



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2512: PUBLIC HEALTH ENGINEERING IV

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 16 May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attempt question ONE (Compulsory) and any other TWO questions.

Question One (Compulsory)

- a) Explain the importance of the following in the design of sewer systems:
- i). Maximum dry weather flow rate (Q_d)
 - ii). Minimum flow rate (Q_{\min}) (4 Marks).
- b) Voi town has a population of 40,000 people and has an area of 1400 hectares of land. Out of this vast area, 400 and 350 hectares are zoned commercial and industrial respectively. The average water consumption is 150 litres per hectare per day and 70% of this water reaches the sewers. On the basis of sewer gauging, the average flow from the commercial area is 300,000 litres per day. The peaking factors for domestic, commercial, industrial and infiltration/inflow are 2.8, 1.75, 1.78, and 1.62 respectively. Using an industrial allowance of 6000 litres per hectares per day and 600 litres per hectare per day for infiltration/inflow, determine the following:
- i). Average wastewater flow
 - ii). Peak Wastewater flow rate
 - iii). The overall peaking factor.
 - iv). What is the effect of commercial, industrial and infiltration/inflow on the overall peaking factor? (12 Marks).
- b). Discuss the procedures for the economic analysis (8 Marks).
- c). Explain ways in which a designer can control odour in anaerobic pond. (6 marks).

Question Two

- a). Design a rectangular sedimentation tank for a flow (Q) of 25000 m³ per day from the following details.
- Detention time (DT) = 3 hours
 - Bottom slope = 1:100
 - Length (L) to Width (W) ratio of 4:1
 - Surface loading rate = 20 m³/m/day
 - Weir loading rate = 0.1 m³/min (10 Marks).
- b). How do you identify the gap between the forecast need and output from an existing wastewater treatment facility? (6 Marks).
- c). Describe any two methods of screen disposal (6 Marks).

Question Three

- a). Design a sedimentation tank for a flow of $1200 \text{ m}^3/\text{d}$. Assume the following: An Overflow rate (OFR) of $20 \text{ m}^3/\text{m}^2 \cdot \text{d}$, detention time of 2hrs, the ratio of width (W) to length (L) is 1:3 (10 Marks).
- b). Discuss the criteria for the estimation of the design of period (5 Marks).
- c). What are the main objectives for wastewater treatment? (5 Marks).

Question Four

- a). Meru town has a population 40,000 people and the average water consumption is 200 litres per person per day and an effluent flow of 70 litres per day. Determine the following parameter: mid-depth area, detention time, organic loading and the bacterial quality of the final effluent, use $K=0.30$ per day, and $D = 1.2 \text{ m}$ (9 Marks).
- b). Discuss the following types of surveys applied by the design team for the information on project preparation and economic analysis
- i). Reconnaissance survey
 - ii). Socio – economic survey
 - iii). Contingent valuation survey
 - iv). Existing water supply facilitate survey (8 Marks).
- c). List factors that determine the criteria for sewer design (3 Marks).

Question Five

- a). A 40 hectare drainage basin containing 24 hectare net residential area with average 5 dwelling units per hectare with 4 residents, and 15 hectare zoned commercial area. Determine the design flow for a sewer servicing this area. Take wastewater generation:
- Residential = 400 litres/capita/day
 - Commercial = 16000 litres/hectare/day
 - Peak I and I allowance = 9000litres/hectare/day (6 Marks).
- b). Describe any three types of screens (6 Marks).
- c). Discuss three major steps of determining financial viability of a proposed project (6 Marks).
- d). Define infiltration (2 Marks).