



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION SEMESTER II SESSION 2023/2024

COURSE NAME : ENVIRONMENTAL ENGINEERING

COURSE CODE : BFC32403

PROGRAMME CODE : BFF

EXAMINATION DATE : JULY 2024

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 Open book
 Closed book
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

Q1 (a) Explain **TWO (2)** important reasons that necessitate the removal of discrete particles (grit) at an early stage before entering subsequent treatment processes in a sewage treatment plant.

(5 marks)

(b) A new residential area consists of the following premises as shown in **Table Q1.1**.

Table Q1.1 Premise type, quantity, and the population equivalent of the new residential area

Premise Type	Quantity	Population Equivalent (PE)
Residential house	4500-unit	5 per house
Commercial building	15,000 m ²	3 per 100 m ²
Primary school	1200 students	0.2 per person
Private hospital	350 beds	4 per bed

Note: Design flowrate = 225 L/capita.day

Calculate:

(i) Total PE (2 marks)

(ii) Average daily flow (1 mark)

(iii) Peak flow factor (1 mark)

(iv) Peak flowrate (1 mark)

(c) The wastewater of 15,850 m³/d flows into a primary sedimentation tank. The dimension of the tank is 48 m length, 7.5 m width and 3.5 m depth. The weir of 111 m was provided in this tank. Calculate the following:

(i) Length: width ratio Length: width ratio (1 mark)

(ii) Width: depth ratio (1 mark)

(iii) Detention time (1 mark)

(iv) Surface overflow rate (1 mark)

(v) Weir loading rate

(1 mark)

Evaluate the compliance of the following parameters with the recommended design criteria for the design of primary sedimentation tank as shown in **Table Q1.2**.

Table Q1.2 Design parameters for primary sedimentation

Description	Unit	Design Criteria
Sedimentation followed by secondary treatment		
Detention time at Q_{peak}	hr	2
Surface overflow rate at Q_{peak}		
- circular (maximum)	$m^3/m^2/d$	45
- rectangular (maximum)	$m^3/m^2/d$	45
Weir loading at Q_{peak}	$m^3/m/d$	150
Upward flow rate at Q_{peak}	m/hr	1.2 - 2.0
Sizing of rectangular tanks		
Length : Width		> 3:1
Min water depth	m	2.5
Width : Depth		1 : 1 to 2.5 : 1
Sizing of circular tanks		
Min. side water depth	m	> 3.0
Floor slope wall		1:12

(d) Differentiate between aerobic and anaerobic decomposition in terms of COD balance.

(5 marks)

Q2 (a) Scheduled wastes are waste falling under categories listed in the First Schedule of the Environmental Quality (Scheduled Wastes) Regulations 2005. State **FOUR (4)** of schedule waste characteristics.

(4 marks)

(b) Batu Pahat Distribution Council plans to collect household solid waste in Kampung Bharu, Batu Pahat, Johor. Solid waste sampling was carried out for five selected houses, and data collection is shown in **Table Q2.1**.

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Table Q2.1 Solid waste sampling work

House Number	Family size	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
1	3	1.5	1.1	1.9	-*	1.8	1.7	1.4
2	4	2	2.1	-*	3	2.7	2.8	2
3	2	1	1.1	1.5	1.3	1.7	1.8	1.9
4	8	3.1	2.9	2.8	3.5	-*	4.1	4.2
5	1	0.5	0.6	0.1	0.3	0.9	1.0	0.4

*No trash was collected

- (i) Determine the total waste, total people and generation rate per capita for each day. (3 marks)
 - (ii) Determine the average generation rate per capita for all houses. (1 mark)
 - (iii) By estimating the waste density as 140 kg/m³, calculate the container volume for each house within four days of collection. (3 marks)
 - (iv) Household wheelie bin sizes are 120, 140, 180, 240, or 360 liters. Based on your opinion, recommend the size of bins in this area. Justify your answer. (3 marks)
- (c) In a city with a population of 410,000, residents collectively produce municipal solid waste (MSW) at a daily rate of 1.2 kg per capita. The landfill's total capacity is 12,000,000 m³, and the compacted waste has a density of 400 kg/m³. Presently, 70% of the landfill is in use, and the ratio of cover to compacted fill stands at 2.0. Estimate the projected lifespan of the landfill. (6 marks)

- Q3**
- (a) Distinguish between primary and secondary air pollutants. (4 marks)
 - (b) Correlate the outdoor release of sulfur dioxide (SO₂) towards health and environmental impacts. Limit to **TWO (2)** impacts for each. (8 marks)

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- (c) A coal containing 2% sulfur is burned completely to ash in brick kiln at a rate of 30 kg/min. The sulfur contain in the ash is 6% of the initial amount of sulfur present in the coal fed to brick kiln. The molecular weights of S, H and O are 32, 1 and 16 g/mole, respectively. Determine the annual rate of sulfur dioxide (SO₂) emission from the kiln in tonnes/year.

(8 marks)

- Q4** (a) Describe meant of industrial noise.

(3 marks)

- (b) Explain **TWO (2)** reasons in determining baseline data for noise monitoring (4 marks)

- (c) The noise monitoring equipment is to be positioned in a selected area as shown in **Figure Q4.1**. Choose the location that are; Point A: preferable and Point B: less preferable to locate the equipment. Provide reason for each selection. Template for **Figure Q4.1** is available in **Appendix A.1** for your sketch answer.

(5 marks)

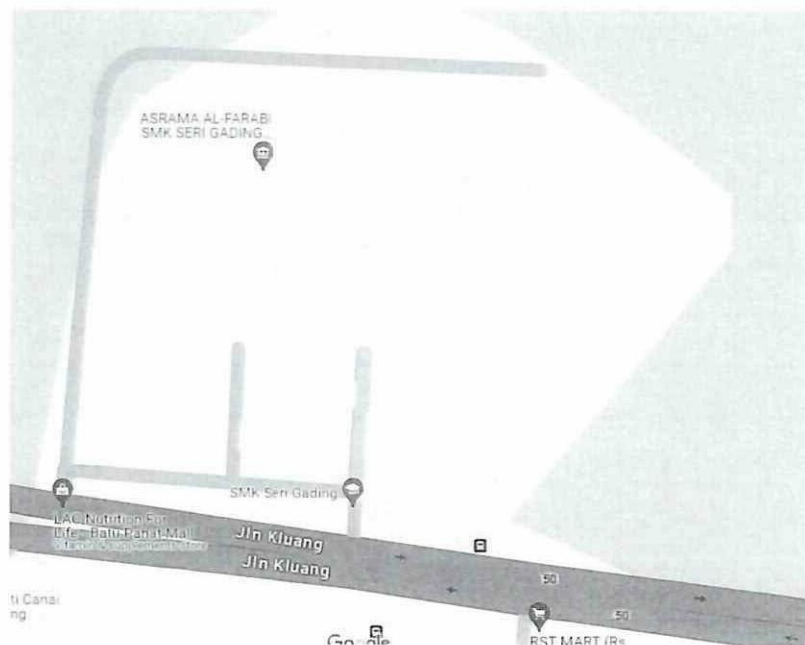


Figure Q4.1 Indicate points of noise monitoring equipment location for Point A and B on map

- (d) Distinguish between the boundary noise and indirect noise and explain how these noises occurred in construction site.

(8 marks)

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- Q5** (a) There are **TWO (2)** types of Environmental Impact Assessment (EIA) according to Environmental Quality Act 1974. List and explain the type of EIA. (5 marks)
- (b) A high-rise building will be constructed in urban area where the construction area is surrounded by residential area. Regarding the mentioned construction project, there are potential impacts to environment during construction as follows. As EIA consultant, propose mitigation measures for each issue:
- (i) As a lot of heavy machinery, and other vehicles on site, operate on diesel engines, they release pollutants into the air. (3 marks)
- (ii) Construction can disturb land surfaces, leading to increased erosion. Rain can wash the sediment into nearby waterways, impacting aquatic life and water quality. (3 marks)
- (iii) Piling activities on the construction site will contribute to noise and vibration pollution. (3 marks)
- (c) Describe **THREE (3)** objectives of the Environmental Management Plan (EMP). (6 marks)

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-END OF QUESTIONS-

APPENDIX A

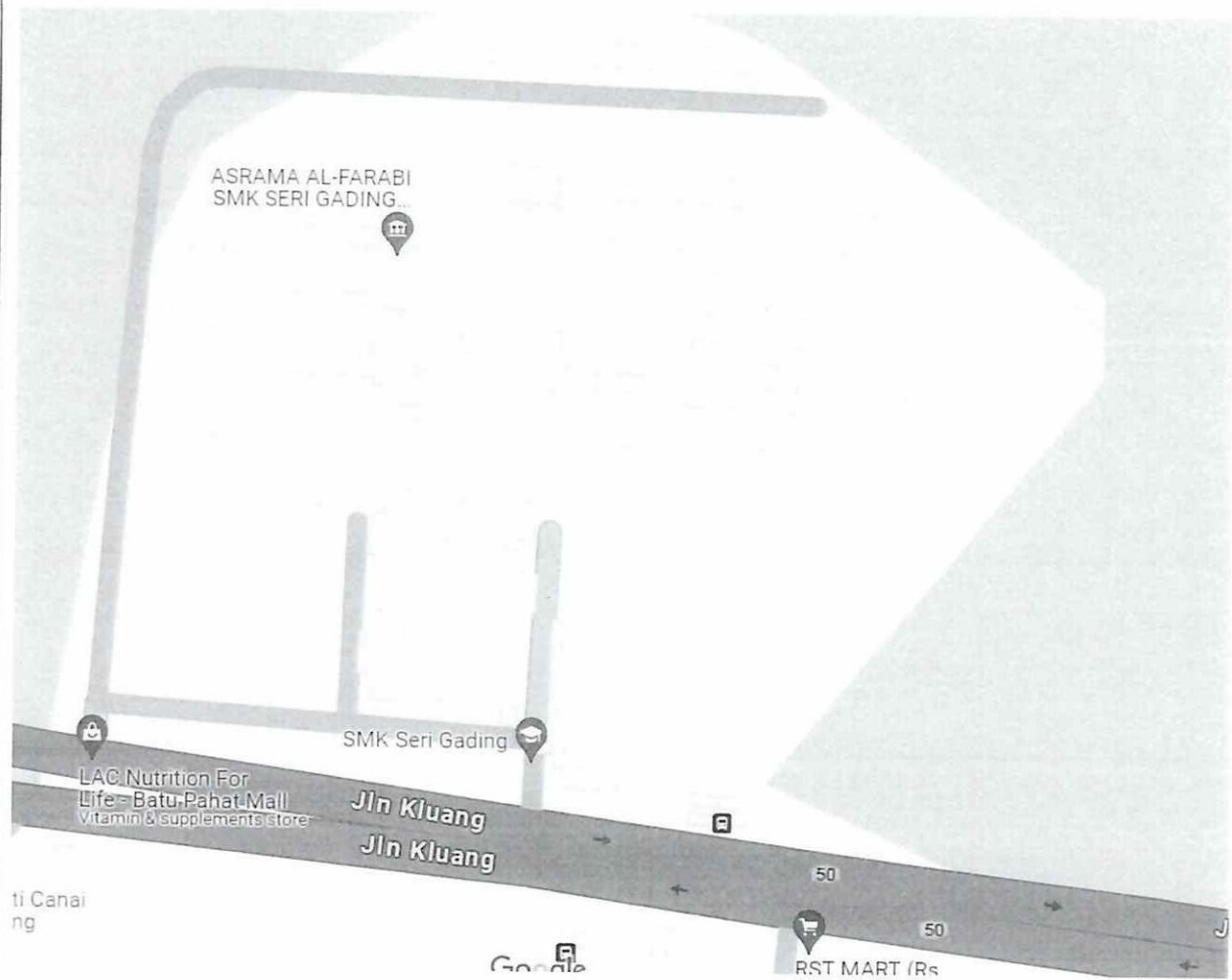


Figure APPENDIX A.1 Template to indicate points of noise monitoring equipment location for Point A and B

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