

SULIT



First Semester Examination
2017/2018 Academic Session

January 2018

EAP582 – Wastewater Engineering

Duration : 2 hours

Please check that this examination paper consists of FIVE (5) pages of printed material including appendix before you begin the examination.

Instructions : This paper contains **FIVE (5)** questions. Answer **FOUR (4)** questions.

All questions must be answered in English.

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1. (a) Name the main and sub-legislations that govern the non-hazardous, high organic industrial wastewater discharges in Malaysia. Suggest appropriate standard to be complied with should the premise is located within the catchment area.

[4 marks]

- (b) There are a few main factors which should be considered and incorporated in developing the environmental policy within the Environmental Management System (EMS) in an organisation. In brief, discuss **FOUR (4)** important criteria that should be taken into consideration in this process.

[6 marks]

- (c) Cleaner Production (CP) is recognized as a tool that can contribute to the sustainable forms of economic development, as endorsed in Agenda 21 adopted by the United Nations Conference on Environment and Development (UNCED). By giving a suitable example, describe the concept of process modifications in waste minimization.

[5 marks]

- (d) Organic compounds in wastewater can be classified as biodegradable and non-biodegradable. Discuss these two types of organic matters and explain the biodegradation process.

[10 marks]

2. (a) Define the terms;

- (i) Sewage
- (ii) Sewer
- (iii) Sewerage

[6 marks]

- (b) Manhole is one of the sewer appurtenances. Describe the usage of the manhole and where it should be provided.

[10 marks]

- (c) An 800 mm diameter sewer pipe is placed on a slope of 0.4%. Assuming $n = 0.013$,
- (i) Determine the depth of flow when the velocity equals to 0.6 m/s
 - (ii) Calculate the discharge if the depth of flow is 450 mm
- [9 marks]
3. (a) Equalization or also known as balancing tank is the final stage in the pre-treatment of wastewater. Discuss the function of equalization tank. With the aid of diagram, explain the differences between the in-line equalization and off-line equalization tank.
- [15 marks]
- (b) Describe the **TWO (2)** advantages and **TWO (2)** disadvantages of anaerobic treatment process for wastewater.
- [10 marks]
4. (a) Waste stabilization pond is one of the simplest treatment methods which could be adapted for treating wastewater in hot climate. Suggest a typical process flow diagram that could be suitable to treat concentrated palm oil mill effluent in Malaysia.
- [5 marks]
- (b) An anaerobic waste stabilization pond is treating a poultry wastewater with the following design data:
- | | |
|------------------------|-------------------|
| Aerial Organic Loading | 500 kg BOD/ha.day |
| BOD load | 3,500 kg/day |
| Depth | 2 m |
| BOD | 20,000 mg/L |
- Assume no side slope
- Calculate:
- (i) Volume of tank
- [5 marks]
- (ii) The incoming flow in m^3/day
- [5 marks]

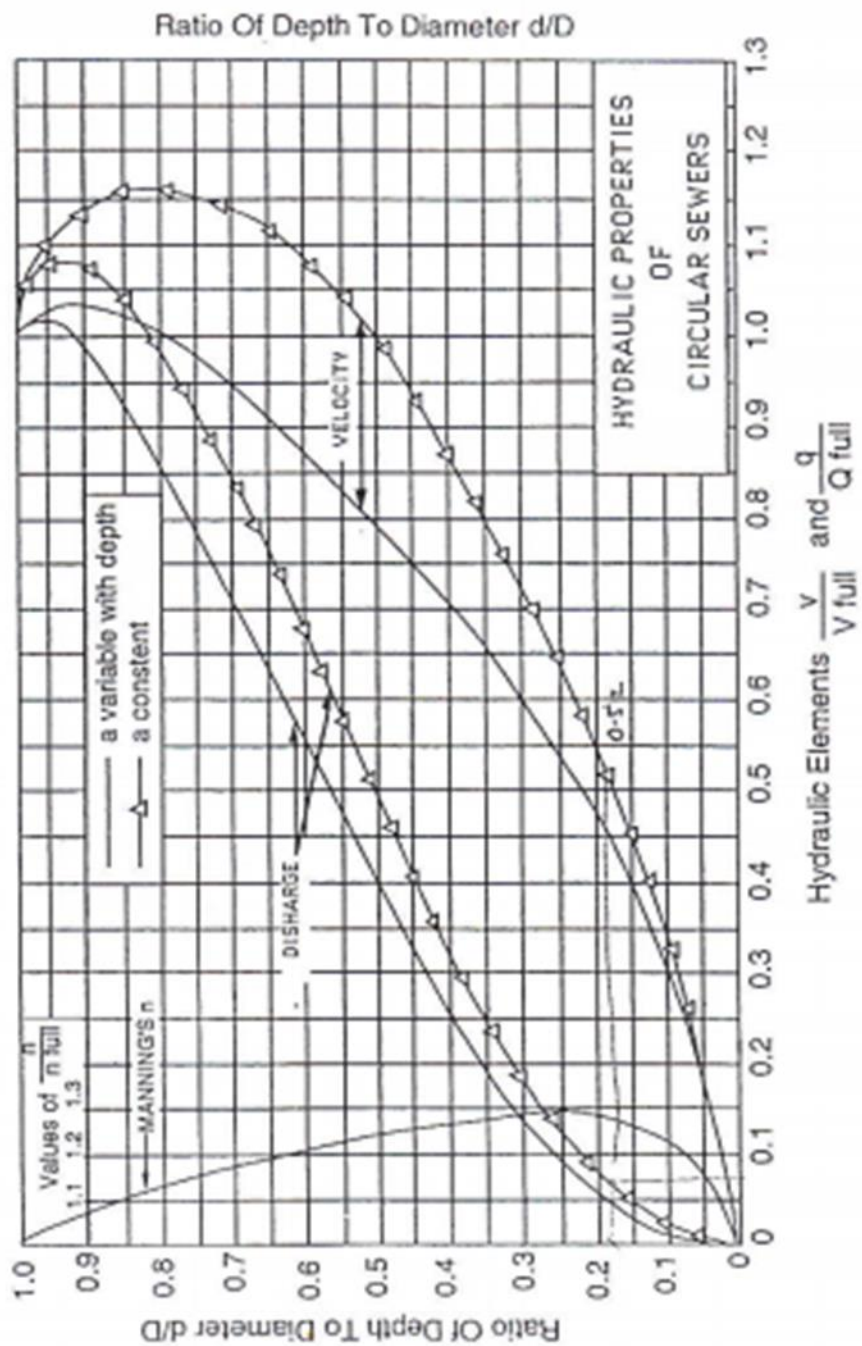
- (c) In Indonesia, the tofu industry produces an average of 20 million m³/year of liquid waste and about 1024 million tons of solid waste. The liquid waste from the tofu industries are generally discharged into the river, disrupting the water quality due to its high organic substances while releasing bad odor caused by the biodegradable solid waste.
- (i) Describe and draw two types of anaerobic treatments which liquid waste is treated using the aid of microorganisms. [6 marks]
- (ii) Explain the methods of managing the (okara) solid waste, as well as the biogas produced from tofu industries. [4 marks]
5. (a) Sludge contains settleable solids such as fecal materials, fibers, silt among others which can be described based on its physical and chemical characteristics.
- (i) Describe **TWO (2)** factors that affect the characteristics of sludge [3 marks]
- (ii) Describe the physical characteristics specific to the sludge originating from the following:
- Primary sedimentation tank
 - Chemical precipitation
 - Secondary sedimentation tank after trickling filter
 - Anaerobic digesters
- [12 marks]
- (b) Most of wastewater treatment plant sludge is disposed in co-disposal with urban solid waste at landfills. Discuss the **TWO (2)** advantages and **TWO (2)** disadvantages of sludge co-disposal with urban solid waste. [10 marks]

APPENDIX

$$Q = (1/n) (A) (R)^{2/3} (s)^{1/2}$$

$$V = (1/n) (R)^{2/3} (s)^{1/2}$$

$$R = A/P$$



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