UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 2
SESSION 2018/2019

COURSE NAME	:	ENVIRONMENTAL ENGINEERING
COURSE CODE	:	BFC 32403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE/ JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

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Q1   (a)   Define point source and non-point source pollution.

(2 marks)

(b)   A series of dilutions were prepared in 300 mL BOD bottles using wastewater and dilution water. The dilution range, initial DO, final DO, and depletions are given in **Table 1**. Determine the BOD of each dilution and calculate the average BOD.

Table 1

Bottle	mL wastewater	Initial DO	Final DO
1	3	7.95	5.20
2	6	7.95	3.85
3	9	7.90	2.40
4	12	7.85	1.35

(4 marks)

(c)   Sketch and briefly explain the dissolved oxygen sag curve.

(6 marks)

(d)   A wastewater treatment plant serving a city of 200,000 discharges 1.10 m³/s of treated effluent having an ultimate BOD of 50 mg/L and a dissolved oxygen of 2.0 mg/L into stream that has a flow of 8.70 m³/s. BOD and DO of its own equal to 6.0 mg/L and 8.3 mg/L, respectively. The deoxygenation constant, k_d, is 0.20/day.

(i)   Assuming complete and instantaneous mixing, calculate the ultimate BOD of the river just downstream from the outfall.

(2 marks)

(ii)   Determine the initial dissolved oxygen deficit of the mixture of wastewater and river water just downstream from the discharge point. Assume the saturated value of dissolved oxygen DO_s at 20°C is 9.09 mg/L.

(2 marks)

(iii)   If the stream has a constant cross section, it flows at a fixed speed equal to 0.30 m/s, calculate the BOD remaining in the stream at a distance of 30,000 m downstream.

(4 marks)

Q2 (a) Sketch and briefly explain a typical surface water treatment plant system.

(4 marks)

(b) List **FOUR (4)** factors that affect particle settling in a sedimentation tank.

(2 marks)

(c) Calculate the size of a Type I square sedimentation tank that needs to treat 36,400 m^3/day of raw water, with a surface overflow rate of 12 m^3/day/m^2 and a detention time of 6 hours.

(6 marks)

(d) A city is to install rapid sand filters downstream of the sedimentation tank. The design loading rate is selected to be 160 m^3/day/m^2. The design capacity of the water works is 0.35 m^3/s. The maximum surface per filter is limited to 50 m^2.

(i) Design the number and size of filters.

(6 marks)

(ii) Calculate the normal filtration rate.

(2 marks)

Q3 (a) Flow equalization is an important option in a wastewater treatment plant. Explain the importance of flow equalization to the overall operation of the plant.

(6 marks)

(b) A primary settling tank is designed to handle maximum hourly wastewater flow of 0.6 m^3/s at an overflow rate of 62 m/day. Determine the surface area of the tank and calculate the hydraulic detention time if the tank depth is 3.2 m.

(4 marks)

(c) A slaughterhouse generated 1036.8 m^3/day of wastewater. The average BOD_5 of the raw wastewater before primary settling is 1400 mg/L. The aeration tank has an effective dimensions of 8.0 m wide by 8.0 m long by 5.0 m deep. Soluble BOD_5 after primary settling and MLVSS (X) entering the activated sludge system are 966 mg/L and 2000 mg/L, respectively. Determine the aeration period and F/M ratio.

Use: $F/M = \dfrac{Q \, So}{VX}$

(6 marks)

(d) Removal of nutrients such as nitrates (NO_3) and phosphates (PO_4) is done at tertiary level of a wastewater treatment before being discharged into water receiving bodies. Discuss why these nutrients have to be removed and explain the methods used.

(4 marks)

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Q4   (a)   Describe **ONE (1)** method of municipal solid waste collection system.

(4 marks)

(b)   Briefly describe **FOUR (4)** technologies for hazardous waste treatment.

(8 marks)

(c)   Suppose a city of 50,000 people generates 40,000 tonne of waste per year. At current recovery and recycling rates, 18 percent of that is recovered or recycled and the rest goes to a landfill. The landfill density is 800 kg/m^3, cell depth is 3m, and the cell contains 80 percent of waste. Determine:

(i)   Area of lift required in unit ha/year

(6 marks)

(ii)   Lifetime of landfill, if the current landfill site covers 20 hectares and there are only two more remaining lifts.

(2 marks)

Q5   (a)   Differentiate between haze and smog.

(5 marks)

(b)   Explain and illustrate **TWO (2)** types of electrostatic precipitator.

(5 marks)

(c)   A new elevated highway will be constructed nearby UTHM. Plan **FIVE (5)** noise control mechanisms that can be implemented to reduce the impacts of the construction to the UTHM community.

(10 marks)

-END OF QUESTIONS –

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