TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2512: PUBLIC HEALTH ENGINEERING IV

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE:16May2016

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.

Attemptquestion ONE (Compulsory) and any other TWO questions.

Question One (Compulsory)

a) Thika town has a population of 30,000 people and has an area of 1500 hectares of land. Out of this vast area, 300 and 250 hectares are zoned commercial and industrial respectively. The average water consumption is 200 litres per hectare per day and 85% 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 commercial, domestic, 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).

d). List down ANY four methods applied in population forecasting (4 Marks).

Question Two

a). Design a sedimentation tank for a flow (Q) of 1000 m^3 per day. Determine the dimensions of the tank and the outflow weir length. Other details are: an Overflow rate (OFR) of 20 m^3 /m^2.d, detention time = 2hrs and the width (W) to length (L) is 1:3 and the weir loading of 160 m^3/m.d (8 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 three methods of screen disposal (6 Marks).

Question Three

a). 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 160 litres per person. Assume a surface loading rate of 0.9 $m^3 m^{-2} h^{-1}$ and that the weir loading rate is within the acceptable limits (12 Marks).

b). Discuss the types of surveys that must by a design team in order for them to get information regarding project preparation and economic analysis (8 Marks).

Question Four

a). Explain the importance of the following in the design of sewer system

i). Maximum dry weather flow rate (Q_d).

ii). Minimum flow rate (Q_{min})

iii). Estimation of industrial wastewater (6 Marks).

b). Mikindani town has a population 32,000 people and the average water consumption is 150 litres per person per day and an effluent flow of 80 litres per day. Determine the mid-depth area of a facultative tank, detention time, organic loading and the bacterial quality of the final effluent, use K=0.30 per day, and D = 1.2 m (8 Marks).

c). Make short notes on the following terms as used in wastewater processes

i). Clarification

ii). Sedimentation

iii). Thickening (6 Marks).

Question Five

a). Given the following details, design a rectangular sedimentation tank for a flow rate of 30,000 m^3/day. These details are:

- Detention time (DT) = 3 hours
- Length (L) to Width (W) ratio of 4:1
- Surface loading rate = 20 m^3/m/day
- Weir loading rate = 0.1 m^3/min (10 Marks).

b). A 50 hectare drainage basin containing 24 hectare net residential area with average 5 dwelling units per hectare with 4 residents, and 16 hectare zoned commercial area. Determine the design flow for a sewer servicing this area. Take wastewater generation:

- Residential = 400 litres/capita/day
- Commercial = 18000 litres/hectare/day
- Peak I and I allowance = 9000litres/hectare/day (5 Marks).

c). Why is treatment of wastewater important? (5 Marks).