UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	DESIGN OF WASTEWATER ENGINEERING
COURSE CODE	:	BFA 4043
PROGRAMME	:	BFF
EXAMINATION DATE	:	JUNE 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) What are the design criteria for an Imhoff tank for PE of 1000?

(5 marks)

(b) A number of two (2) similar rectangular grit chambers are required for PE of 20,000. The design criteria are specified as follows:

Minimum retention time at peak flow=1.0 min
Peak flow factor = $4.7\ (P)^{-0.11}$
Sewage flow contribution=225LPCD
Maximum horizontal velocity = 0.2 m/s
Surface overflow rate less than 1500 m^3/d per m^2
L: W = 2:1
Use practical depth, D

Determine the following for one grit chamber:

(i) Peak flow factor
(ii) Peak design flow (m^3/d)
(iii)Volume (m^3)
(iv) L, W and D
(v) volume (m^3) required for 30-day grit storage. Assume 0.03 m^3 of grit is produced for every 1000 m^3 of sewage at peak flow.

(20 marks)

Q2 (a) What is the purpose of installing a balancing tank at sewage treatment works?

(5 marks)

(b) A number of two (2) similar rectangular balancing tanks are required for PE of 20,000 at a sewage treatment works. Determine for each tank: the volume (m^3), power requirement (kW), and air supply (m^3/d) to satisfy the following specified design criteria:

Dead water depth = 0.5m
Retention time = 1.5h at peak flow
Peak flow factor = $4.7\ (P)^{-0.11}$
Sewage flow contribution=225LPCD
Mixing requirement = 5W for every m^3 of sewage
Air requirement = 1m^3 of air supply for every m^3 of sewage stored

(20 marks)

Q3 (a) A number of two (2) similar rectangular sedimentation tanks are required prior to secondary treatment at a sewage treatment works. Determine the dimensions of each tank (L, W and D) and the weir length if the following design criteria are to be satisfied:

PE=20,000
Retention time = 2 h at peak flow
Peak flow factor = $4.7\ (P)^{-0.11}$
Surface overflow rate = 30 m^3/d per m^2
Weir loading = 100 – 200 m^3/d per m
L: W = 3:1
Use practical depth, D

(20 marks)

(b) If the tanks above had been square in shape, determine the area of each tank (L times W) that would satisfy an upflow rate of 1.5 m/h.

(5 marks)

Q4 (a) A number of four (4) similar circular aeration tanks are required for secondary treatment at a sewage treatment works. Determine the volume and diameter of each tank (m^3) for the following design criteria:

PE=20,000
F/M ratio= 0.25 per day at peak flow
Design MLSS = 2500 mg/L
BOD contribution = 55gPCD
Sewage flow contribution=225LPCD
Peak flow factor = $4.7\ (P)^{-0.11}$

(20 marks)

(b) Determine the hydraulic retention time (h), volumetric BOD loading rate (kg/d/m^3), and oxygen requirement for the above.

(5 marks)

S1 (a) Apakah kriteria rekabentuk bagi tangki Imhof bagi kesetaraan populasi 1000?

(5 markah)

(b) Dua (2) unit kebuk kersik segi empat tepat seragam adalah diperlukan bagi kesetaraan populasi 20,000. Kriteria rekabentuk adalah ditetapkan seperti berikut:

Masa tahanan minimum ketika aliran puncak =1.0 minit
Faktor aliran puncak = $4.7\ (P)^{-0.11}$
Sumbangan aliran kumbahan=225LPCD
Halaju ufuk maksima = 0.2 m/saat
Kadar limpah permukaan kurang daripada 1500 m^3/hari per m^2
L: W = 2:1
Guna kedalaman praktikal, D

Tentukan yang berikut bagi satu kebuk kersik:

(i) Faktor aliran puncak
(ii) Kadaralir rekabentuk puncak (m^3/hari)
(iii)Isipadu (m^3)
(iv) L, W dan D
(v) Isipadu (m^3) diperlukan bagi 30–hari penyimpanan kersik. Anggap 0.03 m^3 kersik terhasil untuk setiap 1000 m^3 kumbahan pada aliran puncak..

(20 markah)

S2 (a) Apakah tujuan pemasangan tangki pengimbang di loji rawatan kumbahan?

(5 markah)

(b) Dua (2) unit tangki pengimbang segi empat tepat seragam diperlukan bagi kesetaraan populasi 20,000 di loji rawatan kumbahan. Hitung bagi setiap tangki: isipadu (m^3), tenaga diperlukan (kW), dan bekalan udara (m^3/hari) bagi memenuhi kriteria rekabentuk yang ditetapkan seperti berikut:

Kedalaman air mati = 0.5m
Masa tahanan = 1.5jam pada aliran puncak
Faktor aliran puncak = $4.7\ (P)^{-0.11}$
Sumbangan aliran kumbahan=225LPCD
Keperluan pecampuran = 5W bagi setiap m^3 kumbahan
Keperluan udara = 1m^3 bekalan udara bagi setiap m^3 kumbahan tersimpan

(20 markah)

S3 (a) Dua (2) unit tangki pengenapan segi empat tepat seragam diperlukan untuk rawatan sekunder di sebuah loji rawatan air kumbahan. Tentukan dimensi bagi setiap tangki (L, W dan D) dan panjang alurlimpah jika kriteria rekbentuk dibawah perlu dipenuhi:

Kesetaraan populasi=20,000
Masa tahanan = 2 jam pada aliran puncak
Faktor aliran puncak = $4.7\ (P)^{-0.11}$
Kadar limpah permukaan = 30 m^3/hari per m^2
Kadaralir limpah = 100 – 200 m^3/hari per m
L: W = 3:1
Guna kedalaman praktikal, D

(20 markah)

(b) Jika tangki-tangki diatas adalah dalam bentuk segiempat sama, tentukan luas bagi setiap tangki (L x W) yang boleh menepati kadar aliran atas 1.5m/jam.

(5 markah)

S4 (a) Empat (4) unit tangki pengudaraan bulat seragam diperlukan untuk rawatan sekunder di loji rawatan air kumbahan. Tentukan isipadu dan diameter setiap tangki dengan kriteria rekabentuk berikut:

Kesetaraan populasi=20,000
Nisbah makanan/mikrob = 0.25 per hari pada aliran puncak
Rekabentuk MLSS = 2500 mg/L
Sumbangan BOD = 55gPCD
Sumbangan aliran kumbahan=225LPCD
Faktor aliran puncak = $4.7\ (P)^{-0.11}$

(20 markah)

(b) Tentukan masa tahanan hidraulik (hari) ,kadar beban BOD (kg/hari/m^3)dan keperluan oksigen bagi rekabentuk diatas.

(5 markah)