



TECHNICAL UNIVERSITY OF MOMBASA

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

BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING
TCV 4327 : PUBLIC HEALTH ENGINEERING II

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2024
TIME: 2 HOURS

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. Define the following terms as used in wastewater engineering:

- i. Sewage
- ii. Sewer
- iii. sewerage

6 Marks

- b. State the merits and demerits of a separate sewerage system. **4 Marks**
- c. Explain what is meant by variation in hourly sewage flow. **4 Marks**
- d. Explain the factors which, influence the quantity of sewage generated in a community. **(4 Marks)**
- e. What is the time of concentration as used in the design of stormwater drainage?
(2 Marks)

QUESTION TWO (20 Marks)

- a. Describe how to perform Biochemical Oxygen Demand (BOD) test in the laboratory. **4 Marks**



- b. Explain the term chemical oxygen demand. **3 Marks**
- c. Discuss the practical importance of Chemical Oxygen Demand (COD) in wastewater treatment. **(3 Marks)**
- d. Describe the biochemical action in sewage treatment **(4 Marks)**
- e. Determine the 1-day BOD and the ultimate first stage BOD for wastewater whose 5-day BOD, at 20°C is 300mg/l. The reaction constant at 20°C, $K' = 0.23 \text{ d}^{-1}$. **(6 Marks)**

QUESTION THREE (20 Marks)

- a. Briefly describe the following terms as used in wastewater management:
 - i. Preliminary treatment of sewage
 - ii. Secondary treatment of sewage**(6 Marks)**
- b. Explain the function and design considerations of a grit chamber in the sewage treatment plant. **(4 Marks)**
- c. Discuss the factors, which influence the efficiency of settlement of suspended solids in sewage in a sedimentation tank. **(4 Marks)**
- d. A County Government intends to develop a sewerage system for one of its towns. The town has an ultimate projected population of 360,000. The expected average wastewater flow per capita is 120 l/h/d. Design a sedimentation tank for wastewater treatment for the town. The recommended depth is 4.0 metres. Assume a detention time of three hours and a design flow of 125% of the average flow. **(6 Marks)**

QUESTION FOUR (20 Marks)

- a. Explain what is meant by the biological treatment of sewage. **(3 Marks)**
- b. What method of sewage treatment will you recommend in tropical developing countries? State the reason(s) for your recommendation. **(3 Marks)**
- c. 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)**
- d. Explain explicitly the biological processes that take place in an activated sludge process that effect the wastewater treatment. **(4 Marks)**
- e. In a high density housing scheme, the design population is projected to be 50,000 people with a water consumption rate of 100l/h/d. The sewage generation is expected to be 80% of water consumption. The temperatures experienced in the area do not go below 20°C. Design anaerobic pond required for treatment of

sewage for the scheme. Assume a retention period of five days and a depth of five metres. Make any other useful assumption(s). **(4 Marks)**

QUESTION FIVE (20 Marks)

- a. Explain the importance of self-cleansing velocity and non-scouring velocity in the design of sewers. **(4 Marks)**
- b. Discuss the purpose of nomograms and partial flow diagrams in the sewer design process. **(6 Marks)**
- c. Discuss the factors, which influence the gradient of sewers. **(5 Marks)**
- d. Calculate the velocity of flow in a circular sewer of diameter 36cm laid in a slope of 1 in 750 while flowing full. The sewer is made of cast iron with a Manning's coefficient of roughness, $n = 0.013$. Also, determine the flow, Q in the sewer. **(5 Marks)**