First Semester Examination
Academic Session 2019/2020

December 2019/January 2020

EAP582 – Wastewater Engineering

Duration : 2 hours

Please check that this examination paper consists of **SEVEN (7)** 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.

Each question **MUST BE** answered on a new page.

(1). (a). Name the main and the sub-legislation that govern the discharge of a domestic wastewater in Malaysia. Differentiate the appropriate standards to be complied with, should the premise is located outside or within the catchment area.

[5 marks]

(b). Environmental objectives and targets are important during planning stage in environmental management system model. With suitable example, compare these parameters and include the indicator in your answer.

[5 marks]

(c). Select **TWO (2)** examples on how input materials substitution may reduce quantity and pollution load of wastewater discharges.

[5 marks]

(d). BOD reaction is a first order reaction, whereby the rate of reaction is proportional to the amount of oxidisable organic matter remaining at any time. There are few methods to determine the reaction rate.

Using least-square method, determine the ultimate BOD and the reaction rate constant for the following case in **Table 1**:

Table 1

Time (day)	1	2	3	4	5
BOD (mg/L)	105	180	245	290	327

[10 marks]

(2). (a). Define the terms:

(i). Sewage

(ii). Sewer

(iii). Sewarage

[6 marks]

(b). There are two types of sewer system. Describe the **TWO (2)** systems and justify the suitable system in Malaysia.

[10 marks]

(c). During the installation of the sewer pipe, the maximum allowable flow velocity is given 3 m/s and Manning's Coefficient, n = 0.013, determine the pipe size and slope that suitable to carry sewage at a flow of 0.15 m^3/s.

[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 this stage before the wastewater flows into the primary treatment. With the aid of diagrams, explain the differences between the in-line and off-line equalization tanks.

[15 marks]

(b). Describe **FIVE (5)** advantages and disadvantages each in anaerobic treatment process for wastewater.

[10 marks]

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(4). (a). Tofu is a popular food amongst many because it contains good and healthy nutrition. However, it is also believed that the tofu processing industry creates a lot of negative impact towards the environment. Explain the common type of treatment that is applied in treating the tofu wastewater. Add a schematic diagram in your answer.

[6 marks]

(b). Timber is harvested to supply raw material for the wood products industry. Explain **TWO (2)** steps that can be taken by the operators to prevent and preserve the forest from further destruction.

[4 marks]

(c). Draw a simple diagram and explain the life cycle assessment of plastic waste.

[5 marks]

(d). A waste stabilization pond is one of the simplest treatment methods which could be adapted for treating wastewater in hot climate. Select **ONE (1)** of the typical process flow diagrams that could be suitable to treat concentrated effluent from a rubber factory in Malaysia.

[5 marks]

(e). Sketch and illustrate the principle and design parameters of a trickling filter.

[5 marks]

(5). (a). An anaerobic waste stabilization pond treats a food processing wastewater with following design data:

Aerial Organic Loading: 600 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]

(b). Select and sketch **ONE (1)** of a typical process for dewatering of a domestic sludge.

[5 marks]

(c). Efficient municipal wastewater treatment plant produces a vast amount of sludge, and this sludge can be a source of contamination, which needs to be treated. Landfill is one of the wastewater sludge treatment methods. The sludge, however, needs to be treated by at least dewatering to a certain water content before it can be disposed at the landfill site. Explain **TWO (2)** mechanisms that will cause landfill instability in the aspect of geotechnical engineering if the untreated sludge were disposed at the landfill site.

[10 marks]

APPENDIX

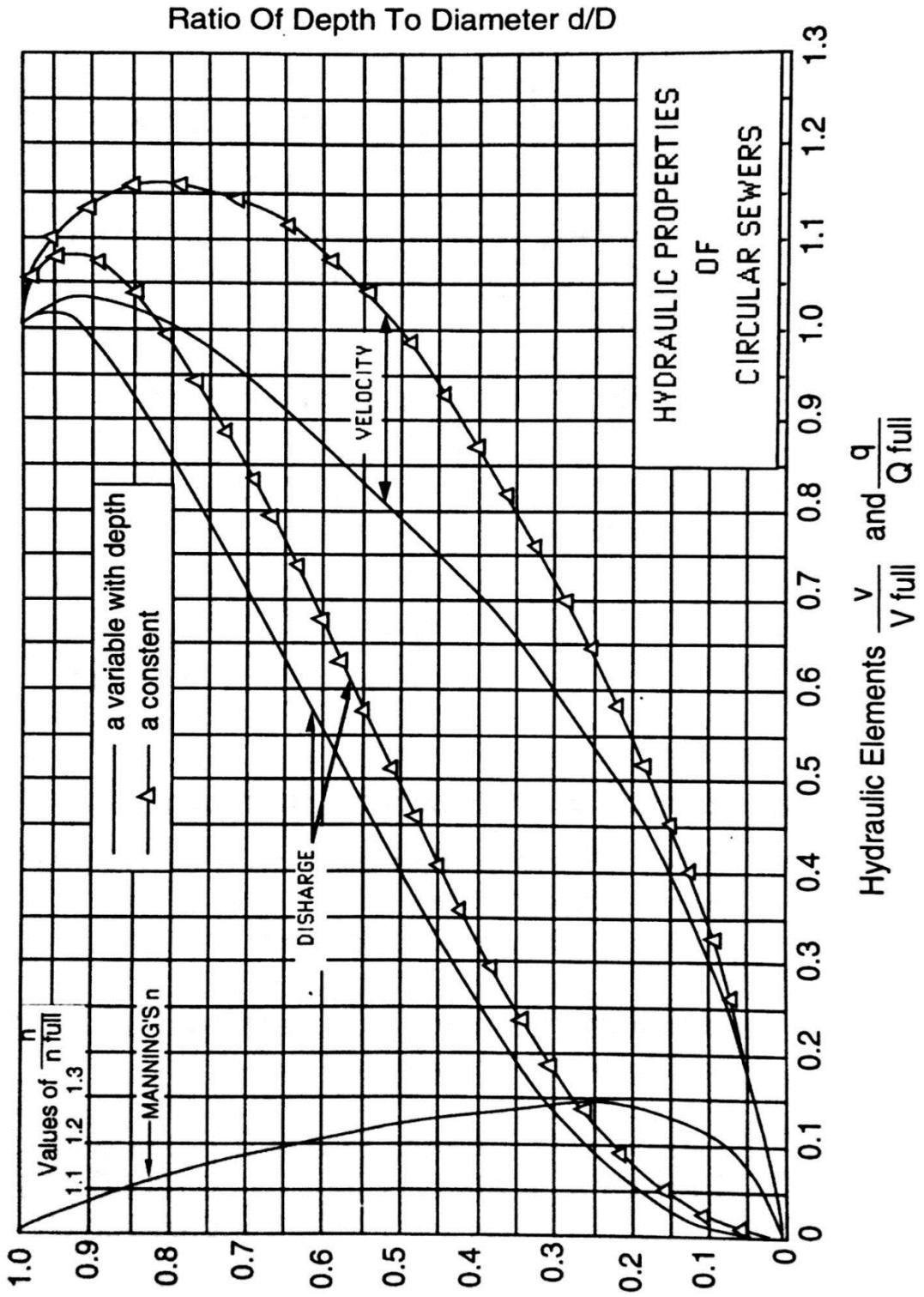
$$na + b\sum y - \sum y' = 0$$
$$a\sum y + b\sum y^2 - \sum y\,y' = 0$$

Where y = BOD at time t, mg/l

$$y' = \frac{y_{n+1} - y_{n-1}}{2\Delta t}$$

$$k = -b$$
$$L_0 = -\frac{a}{b}$$

$$V = \frac{1}{n} R^{2/3} S^{1/2}$$


Ratio Of Depth To Diameter d/D
HYDRAULIC PROPERTIES OF CIRCULAR SEWERS
VELOCITY
DISHARGE
a variable with depth
a constent
MANNING'S n
Values of n/n full
1.1 1.2 1.3
Hydraulic Elements v/V full and q/Q full
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

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