Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	ENVIRONMENTAL ENGINEERING
COURSE CODE	:	BFC 32403
PROGRAMME	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER ANY **FOUR (4)** QUESTIONS ONLY.

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

Q1 (a) List the main objectives of the National Drinking Water Quality Standard and Environmental Quality (Sewage) Regulations 2009.

(3 marks)

(b) Define eutrophication process, and provide **THREE (3)** solutions to overcome problems related to the phenomenon.

(6 marks)

(c) Briefly explain why turbidity and BOD_5 are important in water quality management.

(6 marks)

(d) The concentration analysis of groundwater samples constituents is as outlined in **Table Q1(d)**:

(i) Calculate the equivalent weight and concentration as mg/L as $CaCO_3$ of each constituent.
(ii) If the pH value is 9, determine the concentration of pH ions (H^+ and OH^-) in mg/L.
(iii) Calculate hardness as mg/L $CaCO_3$.

(10 marks)

Q2 (a) Define **TWO (2)** of the water treatment processes listed below:
(i) Coagulation/Flocculation
(ii) Sedimentation
(iii) Filtration
(iv) Disinfection

(4 marks)

(b) A town has an existing horizontal-flow sedimentation tank with an overflow rate of $23 m^3/d.m^2$ to remove particles that has settling velocities of 0.35 mm/s.

(i) Calculate the expected percentage of removal for each particle in an ideal sedimentation tank.

(4 marks)

(ii) Suggest a suitable settling velocity for the tank to ensure 100% particles removed.

(5 marks)

(c) Explain in detail the functions of aeration in water treatment.

(6 marks)

(d) Jar testing was performed using alum on a raw drinking water source that contained an initial turbidity of 17 NTU and alkalinity of 55 mg/L as $CaCO_3$. The optimum coagulant dosage was determined as 12 mg/L. Determine the quantity of alkalinity consumed as $CaCO_3$.

(6 marks)

Q3 (a) Wastewater is characterized physically, chemically and biologically. Describe with examples, the physical, chemical and biological characteristics of wastewater.

(7 marks)

(b) There are various types of secondary wastewater treatment. State, sketch and explain with examples two types of aerobic secondary treatment processes.

(8 marks)

(c) A wastewater secondary treatment reactor without cell recycle as shown in **Figure Q3** receives an influent with 300mg/L BOD at a rate of 200 m^3/day. The BOD in the effluent must be 8mg/L. Given: K_s = 200mg/L and k_d = 0.03/d, μm = 10/d, Y = 0.8 mg VSS/mg BOD and X=2500 mg/L.

Calculate;
(i) mean cell residence time (θ_c)
(ii) volume of the reactor
(iii) hydraulic retention time (HRT)
(iv) effluent concentration S_e if volume of reactor is reduced to 30 m^3.

(10 marks)

Q4 (a) Bandar Universiti Parit Raja is a new township which caters for the need of residential area for the development of Universiti Tun Hussein Onn Malaysia campus. If the population of the new township is 10,000 and each person generates 0.9 kg/day;

Calculate:
(i) municipal solid that will be generated
(ii) number of trucks needed to collect the waste three times a week. Each truck has the capacity of 6 metric tonnes and operates 6 days a week. Assume that the trucks average load capacity is 80%.

(10 marks)

(b) Determine the area required for a landfill site with life span of 15 years and population of 30,000. Assume generation of solid waste is 1.2 kg/capita/day, the density of compacted waste is 500kg/m^3 and maximum height of 10 m.

(5 marks)

(c) With the help of sketches or diagrams, describe the following activities in a landfill system;

(i) Control of leachate
(ii) Leachate collection
(iii) Leachate treatment

(10 marks)

Q5 (a) Define air pollution.

(3 marks)

(b) Discuss primary and secondary air pollutants with examples.

(6 marks)

(c) State the severity impacts of particles size greater than 10 μm, less than 0.5 μm, and between 2-4 μm on human respiratory system.

(6 marks)

(d) Relate air pollution and acid rain formation. Suggest **TWO (2)** solutions to reduce the occurance of acid rain.

(10 marks)

- END OF QUESTIONS -

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Table Q1 (d)

Ion	Concentration, mg/L
Ca^{2+}	210
Mg^{2+}	90
SO_4^{2-}	42
NO_3^{2-}	24.5

(Ca^{2+} = 40.1 , Mg^{2+} = 24.3, S =32, O=16)

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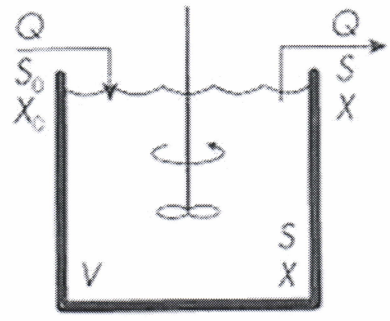
Figure Q3



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Supplementary Equations

$$X = \frac{\theta_c (Y)(S_0 - S)}{\theta(1 + k_d \theta_c)}$$

$$S = \frac{K_s(1 + k_d \theta_c)}{\theta_c(\mu_m - k_d) - 1}$$