

## 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 8<sup>th</sup> floor, and the measured noise level under unmitigated scenario is 98 dB on the 2<sup>nd</sup> 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 <sub>2</sub> e/kWh  |
| Operation of light vans (unleaded petrol) | Fuel consumption:<br>27000 L | EF <sub>CO2</sub> = 2.360 kg/L<br>EF <sub>CH4</sub> = 0.203 g/L<br>EF <sub>N2O</sub> = 1.105 g/L |
| Paper consumption                         | 8 tonnes                     | 4.8 kg CO <sub>2</sub> 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 CO<sub>2</sub> 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 (CO<sub>2</sub> equivalent) =  $\Sigma$  (Fuel consumption × Emission Factor of each GHG × GWP)
- GWP of different GHGs

| GHG              | Global warming potential (GWP) |
|------------------|--------------------------------|
| CO <sub>2</sub>  | 1                              |
| CH <sub>4</sub>  | 28                             |
| N <sub>2</sub> O | 265                            |