TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2512 : PUBLIC HEALTH ENGINEERING - IV
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS

Instructions to Candidates
You should have the following for this examination
   -*Answer Booklet, examination pass and student ID*
   -*Drawing instruments.*
This paper consists of five questions.
Attempt any THREE questions.
Do not write on the question paper.

Question ONE (Compulsory) 30 Marks
a).   Machakos town with a population of 30,000 people has an area of 1500 hectares of land, out of this area, 200 and 100 hectares were zoned commercial and industrial respectively. The average water consumption was provided as 200 l/ha/day and that 75% of the water is converted to sewerage. On the basis of sewer gauging, the average flow from the commercial area was 200,000 litres per day. The peaking factors for domestic, commercial, industrial and infiltration/inflow were 3.0, 1.80, 1.85, and 1.60 respectively. Using an industrial allowance of 5000 litres/hectares/day and 570 l/ha/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   **(14 Marks).**
b).   Discuss three ways in which an engineer can control odour in an anaerobic pond
                                                                                                              (6 Marks).
c).   Outline the procedures for carrying out economic analysis of a water supply project

(8 Marks).

d).   Explain the term Maximum dry weather flow rate (Q_d)   **(2 Marks).**

ANSWER ANY TWO QUESTIONS FROM THIS SECTION
Question TWO (20 Marks)

a).   A 45-hectare drainage basin has 25-hectare net residential area with an average 5 dwelling units per hectare with 5 residents and 15 hectares zoned commercial area. Calculate the design flow for a sewer servicing the area from the following details:
   -        Wastewater generated from the residential houses = 450 litres/capita/day
   -        Wastewater generated from commercial = 19000 litres/hectare/day
   -        Peak I and I allowance = 9000 litres/hectare/day   **(10 Marks).**

b).   The treated wastewater is being discharged into a river that has a temperature of 15^0C. The BOD rate constant determined in the laboratory for the mixed water is 0.20 per day.
                                                                      (2 Marks).
c).   Discuss ANY four methods of population forecasting   **(8 Marks).**

Question THREE (20 Marks)

a).   Discuss the following types of surveys useful to the design team in preparing water supply projects for the economic analysis:
   i).   Reconnaissance survey
   ii).   Socio – economic survey
   iii).   Contingent valuation survey
   iv).   Existing water supply facilitate survey   **(8 Marks).**
b).   Arusha town has a population of 25,000 people and an average water consumption of 100 litres/person/day with an effluent flow of 100 litres/day. Determine the following: Mid-depth area, detention time and organic loading, use K= 0.3^- day, and D = 1.20 m
                                                                      (6 Marks).
c).   Discuss methods of disposal of screenings   **(6 Marks).**

Question FOUR (20 Marks)
a).   Discuss any three types of sewerage systems   **(6 Marks).**
b).   Design a coagulation sedimentation tank with a continuous flow for treating water for a population of 45,000 people with an average daily consumption of 140 litres per person. Assume a surface loading rate of 0.9 $m^3m^{-2}h^{-2}$ and the weir loading rate is within the acceptable limits   **(12 Marks).**

Question FIVE (20 Marks)

a).   What are the components of design period of a project   **(5 Marks).**

b).   Design a rectangular shaped primary settling tank for a town having a population of 50,000 with water supply of 180 litres per capita per day. Assume suitable design criteria with the following data: Overflow rate (QFR) = 30 m^3/m^2. d, Detention time (DT) = 2 hrs and the ratio of **L** to **B** is 1:4   **(14 Marks).**

c).   Define the term dry weather flow   **(1 Marks).**