developing countries? State the reason(s) for your recommendation. **(4 Marks)**
- b) State the function(s) of the following units in a waste stabilization pond system:
- i. Anaerobic pond **(2 Marks)**
  - ii. Facultative pond **(2 Marks)**
  - iii. Maturation pond **(2 Marks)**
- c) In a high density housing scheme, the design population is projected to be 30,000 people with a water consumption rate of 120l/h/d. The sewage generation is expected to be 80% of water consumption. The temperatures experienced in the area do not go below 20<sup>0</sup>C.

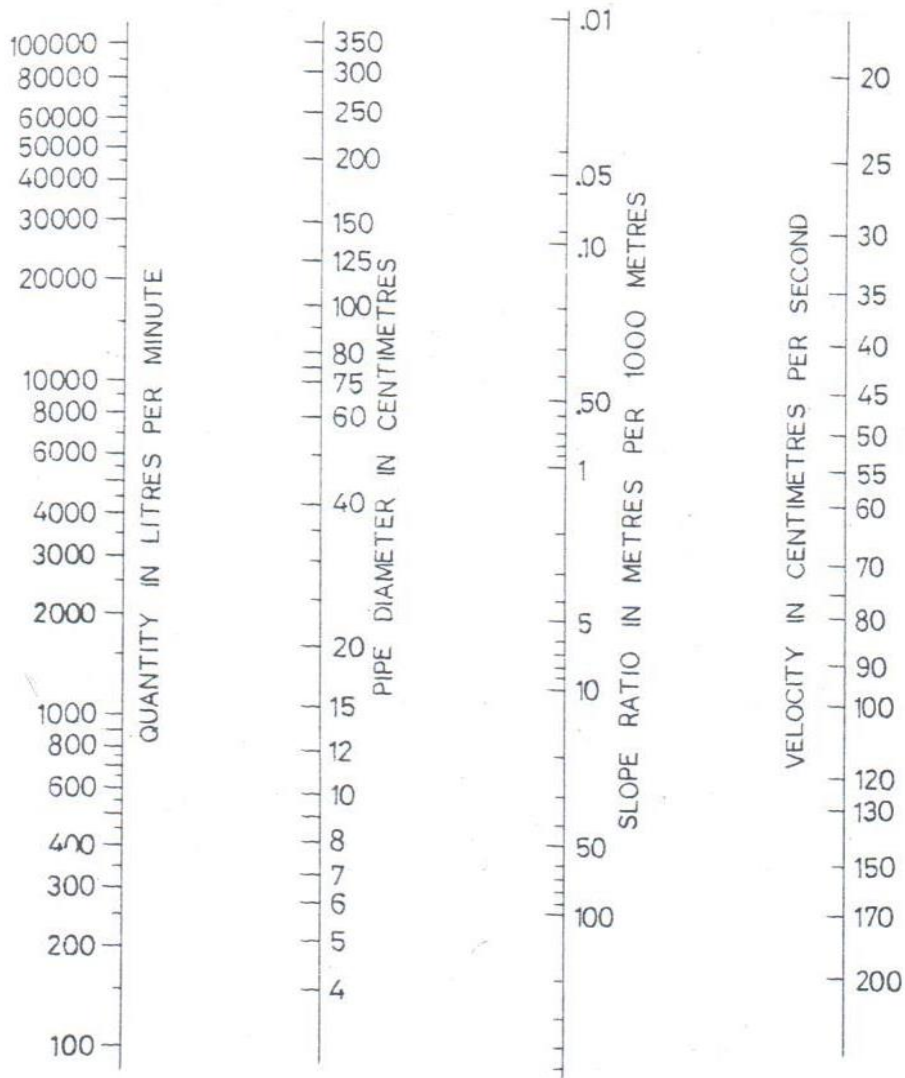


Design anaerobic pond required for treatment of sewage for the scheme. Assume a retention period of five days and a depth of four metres. **(10 Marks)**

**QUESTION 4:**

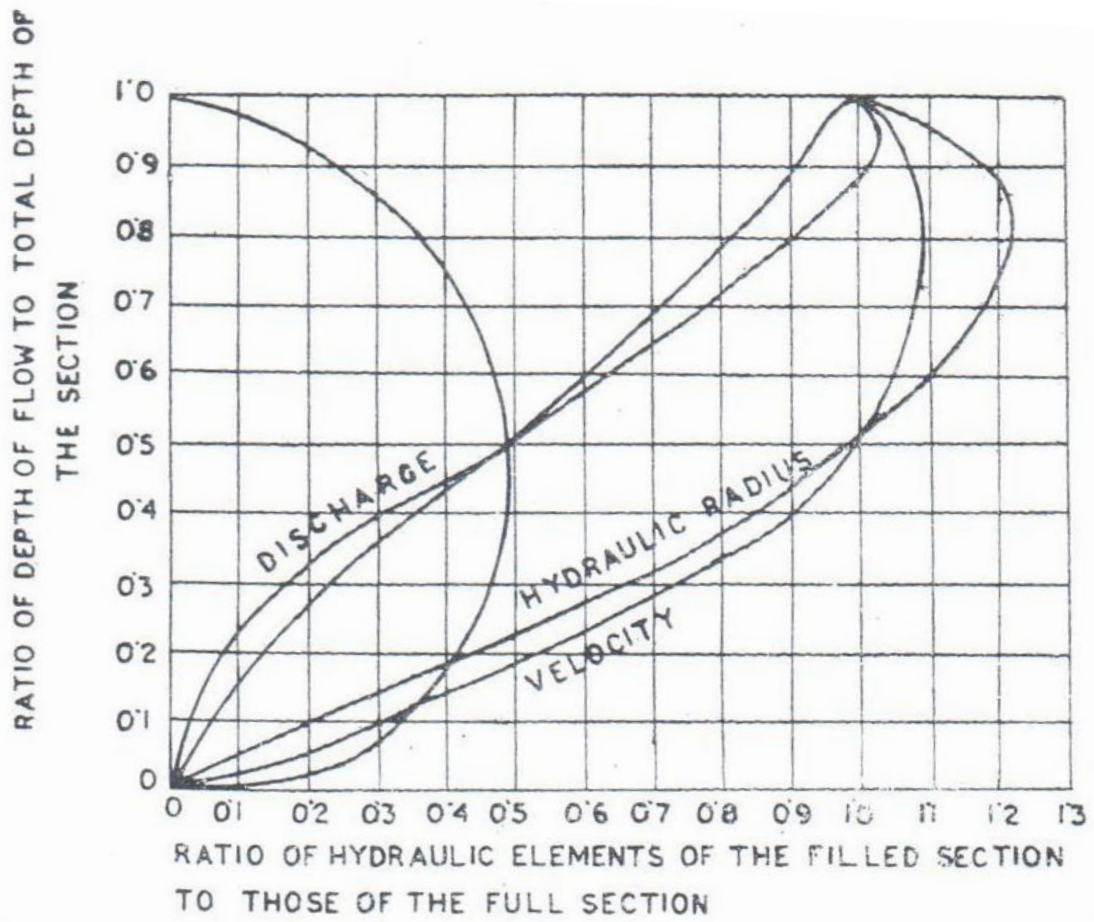
- a) List three methods of sewage disposal. **(3 Marks)**
- b) Screening is one of the primary treatment methods of sewage. The solids removed after the screening process is called screenings. State five methods of disposal of the screenings. **(5 Marks)**
- c) During sedimentation to remove suspended solids from sewage, it sometimes necessary to use chemicals called coagulants to enhance sedimentation. Discuss the merits of using these chemicals. **(4 Marks)**
- d) Determine the discharge in a 45 cm circular sewer with a Manning's coefficient of roughness,  $n = 0.013$ , slope,  $i = 0.002$  and depth of flow equal to 9.0 cm. Use both the nomogram based on Manning's formula for circular sewers ( $n = 0.013$ ) and partial flow diagram provided. **(8 Marks)**





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





Partial flow diagram

