UNIVERSITY OF RUHUNA
THIRD EXAMINATION IN B.Sc GREEN TECHNOLOGY (PART I) – JULY/AUGUST-2022
Wastewater Treatment – ID 3101

Structured and Essay Type **Time: 1½ hours**

Index Number [ ]

Answer ALL questions.
Answers to the structured question in Part A must be supplied in the spaces provided.
Answers to essay type questions in Part B must be supplied on the answer books.
All questions carry equal marks.
Only non-programmable calculators are permitted.
Mobile Phones are not allowed

PART A- STRUCTURED TYPE

1. (a). Wastewater treatment is one of the major parts of environmental sciences.
   i. List FIVE reasons for the wastewater treatment.

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   .....(10 Marks)

   ii. Determination of properties of wastewater is very important in wastewater treatment. Why do we determine wastewater properties?

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   .....(10 Marks)

   iii. List the inorganic constituents frequently determined in the wastewater characterization.

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   .....(10 Marks)

   (b). Determination of solids are one of the very important physical properties frequently used in wastewater characterization. The following test results were obtained for a wastewater sample taken at the inlet of a wastewater treatment plant. All tests were performed using a sample size of 40 mL. Samples used in the solid analysis were all either evaporated, dried, or ignited to a constant weight.

Tare mass of evaporating dish	50.5248 g
Mass of evaporating dish plus residue after evaporation at 105°C	51.4894 g
Mass of evaporating dish plus after ignition at 550°C	50.7211 g
Mass of Whatman GF/C filter after drying at 105°C	1.2483 g
Mass of Whatman GF/C filter and residue after drying at 105°C	1.2854 g
Mass of Whatman GF/C filter and residue after ignition at 550°C	1.2686 g

Determine:

i. Total Solids (TS)

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.....(05 Marks)

ii. Total Volatile Solids (TVS)

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.....(05 Marks)

iii. Total Fixed Solids (TFS)

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.....(05 Marks)

iv. Total Dissolved Solids (TDS)

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.....(05 Marks)

v. Total Suspended Solids (TSS)

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.....(05 Marks)

(c). i. What is alkalinity with respect to wastewater?

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.....(05 Marks)

ii. List the major ions that responsible for the alkalinity.

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.....(10 Marks)

iii. Why sufficient alkalinity is beneficial in wastewater treatment?

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.....(10 Marks)

(d). The following information were taken for a seeded 5-day BOD test conducted on a wastewater sample. Ten milliliters (10 mL) of the sample were added directly into a 300 mL BOD incubation bottle. The initial dissolved oxygen of the diluted sample was 9.5 mg/L and the final dissolved oxygen after 5 days was 2.1 mg/L. The corresponding initial and final dissolved oxygen concentration of the seeded dilution water was 9.4 mg/L and 8.7 mg/L, respectively. Determine the 5-day BOD of wastewater sample?

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.....(20 Marks)

PART B- ESSAY TYPE

1. (a). In municipal wastewater treatment, numbers of treatment methods are used in different stages for removal of different pollutants. What are the major treatment stages to be followed in municipal wastewater treatment? Briefly explain with their primary objectives. (20 Marks)

   (b). Briefly explain the unit processes and unit operations used in wastewater treatment with examples. (20 Marks)

   (c). What is the principle involved in the followings?
   - i. Reverse osmosis
   - ii. Electrodialysis
   - iii. Ion exchange
   - iv. Advance oxidation
   - v. Adsorption
   - vi. Depth filtration

   (30 Marks)

   (d). You are requested to construct a treatment system for the wastewater generated from a food factory.
   - i. What is the information you would collect before designing the treatment system?
   - ii. Factory owner suggested to construct a biogas digester as treatment method. Do you agree with the suggestion? Justify your answer?

   (30 Marks)

2. (a). Enlist different categories of microorganism that are responsible for the wastewater treatments with examples? (20 Marks)

   (b). Distinguish the difference between attached growth systems and suspended growth systems in wastewater treatment systems (20 Marks)

   (c). Using a suitable illustration explain all component of an activated sludge treatment process. (20 Marks)

   (d). Enlist advantages and disadvantages of Rotating biological reactor in wastewater treatment. (20 Marks)

   (e). Using schematic diagrams, depict different anaerobic reactor types in wastewater treatments (20 Marks)

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