UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

EAP 581/4 – Water Supply Engineering

Duration: 3 hours

Please check that this examination paper consists of **SEVEN (7)** pages of printed material including appendix before you begin the examination.

Instructions: Answer **FIVE (5)** questions. All questions carry the same marks.

You may answer the question either in Bahasa Malaysia or English.

All questions **MUST BE** answered on a new sheet.

Write the answered question numbers on the cover sheet of the answer script.

1. (a) During the three months of water crisis, a village was force to depend on a river for their water source. Water analysis was carried out and the results are shown as Table 1:

Table 1: Water quality results

Parameters	Results
pH	6.85
Nitrate	7.5 mg/L
Ferum, Fe	1.5 mg/l
Turbidity	30 NTU
MPN Index	400 no/100ml
Oil and grease	2.5 mg/L

    (i)   Comment on the suitability of the water to be use as a water source.

[5 marks]

    (ii)   Briefly, suggest the method(s) to improve the water quality.

[5 marks]

(b) If coliform bacteria are not detected in a water sample, what can you conclude about the possibility of recent sewage pollution? If coliforms are detected, will the water cause diseases to those people who drink it? Explain your answer.

[5 marks]

(c) Multiple Tube methods are commonly used to enumerate E.Coli bacteria give a results as Table 2 :

Table 2: MPN results

Dilution	Number of bottles +ve	Number of bottles -ve
10^0	4	1
10^1	4	1
10^2	2	3
10^3	1	4
10^4	0	5

With the aid of Table 1 in the appendix, calculate the MPN indexs for this samples.

[5 marks]

2. (a) 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. Discuss the sustainable approaches need to be developed by water authorities in Malaysia in order to optimize on the existing and future water demand.

[4 marks]

(b) Discuss briefly on the causes of non-revenue water and its impact on water supply industry particularly in Malaysia.

[6 Marks]

(c) A community with the population of 15,000 has an average consumption of 535 lpcd (liter 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 1020m^2. With the aid of the following information estimate the total flow required. You may used Tables 3 and 4 to help your estimation.

$$F = 18C(A)^{0.5}$$

Note: Gallon per minute = [(L/min)/3.78], 1m^2 = 10.76ft^2

[10 marks]

Table 3 – 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 4 – Residential flow duration

Required fire flow (litre/minute)	Duration (hour)
<3780 (<1000 gpm)	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

3. (a) With the aid of a sketch diagram, briefly describe **FOUR (4)** zone found in the sedimentation tank.

[5 marks]

(b) Flotation is an alternative process to sedimentation and this process has gained popularity. Briefly discuss **FIVE (5)** advantages of flotation process with respect to portable water treatment.

[5 marks]

(c) For a mechanically tapered flocculation process, three flocculation tanks require to be constructed in series. The designed velocity gradient for the first, second and third tanks are $80s^{-1}$, $50s^{-1}$, $20s^{-1}$ respectively. The flow rate for each tank is 2 million litres per day and the water temperature is 20^0C (dynamic viscosity = 1.005×10^{-3} kg/ms and density of water = 998.23 kg/m^3). Retention time in each tank is 3 minutes. Calculate the dimension of each flocculation tank and suggest the appropriate dimension. Calculate the input power requires to rotate the blade in each tank.

[10 marks]

4. (a) With the aid of sketch diagram, briefly discuss the disadvantages of dead-end water system with respect to water supply engineering.

[5 marks]

(b) The use of asbestos cement pipes is unfavorable in Malaysia for the past several years. These pipes have been replaced with high density polyethylene pipes. Discuss why this action has been taken by the water authorities.

[5 marks]

(c) Figure 1 shows a water reticulation system for housing scheme. Estimate flow rate at each pipe branch using Hardy Cross method and Hazen William formula up to two iteration. In order to aid you in your calculation, use an initial flow rate of 100 m^3/hour from A to B. Length of pipe AB=2000m, BC = 1500m, CD = 500m and AD = 800m. Diameter of pipe AB = 300mm, BC = 250mm, CD = 250mm and AD = 300 mm. Hazen William coefficient for all pipes is 100.
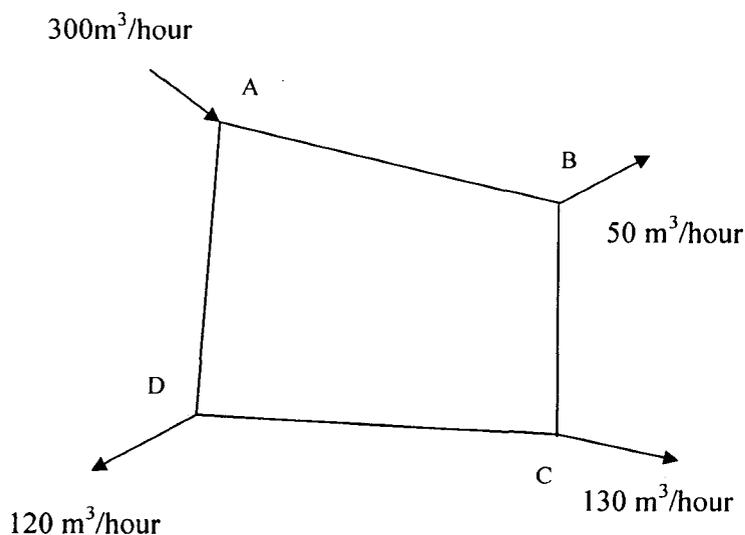
[10 marks]

300m^3/hour

A

B

50 m^3/hour

D

C

120 m^3/hour

130 m^3/hour

Figure 1

5. (a) Please discuss the **TWO (2)** basic related functions of water laws.

[4 marks]

(b) There are three legal regimes to allocate common resources and to resolve disputes among competing water users. Please discuss the three models.

[6 marks]

(c) Water matters are stated in the Federal Constitution of Malaysia as being within the state's jurisdiction. Please elaborate.

[5 marks]

(d) Please discuss the new water framework in Malaysia.

[5 marks]

6. (a) Discuss the need to model surface water resource systems.

[5 marks]

(b) Please discuss the water resource models for planning and management

[5 marks]

(c) In modeling surface water quality, **TWO (2)** models are used, i.e. the far-field model and the mixing zone model. Please elaborate and give examples.

[5 marks]

(d) In Malaysia, new technologies are available such as remote sensing images, digital elevation models, and Geographic Information Systems (GIS), which can be used for modeling water catchments prone to soil erosion. How would you apply the new technologies and consequently model soil erosion?

[5 marks]

- ooo OOO ooo

APPENDIX

Table 1: MPN index table for Enumerate E.Coli bacteria

MPN index and 95% confidence limits for various combinations of positive results when five tubes are used per dilution (10 mL, 1.0 mL, 0.1 mL)							
Combination of positives	MPN index/100 mL	95 % confidence limits		Combination of positives	MPN index/100 mL	95 % confidence limits	
		Lower	Upper			Lower	Upper
0-0-0	<0	-	-	4-2-0	22	7	67
0-0-1	2	<0.5	7	4-2-1	26	9	78
0-1-0	2	<0.5	7	4-3-0	27	9	80
0-2-0	4	<0.5	11	4-3-1	33	11	93
				4-4-0	34	12	93
1-0-0	2	<0.5	7	5-0-0	23	7	70
1-0-1	4	<0.5	11	5-0-1	31	11	89
1-1-0	4	<0.5	11	5-0-2	43	15	110
1-1-1	6	<0.5	15	5-1-0	33	11	93
1-2-0	6	<0.5	15	5-1-1	46	16	120
				5-1-1	63	21	150
2-0-0	5	<0.5	13	5-2-0	49	17	130
2-0-1	7	1	17	5-2-1	70	23	170
2-1-0	7	1	17	5-2-2	94	28	220
2-1-1	9	2	21	5-3-0	79	25	190
2-2-0	9	2	21	5-3-1	110	31	250
2-3-0	12	3	28	5-3-2	140	37	340
3-0-0	8	1	19	5-3-3	180	44	500
3-0-1	11	2	25	5-4-0	130	35	300
3-1-0	11	2	25	5-4-1	170	43	490
3-1-1	14	4	34	5-4-2	220	57	700
3-2-0	14	4	34	5-4-3	280	90	850
3-2-1	17	5	46	5-4-4	350	120	1,000
4-0-0	13	3	31	5-5-0	240	68	750
4-0-1	17	5	46	5-5-1	350	120	1,000
4-1-0	17	5	46	5-5-2	540	180	1,400
4-1-1	21	7	63	5-5-3	920	300	3,200
4-1-2	26	9	78	5-5-4	1,600	640	5,800
				5-5-5	≥ 2,400	-	-