TECHNICAL UNIVERSITY OF MOMBASA

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

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4506 : PUBLIC HEALTH ENGINEERING III

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 question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

QUESTION ONE (COMPULSORY) 30 Marks

a) Explain why it is important to have alternative forms of sanitation to conventional sewerage system. **(5 Marks)**
b) Discuss the differences and similarities between a conventional sewerage system and a septic tank. **(5 Marks)**
c) Define the terms as used in sewage sludge treatment:

i. Sludge grinding
ii. Sludge degritting
iii. Sludge thickening

(6 Marks)

d) A county government is about to complete construction of a sewage treatment plant (STP) to serve one of its major towns. It has been noted that there is no provision for the sewage sludge treatment which, will be generated in the sewage treatment plant. It has been decided to include a sludge handling unit. You have been appointed as a consultant to design the sludge treatment unit within the STP. Outline the major considerations in designing this sludge handling unit. **(5 Marks)**

e) Discuss the major requirements for industrial wastewater to be discharged into municipal sewer system. **(5 Marks)**

f) Define the following terms.

i. Solid waste

ii. Adsorbent

(4 Marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

a. Explain the importance of studying the sewage sludge characteristics. **(2 Marks)**

b. Discuss two methods of sludge thickening. **(4 Marks)**

c. Describe two methods of sludge disposal. **(4 Marks)**

d. Explain the difference between batch and continuous operation in sewage sludge stabilization process. **(2 Marks)**

e. A town in Kenya has a sewage treatment plant with a capacity of $6.0x10^6$ litres of sewage per day. The sewage has suspended solids of 270 mg/l. The primary sedimentation tank removes 60% of suspended solids and the water content of the sludge is 96%. Determine the quantity of sludge produced by volume in a day. Assume a specific gravity of sludge as 1.0. **(6 Marks)**

QUESTION THREE (20 Marks)

a. Discuss the advantages of using a Ventilated Improved Pit (VIP) latrine instead of the traditional pit latrine as a form of alternative sanitation. How is odour eliminated in a VIP latrine? (5 Marks)

b. In the design of a septic tank, it is recommended that its length should not be too long or too short compared to its width. Explain why this is so and recommend suitable length to width ratio for the septic tank to function efficiently. (5 Marks)

c. Discuss in detail how effluent from a septic tank is safely disposed into the environment. (4 Marks)

d. Design a septic tank for a Medical Training Institute using the data given hereunder.

i. Number of trainees 600

ii. Number of teaching and non-teaching staff together with their families 100

iii. Detention period 48hours

iv. Rate of water consumption 50l/h/d for students and 120l/h/d for staff and their families.

v. Sludge accumulation is assumed to be 25l /head /year.

vi. Sludge is removed once every year.
(6 Marks)

QUESTION FOUR (20 Marks)

a. Discuss the factors which influence the quality and quantity of solid waste generated in a community. **(4 Marks)**
b. Describe the effects of improper solid waste management on the environment. **(4 Marks)**
c. Outline the major best practices in solid waste management to ensure the natural resources in particular and the environment in general are safeguarded. **(4 Marks)**
d. Explain the basic principle behind solid waste disposal by landfilling method. **(4 Marks)**
e. Briefly describe Compositing as methods of refuse disposal. **(4 Marks)**

QUESTION FIVE (20 Marks)

a. Discuss why it is important to treat industrial wastewater before discharging it to the environment. **(4 Marks)**
b. It is important to study the characteristics of wastewater generated by each industry before recommending the appropriate method of treatment. **(4 marks)**
c. Explain why it is necessary to have industrial effluent standard for it to be disposed on land. **(4 Marks)**
d. Describe the dairy and canning industries and how their wastes can be treated. **(8 Marks)**