UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2010/2011

COURSE NAME	:	ENVIRONMENTAL ENGINEERING
COURSE CODE	:	BFC 3103
PROGRAMME	:	3 BFF
EXAMINATION DATE	:	APRIL / MAY 2011
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **FIVE (5)** QUESTIONS

THIS PAPER CONSISTS OF **ELEVEN (11)** PAGES

Q1 (a) Explain briefly the essence in each of the following acts:

i) Environmental Quality Act 1974

ii) Water Supply Act

(6 marks)

(b) Define and compare the wastewater standards, STANDARD A and STANDARD B for effluent discharge to inland waters.

(4 marks)

(c) Discuss briefly **one (1)** cause and consequences of water pollution to the environment. and suggest a solution for the problem.

(3 marks)

(d) Give **three (3)** examples of human activities that affect the environment and the measures that could be taken to reduce the impacts. (7 marks)

Q2 (a) Explain the different applications of unseeded BOD test and seeded BOD test

(6 marks)

(b) A Wastewater Treatment Plant discharges 0.48 m^3/s of treated wastewater into a river. The river has a flow rate of 3 m^3/s .The treated wastewater has an ultimate BOD of 60.0 mg/L and dissolved oxygen (DO) of 2.0 mg/L with temperature of 30.0°C. Upstream of the discharge point, the ultimate BOD of the river is 5 mg/L, dissolved oxygen (DO) of 8.0 mg/L and temperature of 20°C. The average speed of the mixture is 0.6 m/s. At 20°C, the deoxygenation rate constant, k_d is $0.37d^{-1}$ at 20°C while reaeration, k_r rate constant is 0.5 d^{-} Determine the following:

i) DO initial, ultimate BOD and temperature after mixing.

(6 marks)

ii) Initial DO Deficit of the stream

(4 marks)

iii) Dissolved oxygen concentration 50 km downstream

(4marks)

Q3 (a) List **two (2)** basic types of coagulant aids and explain the purpose of coagulant aids in chemical coagulation for water treatment

(3marks)

(b) A jar test was conducted on raw water with an initial turbidity of 13 NTU and a HCO_3^- alkalinity concentration of 65 mg/L as $CaCO_3$. Using the following data obtained from a jar test;

Alum dose, mg/L	4	8	12	16	20	24
Turbidity, NTU	10	7	5.5	4.5	6	8.5

i) Estimate the optimum alum dosage for turbidity removal

(3 marks)

ii) Theoretical amount of alkalinity that will be consumed at the optimal dosage (express concentration as mg/L as $CaCO_3$)

(2 marks)

(c) A groundwater contains the following constituents:

- CO_2 = 6.60mg/L
- Ca^{2+} = 34.00mg/L
- Mg^{2+} = 29.00mg/L
- HCO_3^- = 145.05 mg/L
- SO_4^{2-} = 32.10 mg/L
- Cl^- =42.00 mg/L

i) Determine the total, carbonate, and noncarbonate hardness

(5 marks)

ii) Determine the lime and soda ash dose, in mg/L as CaCO3 to soften the water to a final hardness of 80 mg/L as $CaCO_3$. Assume the lime is 90% pure and soda ash is 98% pure. (*EW CaO= 28, EW* Na_2CO_3*= 53*)

(7marks)

Q4 (a) State the need for secondary wastewater treatment.

(2 marks)

(b)Explain activated sludge process for wastewater treatment plant.

(5 marks)

(c) In a complete mixed activated sludge system determine:
i) The aeration basin volume, V
ii) The hydraulic retention time, θ
iii) Mass of the sludge wasted daily, Q_w
iv) The F/M ratio

Given:
i) Population equivalent 50,000 (11250 m3/day)
ii) Influent BOD5 (S0) = 200 mg/L
iii) Required effluent BOD_5 > 10 mg/L
iv) Yield coefficient Y = 0.6
v) Decay rate $k_d = 0.06\ d^{-1}$

Assume:
MLSS in aeration basin (X) = 3500 mg/L (3.5 kg/m^3)
MLSS in clarifier sludge (X_w) = 15000 mg/L (15 kg/m^3)
Mean cell residence time (Φ) = 10 days

(13 marks)

Q5 (a) List the various types of solid waste and their sources

(5 marks)

(b) Explain the factors that influence the rate of solid waste generation.

(5 marks)

(c) Estimate waste generation rate (kg/capita/day) for a residential area. Given the following information

Number of houses	=	1500
Waste collection period	=	7 days
No persons in a household	=	4.5
Number of compactor truck loads	=	20
Volume of compactor truck	=	15 m^3
Density of solid waste compacted in compactor truck	=	297 kg/m^3
Number of flatbed truck	=	15
Volume of flatbed truck	=	5 m^3
Density of solid waste in flatbed truck	=	89 kg/m^3

(10 marks)

Q6 (a) Discuss air pollution caused by antharopogenic activities.

(3 marks)

(b) Using specific examples, differentiate between primary and secondary air pollutants.

(4 marks)

(c) Why is carbon monoxide considered a hazard to human health?

(3 marks)

(d) As a civil engineer at a local authority, design a framework that may be used to overcome air pollution problem in a city area

(10 marks)

S1 (a) Terangkan dengan ringkas intipati berkaitan akta-akta berikut:

i) Akta Alam Sekeliling 1974

ii) Akta Bekalan Air

(6 markah)

(b)Takrif dan bandingkan standard-standard air kumbahan, iaitu STANDARD A dan STANDARD B yang digunakan di dalam pembuangan effluen ke sumber air.

(4 markah)

(c)Terangkan dengan ringkas **satu (1)** sebab dan akibat pencemaran air kepada alam sekitar. Cadangkan kaedah yang sesuai bagi mengatasi masalah tersebut.

(3 markah)

(d) Berikan **tiga (3)** contoh aktiviti manusia yang memberi kesan terhadap alam sekitar dan tindakan yang boleh diambil untuk mengurangkan impaknya. (7 markah)

S2 (a) Terangkan perbezaan aplikasi ujikaji BOD tanpa pembenihan dan dengan pembenihan

(6 markah)

(b) Satu loji rawatan air sisa melepaskan 0.48 m^3/s efluen kesebuah sungai. Halaju sungai adalah 3 m^3/s. BOD akhir air sisa tersebut adalah 60.0 mg/L dan oksigen terlarut (DO) 2.0 mg/L dengan suhu 30.0°C. Di bahagian hulu titik pelepasan, BOD akhir sungai adalah 5 mg/L, oksigen terlarut (DO) 8.0 mg/L dan suhu 20°C. Halaju purata campuran adalah 0.6 m/s. Pada suhu 20°C, pemalar kadar tindakbalas deoksigenasi, k_d adalah $0.37d^{-1}$ manakala pemalar kadar tindakbalas pengudaraan, k_r adalah 0.5 d^{-1}. Anggap percampuran sempurna berlaku. Cari

i) DO awal, BOD muktamad dan suhu selepas percampuran.

(6 markah)

ii) susut DO permulaan sungai

(2 markah)

iii) Kepekatan oksigen terlarut pada 50 km dihilir sungai

(5 markah)

S3 (a) Senarai **dua (2)** jenis bahan pengental dan jelaskan bagaimana setiap bahan pengental berfungsi.

(3 markah)

(b) Sebuah tes jar dilakukan pada air yang tidak dirawat dengan kekeruhan awal 13 NTU dan kepekatan HCO_3^- sebanyak 50 mg / L sebagai CaCO3. Dengan menggunakan data berikut yang diperolehi daripada jar test;

Dos Alum, mg/L	4	8	12	16	20	24
Kekeruhan, NTU	10	7	5.5	4.5	6	8.5

i)Anggarkan dos optimum alum untuk menghilangkan kekeruhan.

(3 Markah)

ii)Jumlah teori alkaliniti yang akan digunakan pada dos yang optimum.

(2 markah)

(c) Air tanah mengandungi unsur-unsur berikut;

- CO_2 = 6.60mg/L
- Ca^{2+} = 34.00mg/L
- Mg^{2+} = 29.00mg/L
- HCO_3^- = 145.05 mg/L
- SO_4^{2-} = 32.10 mg/L
- Cl^- =42.00 mg/L

i)Tentukan jumlah kekerasan, kekerasan karbonat dan kekerasan bukan karbonat.

(5 markah)

ii)Tentukan dos kapur dan soda abu, dalam mg / L sebagai $CaCO_3$ untuk melembutkan air ke kekerasan akhir 80 mg / L sebagai CaCO3. Andaikan kapur adalah 90% tulen dan soda abu adalah 98%tulen. (*EW CaO= 28, EW* Na_2CO_3*= 53*)

(7 markah)

S4 (a) Nyatakan keperluan sistem perawatan sekunder bagi air sisa.

(2 markah)

(b)Terangkan dengan ringkas proses enapcemar teraktif bagi perawatan air sisa

(5 markah)

(c) Dalam satu sistem enapcemar teraktif, tentukan:
i) Isipadu bekas pengudaraan, V
ii) Masa tahanan hidraulik, θ
iii) Berat enapcemar yang tersingkir sehari, Q_w
iv) Nisbah Makanan/Mikroorganisma

Diberi:
i) Nilai PE 50,000 (11250 m^3/hari)
ii) Nilai BOD_5 influen (S_0) = 200 mg/L
iii) Nilai efluen BOD_5 yang diperlukan > 10 mg/L
iv) Yield coefficient Y = 0.6
v) Kadar pereputan $k_d = 0.06\ d^{-1}$

Anggapkan:
MLSS dalam tangki pengudaraan (X) = 3500 mg/L (3.5 kg/m^3)
MLSS dalam penapis enapcemar (X_w) = 15000 mg/L (15 kg/m^3)
Purata masa sel berada dalam sistem (Φ) = 10 hari

(13 markah)

S5 (a)Nyatakan punca-punca yang lazim menjana sisa pepejal berserta jenis-jenis sisa pepejal yang dijanakan.

(5 markah)

(b)Huraikan faktor-faktor yang boleh mempengaruhi kadar penjanaan sisa pepejal.

(5 markah)

(c) Anggarkan kadar penjanaan sisa pepejal (kg/kapita/hari). Diberi maklumat-maklumat berikut

Bilangan rumah	= 1500
Tempoh kutipan sisa	= 7 hari
Bilangan isi rumah	= 4.5
Jumlah pungutan oleh trak pemampat	= 20
Isipada trak pemampat	= 15 m^3
Ketumpatan sisa bagi trak pemampat	= 297 kg/m^3
Jumlah pungutan oleh trak biasa	= 15
Isipadu trak biasa	= 5 m^3
Ketumpatan sisa bagi trak biasa	= 89 kg/m^3

(10 markah)

S6 (a) Bincangkan tentang pencemaran udara akibat aktiviti antropogenik.

(3 markah)

(b) Dengan menggunakan contoh yang sesuai, bezakan di antara pencemar primer dan sekunder.

(4 markah)

(c) Mengapa karbon monoksida merbahaya kepada kesihatan manusia.?

(3 markah)

(d) Sebagai seorang jurutera awam di majlis kerajaan tempatan, rancangkan satu pelan perancangan bagi mengatasi masalah pencemaran udara di kawasan Bandar.

(10 markah)

Formula Given:

(1) $$DO = \frac{QwDOw + QrDOr}{Qw + Qr}$$

(2) $$La = \frac{QwLw + QrLr}{Qw + Qr}$$

(3) $$Tf = \frac{QwTw + QrTr}{Qw + Qr}$$

(4) $$k_T = k_{20}(\theta)^{T-20}$$

(5) $$D = \frac{kd \times La}{kr - kd}(e^{-kdt} - e^{-krt}) + Da(e^{-krt})$$

(6) $$X = \Phi_c / \Phi Y \frac{(S_0 - S)}{1 + k_d \Phi_c}$$

(7) $$\Phi = V/Q_0$$

(8) $$\Phi_c = VX/Q_0X_w$$

Periodic Table of the Elements

group classification → 1 IA
atomic number → 1
oxidation state(s) → 1
symbol → H
atomic mass → 1.01

1 IA	2 IIA	3 IIIA	4 IVA	5 VA	6 VIA	7 VIIA	8 VIIIA	9 VIIIA	10 VIIIA	11 IB	12 IIB	13 IIIB	14 IVB	15 VB	16 VIB	17 VIIB	18 VIIIB
1 1 H 1.01																	2 He 4.00
3 1 Li 6.94	4 2 Be 9.01											5 3 B 10.8	6 ±4,2 C 12.0	7 ±3,5,4,2 N 14.0	8 -2 O 16.0	9 -1 F 19.0	10 Ne 20.2
11 1 Na 23.0	12 2 Mg 24.3											13 3 Al 27.0	14 4 Si 28.1	15 5,3 P 31.0	16 6,4,-2 S 32.1	17 ±1,3,5 Cl 35.5	18 Ar 39.9
19 1 K 39.1	20 2 Ca 40.1	21 3 Sc 45.0	22 4,3 Ti 47.9	23 5,4 V 50.9	24 3,6 Cr 52.0	25 2,3,4 Mn 54.9	26 3,2 Fe 55.8	27 2,3 Co 58.9	28 2,3 Ni 58.7	29 2,1 Cu 63.5	30 2 Zn 65.4	31 3 Ga 69.7	32 4 Ge 72.6	33 ±3,5 As 74.9	34 6,4,-2 Se 79.0	35 ±1,5 Br 79.9	36 Kr 83.8
37 1 Rb 85.5	38 2 Sr 87.6	39 3 Y 88.9	40 4 Zr 91.2	41 5,3 Nb 92.9	42 6,4 Mo 95.9	43 7 Tc (99)	44 4,3,2 Ru 101	45 3,4,2 Rh 103	46 2,4 Pd 106	47 1 Ag 108	48 2 Cd 112	49 3 In 115	50 4,2 Sn 119	51 ±3,5 Sb 122	52 6,4,-2 Te 128	53 ±1,5 I 127	54 Xe 131
55 1 Cs 133	56 2 Ba 137	57 3 La 139	72 4 Hf 178	73 5 Ta 181	74 6,4 W 184	75 7 Re 186	76 4,3,2 Os 190	77 4,3,6 Ir 192	78 4,2 Pt 195	79 3,1 Au 197	80 2,1 Hg 201	81 1,3 Tl 204	82 2,4 Pb 207	83 3,5 Bi 209	84 Po (209)	85 ±1 At (210)	86 Rn (222)
87 1 Fr (223)	88 2 Ra (226)	89 3 Ac (227)	104 4 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 Uun (269)	111 Uuu (272)	112 Uub (277)		114 Uuq (289)		116 Uuh (289)		118 Uuo (293)

lanthanides	58 3,4 Ce 140	59 4,3 Pr 141	60 3 Nd 144	61 3 Pm (145)	62 3,2 Sm 150	63 3,2 Eu 152	64 3 Gd 157	65 3,4 Tb 159	66 3 Dy 163	67 3 Ho 165	68 3 Er 167	69 3,2 Tm 169	70 3,2 Yb 173	71 3 Lu 175
actinides	90 4 Th 232	91 5,4 Pa 231	92 6,5,4 U 238	93 5,4,6 Np (237)	94 4,5,6 Pu (244)	95 3,4,5,6 Am (243)	96 3 Cm (247)	97 3,4 Bk (247)	98 3 Cf (251)	99 3 Es (252)	100 3 Fm (257)	101 2,3 Md (258)	102 2,3 No (259)	103 3 Lr (262)

see Appendix A, Table A.1 for element names