UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ENVIRONMENTAL ENGINEERING
COURSE CODE	:	BFC32403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Briefly explain the importance of turbidity and BOD_5 in water quality measurement.
(5 marks)

(b) A meat processing factory discharges 0.011 m^3/s of wastewater into Sembrong River. Ultimate DO and BOD concentration of the wastewater are 1.5 mg/L and 590 mg/L, respectively. Sembrong River has a 7-day low flow of 1.7 m^3/s. Upstream of the factory, the DO and ultimate BOD of Sembrong River are 7.0 mg/L and 3.0 mg/L, respectively. The saturated DO in the Sembrong River is 8.6 mg/L. Using kr and kd of 0.7 day^{-1} and 0.6 day^{-1}, calculate the critical time.
Given:

$$t_c = \frac{1}{k_r - k_d} \ln\left[\frac{k_r}{k_d}\left(1 - D_a \frac{k_r - k_d}{k_d L_a}\right)\right]$$

(7 marks)

(c) A town has an existing horizontal-flow sedimentation tank with an overflow rate of 15 $m^3/d.m^2$ to remove particles that have settling velocities of 0.2 mm/s.

(i) Calculate the percentage of removal that should be expected for each particle in an ideal sedimentation tank.
(4 marks)

(ii) Suggest a suitable settling velocity for the tank to ensure 100% of the particles are removed.
(4 marks)

Q2 (a) Define the following water treatment processes:

(i) Softening
(1 marks)

(ii) Coagulation/flocculation
(1 marks)

(iii) Sedimentation
(1 marks)

(iv) Disinfection
(1 marks)

(b) Illustrate the coagulation and flocculation process with the aid of a diagram.
(7 marks)

(c) A new treatment plant in Parit Raja is proposed to be constructed based on the coagulation with a capacity of 3.8×10^3 m^3/d. The rapid mixing tank have a mechanical mixer and the average alum dosage will be 30 mg/L. The theoretical mean hydraulic detention time of the tank will be 1 minute. Calculate:

(i) Quantity of alum needed on a daily basis in kg/d.

(3 marks)

(ii) Dimensions of the tank in meters for a tank with equal length, width, and depth.

(3 marks)

(iii) Power input required for a G of 900s^{-1} for a water temperature of 10°C. Given $\mu = 1.307 \times 10^{-3}$ kg/ms, and $G = \left(\frac{P}{\mu V}\right)^{0.5}$.

(3 marks)

Q3 (a) Distinguish the aerobic and anaerobic decomposition of organic matter in secondary treatment of wastewater. Which method is safer towards environment?

(4 marks)

(b) Evaluate the following primary tank design with respect to detention time, overflow rate and weir loading. The tank must be able to handle the maximum flow of wastewater with a capacity of 0.15 m^3 /s. The tank dimension is 3.5 m depth × 8.0 m width × 45 m length. Weir length is 55 m. Comment the results for verification to the standard practice design of MSIG Volume 4.

(6 marks)

(c) Town A has a sewage treatment plant to treat domestic wastewater, which generated a flow of 2,400 m^3/d of wastewater. The aeration tank in the activated sludge plant has effective dimensions of 6.5 m wide by 11.0 m long by 7.0 m deep. The activated sludge plant operating parameters are as follows:

Average BOD_5 after primary settling, S= 1,620 mg/L
BOD_5 after secondary settling = 95 mg/L
MLVSS = 2,200 mg/L
MLVSS/MLSS = 0.75
Settled sludge volume after 30 minutes = 280 mg/L

Given $\frac{F}{M} = \frac{QS}{VX}$ and $SVI = \frac{\text{sludge volume} \times 1000 \frac{\text{mg}}{\text{g}}}{MLSS}$

Calculate the following:

(i) BOD_5 loading

(2 marks)

(ii) Food to micro-organism ratio (F/M ratio)

(2 marks)

(iii) Sludge volume index (SVI)

(2 marks)

(iv) Percentage of BOD_5 removal and justify the efficiency of the activated sludge plant

(4 marks)

Q4 (a) Describe **TWO (2)** types of solid wastes representing a current challenge for solid waste management in Malaysia.

(6 marks)

(b) Discuss **TWO (2)** issues that represent the main challenges for clinical wastes management in Malaysia in the slight of the COVID-19 pandemic.

(6 marks)

(c) Suppose you are assigned as a manager for solid waste management in a town where there is no information on the amount of residential waste produced. The team did its survey and, based on a sample of 34 households taken over seven days, they came up with the data shown below. The total mass of solid waste produced by the 34 sample households over seven days was 480 kg. The average household size was 6.3 people. The population of the town was 75,000. Calculate:

(i) Generation rate of residential solid waste per person per day.

(4 marks)

(ii) Total amount of domestic solid waste generated per day by the people in town.

(4 marks)

Q5 (a) Sketch the flowchart to outline the procedure to calculate the Air Pollution Index (API)

(4 marks)

(b) As a site engineer, plan **THREE (3)** air pollution control suitable to be practiced in the construction site. Include a significant reason for each control.

(6 marks)

(c) (i) Determine **TWO (2)** conditions lead to the unacceptable noise monitoring.
(3 marks)

(ii) Explain the importance of getting the baseline data for noise quality before starting the physical work at a construction site.
(3 marks)

(d) Correlate the noise pollution with human health / behaviour by providing **TWO (2)** examples.
(4 marks)

-END OF QUESTIONS-