
UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2006/2007

Oktober / November 2006

EAP 411/3 – Pengurusan Sisa Pepejal Dan EIA

Masa : 3 jam

Arahan Kepada Calon:

1. Sila pastikan kertas peperiksaan ini mengandungi **TIGA (3)** muka surat bercetak sebelum anda memulakan peperiksaan ini.
2. Kertas ini mengandungi **ENAM (6)** soalan. Jawab **LIMA (5)** soalan sahaja. Markah hanya akan dikira bagi **LIMA (5)** jawapan **PERTAMA** yang dimasukkan di dalam buku mengikut susunan dan bukannya **LIMA (5)** jawapan terbaik.
3. Semua soalan mempunyai markah seperti yang tercatat di penghujung soalan berkenaan.
4. Semua soalan **BOLEH** dijawab dalam Bahasa Malaysia atau Bahasa Inggeris ataupun kombinasi kedua-dua bahasa.
5. Semua jawapan **MESTILAH** dimulakan pada muka surat yang baru.
6. Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.

1. (a) Anda sebagai seorang perunding alam sekitar telah diminta menyediakan laporan penilaian awalan untuk sebuah projek lebuh raya sepanjang 200 km melalui hutan simpanan kekal di Banjaran Titiwangsa dan berhampiran dengan sungai dan air terjun. Sebahagian kawasan yang terbabit ialah kawasan tadahan air bagi negeri Pahang. Kenalpasti dan terangkan **SEPULUH (10)** kesan yang mungkin berlaku dari projek ini terhadap alam sekitar semasa peringkat pembersihan tapak dan pembinaan.

(10 markah)
- (b) Berpandukan bahagian (a), cadangkan satu langkah tebatan untuk setiap kesan yang telah dikenalpastikan bagi setiap peringkat.

(10 markah)
2. (a) Berikan **SEPULUH (10)** jenis projek pembangunan yang memerlukan penilaian EIA dijalankan di bawah Seksyen 34A, Perintah Kualiti Alam Sekeliling, Aktiviti Yang Ditetapkan (Penilaian Kesan Alam Sekeliling) 1987.

(10 markah)
- (b) Terdapat beberapa kaedah yang digunakan untuk menganalisa dan mempersembahkan data dalam perbincangan kesan ke atas alam sekitar. Dua darinya ialah Matriks Leopold dan senarai semak. Bincangkan faktor-faktor dan aspek-aspek yang perlu diambil kira ketika menyediakan matriks untuk projek pembangunan.

(10 markah)
3. Satu projek empangan hidroelektrik untuk kapasiti penghasilan tenaga sebanyak 8 MW telah dirancang dan akan melibatkan pembinaan empangan konkrit tetulang setinggi 100 meter. Kawasan yang bakal ditenggelami adalah dianggarkan seluas 500 ha. Sebagai jurutera projek ini, anda dikehendaki menyediakan satu laporan penuh kajian impak alam sekitar (EIA) dan juga pelan pengurusan alam sekitar (EMP) untuk dihantarkan kepada pihak Jabatan Alam Sekitar untuk kelulusan. Sebelum menyediakan laporan adalah amat penting untuk satu format yang betul digariskan untuk tujuan ini. Sediakan satu format Pelan Pengurusan Alam Sekitar yang sesuai untuk projek ini. Nyatakan isu-isu utama alam sekitar yang perlu diberikan perhatian untuk memastikan alam sekitar kawasan ini terpelihara.

(20 markah)
4. (a) Describe any **TWO (2)** of the following:
 - (i) field capacity of solid waste
 - (ii) ultimate analysis of solid waste components
 - (iii) biodegradability of solid waste

(10 marks)

4. (b) The composition of a solid waste sample is shown as follows:

Component	Wet mass kg	Moisture content %	Composition, %					
			C	H	O	N	S	Ash
Food	14	70	48.0	6.4	37.6	2.6	0.4	5.0
Paper	40	6	43.5	6.0	44.0	0.3	0.2	6.0
Cardboard	9	5	44.0	5.9	44.6	0.3	0.2	5.0
Plastics	9	2	60.0	7.2	22.8	0.0	0.0	10.0
Textiles	6	10	55.0	6.6	31.2	4.6	0.2	2.5
Yard waste	12	60	47.8	6.0	38.0	3.4	0.3	4.5
Wood	5	20	49.5	6.0	42.7	0.2	0.1	1.5

Determine:

- (i) the representative chemical formula of the waste, and (8 marks)
- (ii) the estimated energy content of the waste. (2 marks)

Atomic mass: C = 12, H = 1, O = 16, N = 14 and S = 32.

5. (a) Describe any **TWO (2)** of the following:

- (i) stationary container system for solid waste collection
- (ii) guidelines for laying out solid waste collection routes
- (iii) direct-discharge and storage-discharge transfer stations

(10 marks)

(b) Explain the working of different types of screens in waste separation.

(6 marks)

(c) List **EIGHT (8)** factors that would affect the rate of landfill gas production.

(4 marks)

6. (a) Discuss with the help of a diagram the different phases in the generation of landfill gas.

(10 marks)

(b) A community of 75,000 people uses a 15 hectare landfill site that can be filled to an average depth of 15 m. If Municipal Solid Waste (MSW) is generated at a rate of 2.0 kg per person per day, its compacted unit mass in the landfill is 700 kg/m³ and the MSW to soil cover ratio is 5:1, determine the useful life of the site?

(10 marks)

UNIVERSITI SAINS MALAYSIA

1st Semester Examination
2006/2007 Academic Session

October / November 2006

EAP 581/4 – Water Supply Engineering

Duration: 3 hours

Instructions to Candidates:

1. Ensure that this paper contains **FIVE (5)** printed pages before you start your examination.
2. This paper contains **SIX (6)** questions. Answer **FIVE (5)** questions only. Marks will be given to the **FIRST FIVE (5)** questions put in order on the answer script and **NOT** the **BEST FIVE (5)**.
3. Each question carries equal mark.
4. All questions **CAN BE** answered either in English or Bahasa Malaysia.
5. Each question **MUST BE** answered on a new sheet.
6. Write the answered question numbers on the cover sheet of the answer script.

1. (a) Water demand can be categorized into different types. Briefly describe **FIVE (5)** types of water demand in terms of usage, per capita consumption and percentages based on the overall demand. (5 marks)
- (b) Water resource in Malaysia is on a depleting scale due to contamination of rivers and large scale development. This will affect on the future source for water demand. Briefly discuss five sustainable approaches need to be developed by water authorities in Malaysia in order to optimize on the existing and future water demand. (5 marks)
- (c) A community with a population of 20,000 has an average consumption of 600 lcpd (litres per capita per day) and fire flow dictated by a building of ordinary construction. A floor area excluding the basement for each storey of 8 storeys height building is 1000 m². With the aid of the following information estimate the total flow required. You may use Tables 1 and 2 to help your estimation.

Required fire flow in gallon/minute, $F = 18C(A)^{0.5}$
 Note: Gallon per minute = [(L/min)/3.78], 1m² = 10.76 ft²,

Table 1 - Residential fire flows

Distance between adjacent units (m)	Required fire flow (litre/minute)
>30.5	1890
9.5 – 30.5	2835 – 3780
3.4 – 9.2	3780 – 5670
<3.0	5670 - 7560

Table 2- Residential flow duration

Required fire flow (litre/minute)	Duration (hour)
<3780 (<1000gpm)	4
3780-4725 (1000-1250 gpm)	5
4725-5670 (1250-1500 gpm)	6
5670-6615(1500-1750 gpm)	7
6615-7560 (1750-2000 gpm)	8
7560-8505 (2000-2250 gpm)	9
>8505(>2250 gpm)	10

(10 marks)

2. (a) Describe briefly on the guidelines used for the design and construction of over and under (vertical flow) baffled channel flocculators. (5 marks)

- (b) Rapid mixing using hydraulic jump for the dosing of aluminium sulphate is practised at a water treatment plant. The depths of water upstream and downstream of the jump are 0.3m and 0.9 m respectively. Calculate the Froude Number, velocity $V_1 = 3$ m/s as shown in Figure 1 and comment whether this jump is adequate for rapid mixing.

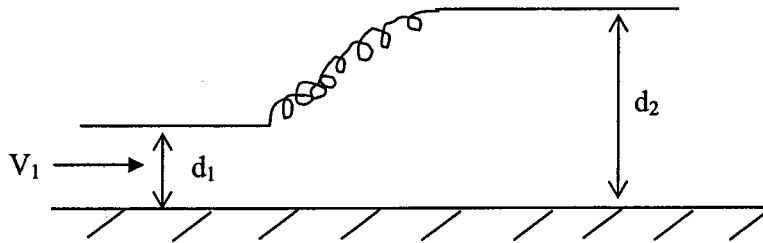
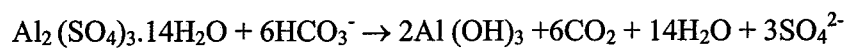


Figure 1

(5 marks)

- (c) Two sets of jar tests are conducted on raw water containing 2.0 NTU and an HCO_3^- alkalinity concentration of 45 mg/L expressed as CaCO_3 . Given the data as shown in Table 3, find the optimal pH, coagulant dose and the theoretical amount of alkalinity that would be consumed at the optimal dose. The reaction occurs when water is added with alum is shown below:



Molecular weights of the elements are shown as follows:

Oxygen = 16, sulphur = 32, aluminium = 27, hydrogen = 1 and carbon = 12.

Table 3

Jar Test 1						
Jar	1	2	3	4	5	6
pH	5.0	5.5	6.0	6.5	7.0	7.5
Alum dose (mg/L)	12	12	12	12	12	12
Turbidity (NTU)	12	7	5.0	6.0	8	13
Jar Test 2						
Jar	1	2	3	4	5	6
pH	6.0	6.0	6.0	6.0	6.0	6.0
Alum dose (mg/L)	6	8	12	14	16	18
Turbidity (NTU)	14	10	5	4.5	6	13

(10 marks)

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3. (a) Define the following terms:
(i) Camp Number
(ii) sedimentation
(iii) thickening
(iv) sludge
(4 marks)
- (b) Sedimentation Class II involves settlement of dilute suspensions of flocculent particles. Describe briefly on this type of sedimentation with respect to water treatment engineering.
(4 marks)
- (c) A horizontal sedimentation tank has a capacity of 10 million litres per day (MLD) with a surface loading of 30m/day. The minimum retention time in the tank is 2 hours. The tank is required to be designed with a length to breadth ratio of 4:1. Determine the dimensions of the tank and the length of the outlet weir.
(12 marks)
4. (a) Besides typical water treatment process, further treatment called advance water treatment may be required. Describe briefly three objectives for advance water treatment.
(3 marks)
- (b) The main processes used commercially to separate soluble salts from water include distillation, freezing, ion exchange, electro-dialysis and reverse osmosis. With the aid of a sketch diagram, describe briefly on the mechanism for reverse osmosis process for the separation of fresh water from salt solution.
(7 marks)
- (c) Briefly discusses the differences between Water Supply Act 1920 (Act 418) and Environmental Quality Act 1984 (Act 134) in terms of provisions and implementary agency.
(10 marks)
5. (a) Rapid sand filter needs to be cleaned from time to time due to deposition of dirty particles which caused higher head loss and lower filtration rate. Describe **TWO** (2) methods that normally be used for filter washing.
(4 marks)
- (b) Disinfection involves with the process of reducing pathogenic organisms so that no infection of disease results when the water is consumed. Briefly describe the factors that contributed to the resistance of organisms to disinfection process.
(6 marks)

5. (c) Figure 2 shows a reticulation system. Estimate the flow rate in each pipeline using Hardy-Cross Method and Hazen-William formula up-to two iteration. Adopt Hazen-William coefficient C as 100. Use an initial flow rate of 50 litres per second (lps) from point A to B. The lengths and diameters for pipes AB, BC, CD and AD are as follows:

Pipe AB: length = 900m and diameter = 250mm
 Pipe BC: length = 700m and diameter = 200mm
 Pipe CD: length = 700m and diameter = 200mm
 Pipe AD: length = 900m and diameter = 250mm

The following formula may be useful:

$$H_L = \frac{12.25 \times 10^9}{D^{4.87}} L \left(\frac{Q}{C} \right)^{1.85}$$

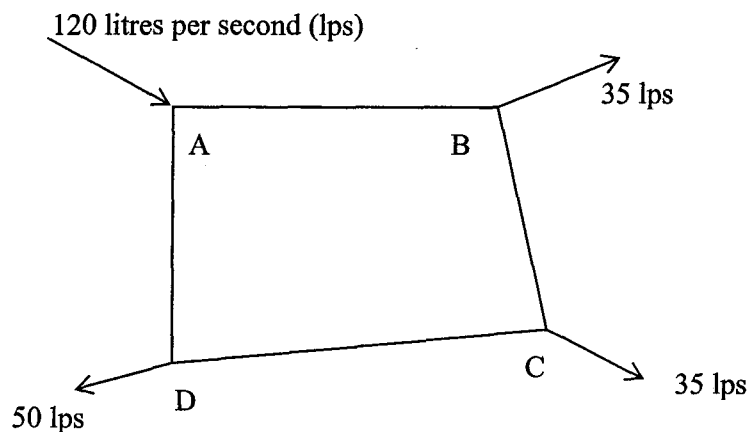


Figure 2

(10 marks)

6. (a) List **SIX (6)** differences between the characteristics of surface water and ground water? (3 marks)
- (b) Differentiate between Infiltration Wells and Infiltration Galleries. (4 marks)
- (c) The bacteriological characteristic of water is often established based on the presence of pathogen indicator organisms. Describe the characteristics of such organisms and their use in water quality determination. (5 marks)
- (d) A 1 litre solution was made by adding 9 g of acetic acid to distilled water. Calculate:
- i. the hydrogen ion concentration (4 marks)
 - ii. the percent ionisation (2 marks)
 - iii. pH (2 marks)