



TECHNICAL UNIVERSITY OF MOMBASA  
**Faculty of Engineering &  
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL  
ENGINEERING  
**[Institutional Based Programmes]**

ECE 2512: PUBLIC HEALTH ENGINEERING IV

**END OF SEMESTER EXAMINATION**  
**SERIES: AUGUST 2013**  
**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- Answer Booklet
- Pocket Calculator

This paper consists of **FIVE** questions.

Answer question **ONE** any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

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**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) Maximum wet weather flow rate ( $Q_w$ ) **(4 marks)**
- b) A city with a population of 20,000 people has an area of 1400 hectares of which 400 hectares are zoned commercial and 400 hectares are zone industrial. The average water consumption is 2000litres/hectare/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 factor is 1.75. Using an industrial allowance of 5000 litres per hectare per day with a peaking factor of 1.8:
- (i) Estimate the average flow rate
  - (ii) Peak hourly flow rate

- (iii) Determine the overall peaking factors
  - (iv) What is the effect of commercial, industrial and infiltration on the overall peaking factor? **(12 marks)**
- c) Describe the procedures followed during the economic analysis process of a water supply project. **(14 marks)**

### Question Two

- a) Why is screening important in waste water treatment. **(5 marks)**
- b) Given the following details from a town:
- (i) Population 30,000 people
  - (ii) Water consumption 200 litres per person per day
  - (iii) Temperature at 20°
- Determine the following:
- Mid-depth area of a facultative pond
  - Retention period **(4 marks)**
- c) Design a primary sedimentation tank of rectangular shape for a town having a population of 50,000 people with a water supply of 190 litres per capita per day. **(10 marks)**
- d) Define the term inflow as used in waste water. **(1 mark)**

### Question Three

- a) Make short notes on the following:
- (i) Preliminary treatment
  - (ii) Primary sewage treatment
  - (iii) Secondary sewage treatment
  - (iv) Tertiary sewage treatment **(8 marks)**
- b) Design a coagulation sedimentation tank with a continuous flow for treating water for a population of 65,000 people with an average daily consumption of 140l/person. Assume a surface loading rate of  $0.9\text{m}^3\text{m}^{-2}\text{h}^{-1}$  and that the weir loading rate is within the acceptable limits **(12 marks)**

### Question Four

- a) Define the following terms as used in wastewater:
- (i) Sedimentation
  - (ii) Clarification
  - (iii) Thickening
  - (iv) Sludge **(8 marks)**
- b) How do you identify the gap between forecast need and output from an existing facility? **(6 marks)**
- c) Define a screen, what are the main objects of screening. **(6 marks)**

### Question Five

- a) A 40 hectare drainage basin containing 24 hectare net residential area with average of 5 dwelling units per hectare with 4 residents and 16 hectares zoned commercial area. Determine the design flow for a sewer serving the area:  
Take wastewater generation for:  
Residential = 300l/capital/day  
Commercial = 1800l/hect/day  
Peak I & I allowance as 9000l/ha/day **(6 marks)**
- b) Describe any three types of coarse screens **(6 marks)**
- c) Design a sedimentation tank for a flow (Q) of 1000m<sup>3</sup>/day. Determine the dimensions of the tank and the outflow weir length. Assume suitable design criteria **(6 marks)**
- d) List down any FOUR methods applied in forecasting of a population **(2 marks)**