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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2023/2024**

- COURSE NAME : ENVIRONMENTAL ENGINEERING
- COURSE CODE : BFC32403
- PROGRAMME CODE : BFF
- EXAMINATION DATE : JANUARY / FEBRUARY 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 **FIVE (5)** PAGES

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- Q1** (a) Explain **TWO (2)** functions of the National Water Services Commission (SPAN), that outlines by Suruhanjaya Perkhidmatan Air Negara Act 2006 (Act 654).  
(4 marks)
- (b) Sketch a diagram illustrating the potential sources of point and non-point water pollution that contributing to the degradation of the water resources quality.  
(6 marks)
- (c) Determine the minimum classes of water for the activities listed in **Table Q1.1** below according to the Malaysia National Water Quality Standard (INWQS):

**Table Q1.1**

No.	Uses
1	Recreational Park with river water sport activities
2	Plantation Estate
3	Tilapia farm
4	Water treatment plant with conventional treatment process

(4 marks)

- (d) Calculate the total hardness, carbonate hardness, non-carbonate hardness and alkalinity for the following concentration of ions:

$\text{Ca}^{2+}$  : 80 mg/L as  $\text{CaCO}_3$   
 $\text{Mg}^{2+}$  : 35 mg/L as  $\text{CaCO}_3$   
 $\text{Na}^+$  : 20 mg/L as  $\text{CaCO}_3$   
 $\text{K}^+$  : 7 mg/L as  $\text{CaCO}_3$   
 $\text{HCO}_3^-$  : 92 mg/L as  $\text{CaCO}_3$   
 $\text{SO}_4^{2-}$  : 51 mg/L as  $\text{CaCO}_3$   
 $\text{Cl}^-$  : 16 mg/L as  $\text{CaCO}_3$

(6 marks)

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Q2 (a) Differentiate between potable and palatable term of the water quality. (4 marks)

(b) Jar testing was performed using alum on a raw drinking water source that contained an initial turbidity of 20 NTU and alkalinity of 100 mg/L as CaCO<sub>3</sub>. The optimum coagulant dosage was determined as 10 mg/L. Determine the quantity of alkalinity consumed as CaCO<sub>3</sub>. Assume the following chemical reaction is applied.



(Given atomic weight: H=1, O<sub>2</sub>=16, C =12, Al=27, Cl=35.5, SO<sub>4</sub>=96, HCO<sub>3</sub>=61, CO<sub>3</sub>=60)

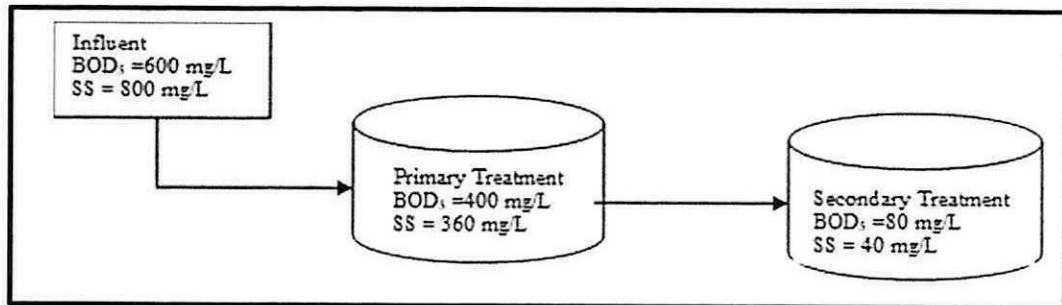
(5 marks)

(c) With an illustration, explain the natural process of hardness formation in a natural water system and describe how to remove carbonate and non-carbonate hardness in water.

(11 marks)

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- Q3** (a) State the need of preliminary and primary wastewater treatment. (3 marks)
- (b) Based on **Figure Q3.1**, determine the BOD<sub>5</sub> and suspended solid (SS) removal efficiencies after primary and secondary treatment for domestic wastewater system.



**Figure Q3.1** Schematic diagram of wastewater treatment system

- (6 marks)
- (c) There are **THREE (3)** types of processes in the decomposition of organic waste in secondary wastewater treatment, namely aerobic, anoxic and anaerobic. Distinguish the respective process. (6 marks)
- (d) Sludge treatment includes thickening and dewatering. Explain and compare these processes in the production of the final product for landscaping or composting. (5 marks)
- Q4** (a) Explain **TWO (2)** factors affecting rate of generation of municipal solid waste in Malaysia. (4 marks)
- (b) Temenggong Ibrahim Girl School has 750 students and 32 standard classrooms. The school week runs five days, with waste pickups on Monday and Thursday mornings. Waste is generated at a rate of 110 g/capita/day and 3.4 kg/room/day, with a waste density of 110 kilograms per cubic meter. Design the storage container size needed for the school's waste. (6 marks)
- (c) Household schedule waste should be separated from the source. In Malaysia, only recyclable waste gets sorted and sent to recycling centres. Suggest effective methods to identify and separate the household scheduled waste according to scheduled waste characteristics. (10 marks)

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**Q5** (a) Distinguish primary pollutants and secondary pollutants for air pollutants. Give an example for each type of air pollutants.

(4 marks)

(b) Explain how noise pollution affects adults and children in terms of human health.

(4 marks)

(c) Six parameters in air pollutants are used to calculate individual index for Air Pollutant Index (API). This maximum individual index is chosen as API value. Due to haze occurring in Malaysia, choose an air pollutant that contribute to the maximum index and subsequently the API value and explain why.

(6 marks)

(d) Outlining the specification of noise monitoring equipment for construction activity.

(6 marks)

**-END OF QUESTIONS-**

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