MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY SPECIAL/SUPPLEMENTARY EXAMINATIONS 2018/2019 ACADEMIC YEAR

FIFTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 531

COURSE TITLE: SEWERAGE AND WASTEWATER TREATMENT

DATE: WEDNESDAY 27ᵀᴴ JANUARY 2020 TIME: 8.00 – 10.00AM

INSTRUCTIONS:

1. This paper contains **FIVE** Questions
2. Answer **ALL** Questions in Section **A** and any **TWO** Questions in Section **B**
3. Marks for each question are indicated in the parenthesis.
4. It is in the best interest of the student to write legibly
5. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

CSE 531: SEWERAGE AND WASTEWATER TREATMENT

SECTION A – Compulsory (40 Marks)

Question One

a) Briefly explain the concepts of self-cleaning velocity and non-scouring velocity in sewer design giving their desired values   **[4 marks]**

b) Calculate the quantity of sewage for a combined sewer system for a town, given the following data:

        Area of the town – 250 hectares
        Intensity of rainfall – 50 mm/hr
        Population density – 300 persons/hectare
        Rate of water supply – 250 litres/capita/day
        Peak factor - 2.0
        Surface classification

Type of surface	% Area	Run off coefficient
Roofs	50	0.90
Paved surfaces	30	0.85
Non paved surfaces	20	0.30

Assume 80% of the water supplied reaches the sewer   **[6 marks]**

c) A main sewer was designed for an area of 50 km^2. Density of population of the town is 200 persons/hectare. The average sewage flow is 250 litre/capita/day. The peak discharge is one and half times more than average flow. Rainfall equivalent of 8mm in 24 hours, all of which are runoff.
i) What should be the capacity of the sewer?   **[5 marks]**
ii) Find the diameter of the sewer when running full. Take n = 0.012 and slope of 1 in 625
                                                                              [5 marks]

Question Two

a) Describe the significance of screening and grit removal in wastewater treatment
                                                                              [4 marks]

b) Design a rectangular grit chamber for a town having a population of 100,000. Assume per capita sewage production as 120 litres/day, horizontal velocity of 30 cm/s, detention time of 60 seconds and settling velocity of 2.2 cm/s. Assume depth is twice its breadth. Take peak factor as 3   **[7 marks]**

c) Explain the treatment mechanism in the following waste stabilization ponds
i) Facultative pond   **[5 marks]**
ii) Maturation pond   **[4 marks]**

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SECTION B (Attempt any Two Questions)

Question Three

a) Calculate the diameter, depth and weir loading of a primary sedimentation tank, using the following data:

- Sewage flow - 6 Million Litres per day
- Detention period - 2 hrs
- Overflow rate - 1500 L/m^2/hr   **[6 marks]**

b) Explain using a suitable sketch the operation of a septic tank   **[5 marks]**

c) Explain re-circulation in trickling filters and its relevance   **[4 marks]**

Question Four

a) Differentiate between suspended and attached growth processes in wastewater treatment. Give one example in each case   **[5 marks]**

b) A wastewater effluent of 600 L/s with a BOD = 60 mg/l, DO = 2.5 mg/l and temperature of 25°C enters a river where the flow is 30 m^3/s and BOD = 3 mg/l, DO = 8.5 mg/l and temperature of 16°C. Deoxygenation constant for the waste is 0.10 per day at 20°C. The velocity of water in the river downstream is 0.15 m/s and the depth of flow is 1.5 m. Determine the following after mixing of wastewater with the river water
i) Combined discharge (ii) BOD (iii) DO (iv) Temperature   **[4 marks]**

c) Why is wastewater stabilization ponds preferred method of wastewater treatment in most towns in Kenya? What are the challenges of this method?   **[6 marks]**

Question Five

a) Explain the different tests for the inspection of a sewer   **[6 marks]**

b) Describe the concept of urine diverting toilet as a sustainable sanitation technology
        [4 marks]

c) Outline factors favouring disposal of treated wastewater to water bodies
        [5 marks]

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