Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	WASTEWATER TREATMENT TECHNOLOGY
COURSE CODE	:	DAK 20803
PROGRAMME	:	DAK
EXAMINATION DATE	:	DECEMBER 2018/ JANUARY 2019
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	SECTION A: ANSWER **ALL** QUESTIONS
		SECTION B: ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

SECTION A

Q1 (a) Pre-treatment is an important part of treatment processes as solids suspension will be screened accordingly and materials that can cause operational problems will be removed.

(i) Define pre-treatment process.

(2 marks)

(ii) There are screening processes whereby bar racks are used in this pre-treatment. Distinguish the **two (2)** types of screens.

(4 marks)

(b) Wastewater will undergo several processes and treatments so that the effluent discharge may remain at the standard range.

(i) Explain the function of having equalization tank in a wastewater treatment plant.

(2 marks)

(ii) Outline the purpose of balancing in equalization tank.

(5 marks)

(c) Design a grit chamber to remove sand particles (ρ_p = 2500 kg/m^3) with a mean diameter of 0.32 mm. Assume the sand is spherical and the temperature of the wastewater is 20 °C. The wastewater flow is 10,000 m^3/d. A flow-through velocity of 0.4 m/s will be automatically maintained and the depth must be 2.5 times the width at maximum flow.

(i) Calculate the settling velocity.

(3 marks)

(ii) Calculate the cross-sectional area.

(2 marks)

(iii) Calculate the width and depth.

(3 marks)

(iv) Determine the detention time required for a particle to fall the entire tank depth.

(2 marks)

(v) Determine the length to achieve this detention time.

(2 marks)

Q2 (a) (i) List **five (5)** criteria need to be considered for solid sludge produced from wastewater plants prior to disposal and sludge treatment process.

(5 marks)

(ii) Explained **two (2)** criteria from **Q1 (a) (i)** of sludge produced from different processes in wastewater treatment system.

(4 marks)

(b) Sludge treatment consist of conditioning part where the sludge is treated either with chemical or heat to remove water. Distinguish between chemical and heat treatment in conditioning process.

(4 marks)

(c) Illustrate the process flow of sludge management in wastewater treatment plant.

(8 marks)

(d) Sludge from a wastewater treatment must be disposed accordingly to minimize the environmental hazards. Analyze some of the effective methods available to dispose sludge produced from wastewater treatment plant.

(4 marks)

SECTION B

Q3 (a) In this recent decade, the environmental statistics mentioned the increment of pollution especially water pollution which has been caused by few factors.

(i) Define water pollution.

(2 marks)

(ii) Explain **three (3)** major sources of water pollution.

(6 marks)

(b) Ocean is filled with plankton and fishes whereby they involve in food source cycle for human as well. Analysis carried out found that there are mercury and manganese in the water sample.

(i) Categorize the group of pollutants for mercury and manganese.

(2 marks)

(ii) Describe the situation that reveals human has been affected by this poisonous chemicals.

(4 marks)

(c) Explain the characteristics of domestic wastewater.

(5 marks)

(d) Sewerage system are divided into two classifications. Explain those **two (2)** types of sewer systems by illustrating into a diagram.

(6 marks)

Q4 (a) Describe the process in determining the suspended solids.

(4 marks)

(b) In terms of biological characteristic of water, it can be measured through metabolic biochemical process behavior or population structure.

(i) Define the term biomonitor.

(2 marks)

(ii) Explain all the indicators that have been highlighted in biological parameter.

(8 marks)

(c) Explain the circumstance that makes pathogenic organisms inside of an animal body can be transferred to human body.

(3 marks)

(d) Describe the classification of infectious diseases associated with water by specifying the transmission mechanisms.

(8 marks)

Q5 (a) Write the purpose of primary sedimentation in wastewater treatment plant.

(2 marks)

(b) Described the typical values of primary settling tank design in wastewater treatment plant.

(6 marks)

(c) Primary sedimentation is carry out in variety types of tank. Explain **three (3)** examples of sedimentation tanks and support with illustration of diagram.

(9 marks)

(d) Design criteria for a primary sedimentation tank with the length, width, liquid depth and weir length of the tank were 30 m, 10 m, 3.5 m and 13.5 m respectively. The sludge concentration is 4 % with the influent suspended solids of 300 mg/L. Using the flow is 0.15 m^3/s with 55 % of efficiency.

(i) Calculate the detention times in hour.

(3 marks)

(ii) Calculate the overflow rate per day.

(3 marks)

(iii) Based on the design criteria from **Q5 (d) (i)** and **(ii)**, analyze the effectiveness of design approached in terms of detention time and over flowrate value of primary sedimentation tank.

(2 marks)

Q6 (a) Secondary treatment system by aerobic decomposition are broadly categorize as suspended and attached growth.

(i) List **two (2)** examples of attached growth system commonly implement in industry.

(2 marks)

(ii) Explain each type mentioned in **Q6 (a) (i)**.

(6 marks)

(b) Sketch the characteristic phase of the growth curve for bacterial population.

(5 marks)

(c) Processes capable of removing pollutant that is not adequately remove by secondary treatment is call advanced treatment. Discuss **three (3)** examples of advanced treatment available in wastewater treatment industry.

(12 marks)

-END OF QUESTIONS-

FINAL EXAMINATION

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FORMULA

Stoke's Law, $v_s = \frac{g(\rho_s - \rho)d^2}{18\mu}$

Where:
v_s = settling velocity
ρ_s = density of particle (kg/m^3)
ρ = density of fluid=999.8 (kg/m^3)
g = gravitational constant (acceleration due to gravity) (m/s^2)
d = particle diameter (m)
μ = dynamic viscosity (Pa.s) / 1.00×10^{-3} $\frac{\text{kg}}{\text{m}\cdot\text{s}}$ (water)