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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019**

COURSE NAME : ENVIRONMENTAL ENGINEERING
COURSE CODE : BFC32403
PROGRAMME CODE : BFF
EXAMINATION DATE : DECEMBER 2018 / JANUARY 2019
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1** (a) State **THREE (3)** sets of environmental regulations promulgated by the Ministry under Malaysian Environmental Law. (3 marks)
- (b) Examine **THREE (3)** benefits of supporting principles that were considered during the establishment of Malaysia National Policy on the Environment. (9 marks)
- (c) Explain **TWO (2)** major classes of air pollutant and their typical members of subclasses. (4 marks)
- (d) Discuss **TWO (2)** most important atmospheric conditions that affect dispersion of pollutants. (4 marks)

- Q2** (a) Briefly explain the following water quality parameters:
- (i) Chemical oxygen demand (1.5 marks)
 - (ii) Biological oxygen demand (1.5 marks)
 - (iii) Dissolved oxygen (1.5 marks)
 - (iv) Total solids (1.5 marks)
- (b) From the following water analysis,
- (i) Prepare a bar chart of the described water
 - (ii) Determine the amount of soda ash (in mg/L as CaCO_3) to soften the Village of Molten's water to 80 mg/L hardness as CaCO_3 .

The water sample consists:

91.5 mg/L of Ca^{2+} , 11.3 mg/L of Mg^{2+} , 27.6 mg/L Na^+ , 19.4 mg/L CO_2 , 182.0 mg/L HCO_3^- , 43.8 mg/L SO_4^{2-} , and 17.3 mg/L Cl^- .

Given the atomic weight:

[S = 32; O = 16; C = 12; Cl = 35.5; Ca = 40.1; Mg = 24.3; Na = 23]

(14 marks)

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- Q3** (a) Sketch and label a diagram of conventional water treatment for groundwater. (4 marks)
- (b) With aid of diagram, explain coagulation and sedimentation processes. (6 marks)
- (c) Calculate the diameter and depth of a circular clarifier for a design flow of 4000 m³/d, an overflow rate of 0.0002 m/s, with 3 hours detention time. Also, calculate the weir loading rate by assuming the total effluent weir is 23 m. (10 marks)

- Q4** (a) State **FIVE (5)** objectives of equalization process. (5 marks)
- (b) Define activated sludge. (2 marks)
- (c) Calculate weir loading rate and the dimension of a primary tank. Given, wastewater flow is 12,000 m³/d, weir for the primary tank is 75 m long, and surface area is 700 m². Assume the ratio of length to width is 2:1. (5 marks)

Calculate the sludge age of activated sludge process to meet effluent standard of 20 mg/L BOD and 25 mg/L suspended solids. Assume the BOD of effluent suspended solids is 65% of the allowable suspended solids concentration. Estimate the required volume of the aeration tank if the hydraulic retention time is 0.25 d and the flowrate is 0.035 m³/s. Determine the BOD loading (in kg/m³.day) for activated sludge process if the effluent BOD is 500 mg/L.

Given:

Soluble BOD₅ concentration at one half the maximum

Growth rate, K_s = 100 mg/L BOD

Decay rate of microbes, k_d = 0.025/d

Maximum growth rate, μ_m = 10/d

$$\text{Sludge age, } \theta_c = \frac{K_s + S}{(\mu_m)(S) - (S)(k_d) - (K_s)(k_d)}$$

(8 marks)

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- Q5** (a) Define recycling of municipal solid waste (MSW). Include the importance of MSW to recycle process. (5 marks)
- (b) Explain source reduction and discuss **TWO (2)** examples of source reduction in solid waste management. (5 marks)
- (c) A MSW landfill is being designed to handle solid waste generated by a town at a rate of 50,000 kg/d. It is expected the solid waste will be collected by compactor trucks and sent to a landfill on a frequency of 5 day/week basis. The density of solid waste as it is spread is 122 kg/m³. It will be spread in 0.5 m layers and compacted to 0.25 m. Assuming three such lifts per day and daily cover of 0.15 m, determine the followings:
- (i) Annual volume of landfill consumed in m³ (5 marks)
- (ii) Daily horizontal area covered by solid waste (5 marks)

- END OF QUESTIONS -

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