

Assignment II.2

Assigned date: 8 April 2024

Due date: **15 April 2024**

Submit **a PDF copy** of your assignment to **Canvas by 23:59 on 15 April 2024** (late submissions will not be accepted).

Complete all the problems. Give the answers in **two decimal places**.

Problem 4.1

Given a flow rate of $8500 \text{ m}^3/\text{d}$ and an overflow rate of $50 \text{ m}^3/(\text{d} \cdot \text{m}^2)$, calculate the following design parameters of a proposed circular primary sedimentation tank:

- (i) Height of the sedimentation tank (assuming a criterion of diameter/height ratio of 3.5) **(2 marks)**
- (ii) Hydraulic retention time (HRT) of the sedimentation tank. **(1 mark)**

Problem 4.2

There is an outdoor renovation project ongoing next to the lobby (G/F) of one of the hall in HKUST. You are a civil engineering student living in the hall and would like to estimate the noise level at your room. Give your answers to the nearest dB for this question.

- (i) Someone claimed that under the same noise source, if receiving distance is doubled, the sound pressure level would be attenuated by approximately 6 dB. Do you agree? (*Hint: Assuming two receivers with distances and sound levels r_1, L_1 and r_2, L_2 respectively and prove the relationship above.*) **(2 marks)**
- (ii) Hence, if you are living on the 8th floor, and the measured noise level under unmitigated scenario is 98 dB on the 2nd floor, what is the estimated noise level at your room without any mitigation measures? **(2 marks)**
- (iii) Suggest one engineering solution that the can be taken to minimize the noise impact to the residents in the hall. **(2 marks)**

Problem 4.3

You are performing carbon auditing for a construction contractor Company A for construction work, and some activity data and related emission factors of Company A in 2020 are tabulated in **Table 1** as follows.

Table 1. Activity data and emission factor of Company A in year 2020

Activities	Activity data	Emission factors
Operation of mobile cars (biodiesel)	(To be calculated in (i))	
Electricity	5000 kWh per month	0.37 kg CO ₂ e/kWh
Operation of light vans (unleaded petrol)	Fuel consumption: 27000 L	EF _{CO2} = 2.360 kg/L EF _{CH4} = 0.203 g/L EF _{N2O} = 1.105 g/L
Paper consumption	8 tonnes	4.8 kg CO ₂ e/kg of waste

(i) Assuming that B35 biodiesel is adopted by Company A to reduce carbon footprint, and the fuel economy of the car used is 50 km/gal. Find the daily carbon footprint caused by mobile combustion if 4 cars are needed to travel for 30 km every day. (Assuming that CO₂ is the only GHG emitted.) (2 marks)

(ii) Categorize the activities in **Table 1** by scope 1, 2 and 3. (3 marks)

(iii) By (i), (ii) and **Table 1**, calculate the total annual carbon footprint of Company A in 2020 (Hint: You should calculate the annual carbon footprint of each activities in **Table 1** and sum them up). (6 marks)

Note:

- Carbon emission = Activity data (e.g. fuel consumption) × Emission Factor
- Emission (CO₂ equivalent) = Σ (Fuel consumption × Emission Factor of each GHG × GWP)
- GWP of different GHGs

GHG	Global warming potential (GWP)
CO ₂	1
CH ₄	28
N ₂ O	265