First Semester Examination
Academic Session 2021/2022

February/March 2022

EAP582 – Wastewater Engineering

Duration : 2 hours

Please ensure that this examination paper contains **FIVE (5)** printed pages before you begin the examination.

Instructions: This paper contains **FIVE (5)** questions. Answer **FOUR** questions.

All questions **MUST BE** answered on a new page.

(1). (a). An anaerobic rectangular waste stabilization pond is treating a poultry wastewater with the following design data.

Aerial Organic Loading	495 kg BOD/ha.day
BOD load	395 kg/day
Depth	2 m
Length: Width ratio	3:1 (at Top Water Level, TWL)
BOD	700 mg/L.

(i). Calculate the incoming flow in m^3/day.

[5 marks]

(ii). If the length and width at the based of the tank is 0.9 length and 0.9 width at TWL, evaluate the retention time of the pond.

[10 marks]

(b). Biochemical Oxygen Demand (BOD) is one of the most crucial parameter in sewage management. Explain the BOD terms and describe the important factors that need to be controlled and taken into consideration during the BOD test.

[10 marks]

(2). (a). A gravitational flow sewer pipe with diameter of 800 mm is placed at 0.4% slope. Using an appropriate assumption;

(i). Identify the depth of flow at a velocity of 0.6 m/s.

[3 marks]

(ii). Identify the discharge if the depth of flow is 450 mm.

[6 marks]

(b). A pumping station working with a pump head of 25 m. The output power of the motor for that pump is 16 kW. Identify the pump efficiency if the sewage discharge velocity is 0.27 m/s and the pipe diameter is 250 mm.

[8 marks]

(c). Explain **TWO (2)** types of sewage systems. Describe the most appropriate system recommended for Malaysia.

[8 marks]

(3). (a). An advanced wastewater treatment is an additional treatment that can be applied to remove remaining specific organic and inorganic materials after the secondary treatment. Explain in detail (i) **ONE (1)** of the advanced wastewater treatment processes and (ii) Justify the possibility of reusing the treated wastewater.

[15 marks]

(b). A complete mix activated sludge process is to be used for biological treatment. This plant receives 10,000 m^3 of wastewater per day with BOD loading of 250 mg/L. The primary treatment efficiency is 25%. Assume the followings:

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- Plant effluent BOD_5 = 12 mg/L
- Biomass yield = 0.54 kg biomass / kg BOD
- Endogenous decay rate = 0.05 day^{-1}
- Solids Retention Time = 8 days
- MLVSS concentration in the aeration tank = 2,700 mg/L
- Waste and recycle solids concentration = 12,000 mg/L

Determine the followings:

(i). The hydraulic detention time in hours.

(ii). The aeration tank volume in cubic meters.

[10 marks]

(4). (a). Explain **TWO (2)** waste treatment approaches that applies sustainability in the tofu industry.

[5 marks]

(b). The anaerobic digestor is an advanced technology that recently surfaced as an alternative clean solution for food waste. Describe how does the anaerobic digestor resolves **TWO (2)** environmental problems.

[5 marks]

(c). An anaerobic digester (AD) is designed with the following data.

Organic loading rate	1.0 kg VSS/m^3.day
VSS load	120 kg/day

(i). Estimate the volume of the AD.

[9 marks]

(ii). If the VSS is 12 kg/m^3, estimate the retention time.

[6 marks]

(5). (a). A wet sludge is thickened to 15% with a final volume of 5 m^3. Determine the initial volume of the sludge if it contains 5% solids.

[10 marks]

(b). In Malaysia, there are still very few sanitary landfills. As a result, most of the sludge is co-disposed with municipal solid waste.

(i). Discuss **ONE (1)** benefit of co-disposal of sludge and municipal solid waste.

[3 marks]

(ii). Discuss **THREE (3)** disadvantages with the help of sketch of co-disposal of sludge and municipal solid waste.

[12 marks]

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