Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	: WATER TREATMENT TECHNOLOGY
COURSE CODE	: BNA 31203
PROGRAMME CODE	: BNA
EXAMINATION DATE	: JUNE/JULY 2019
DURATION	: 3 HOURS
INSTRUCTION	: ANSWER **ALL** QUESTIONS

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

Q1 (a) In Malaysia, sanitation and proper treatment of water are a top priority. This is due to the many diseases which can be caused by drinking contaminated water. List **THREE (3)** examples of water-borne diseases at Malaysia.

(3 marks)

(b) Outline **FOUR (4)** sources of water at Malaysia and elaborate **ONE (1)** issue that is related to each water source.

(12 marks)

(c) Classify the responsibility of water supply from the state and Syarikat Air Johor Holding (SAJ) authorities in management of water at Johor.

(7 marks)

(d) Identify **SIX (6)** water quality parameters included for calculation of Water Quality Index (WQI).

(3 marks)

Q2 (a) Highlight **THREE (3)** functions of National Water Services Commission Act 2006 (Act 654) that are implemented for water supply at Malaysia.

(6 marks)

(b) Engineering technologist must carefully consider numerous factor in site selection for raw water intake. Point out **SIX (6)** important factors that should be considered for water intake of site selection.

(6 marks)

(c) Sketch a simple diagram and elaborate the typical system used for water supply.

(8 marks)

(d) With the aid of diagram, design and develop a softening plant with the intention to remove the hardness of the mineral.

(5 marks)

Q3 (a) Define the Coagulation and Flocculation process.

(4 marks)

(b) The results of a jar test are shown in **Table Q3(b)**.

(i) Sketch the graph for turbidity versus alum dosage.

(3 marks)

(ii) From answer **Q3(b)(i)**, find the optimal coagulant dose and the theoretical amount of alkalinity that would be consumed at the optimal dose.

(3 marks)

(c) Coagulation is a process that utilizes chemical coagulant mixed thoroughly in water to remove colloids under sufficient alkalinity. A rapid mixer is used for the dispersion of the coagulant to achieve the adsorption/destabilization reaction.

(i) If the water flows at 200 MLD, calculate the volume of the coagulation tank and the power usage. Given velocity gradient, G = 1500/s; dynamic viscosity, $\mu = 1.081 \times 10^{-3}$ Pa.s.

(4 marks)

(ii) Construct a bar graph which shows the constituent of TH, CH, NCH, and alkalinity when the water has the concentration of ions and molecular weight as shown in **Table Q4(c)(ii).**

(10 marks)

Q4 (a) Chlorine is the most common disinfecting chemical used. Describe **THREE (3)** properties of chlorine gas and hypochlorite salts.

(6 marks)

(b) Sketch the layout for circular/ring system and radial system of water distribution.

(5 marks)

(c) The construction of a water treatment plant was proposed at Taman Pagoh Jaya. Sedimentation process is one of the main process to be in the treatment plant. As an environmental technologist, you are required to:

(i) Calculate the depth and diameter of a circular clarifier for a design flow of 2700 m^3/d and an overflow rate of 0.00020 m/s and a detention time of 4 h.

(6 marks)

(ii) Design a rectangular sedimentation tank with flow of 0.060 m^3/s. Use a design overflow rate of 23 m/day; detention time of 3 hours; and L:W = 5:1.

(8 marks)

-END OF QUESTIONS –

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Table Q3(b) Jar test results

	Jar numbers					
pH	6	6	6	6	6	6
Alum dosage (mg/L)	4	6	9	12	15	20
Turbidity (NTU)	12	9	5	3	5	12

Table Q4(c)(ii) Concentration of ions and molecular weight

Ion	Concentration (mg/L)	MW (mg/mmol)
Ca^{2+}	39	40.1
Mg^{2+}	11	24.3
Na^{+}	12	23.0
K^{+}	7	39.1
HCO_3^-	111	61.0
SO_4^{2-}	66	96.1
Cl^-	12	35.5