Uva Wellassa University, Sri Lanka
End Semester Examination – September 2011
MRT 381-2 Water Treatment Methods

Time: Three (02) hours

Uva Wellassa University

Total 03 questions
Answer all questions

PART - A

01) The following water quality results were obtained by a chemical laboratory of a water regulating agency in Sri Lanka.

	Min	max
Turbidity / (NTU)	30	450
pH	6.0	7.5
DO / (mg/l)	6.1	6.4
SS / (mg/l)	55	600
Color (Pt-Co)	15	35
Conductivity (µS/cm)	450	800

I. How do you describe the chemical composition of water sample based on the treatment possibilities for using as a drinking water source?

(10 marks)

II. What type of unit processes you would like to propose to treat the above water to meet the SLS water quality parameters for drinking water as given below.

Parameter	SLS 614: Part 1 & 2		
	Units	Maximum desirable level	Maximum permissible level
Colour	Pt-Co	5	30
Turbidity	NTU	2	8
pH		6.5	9.0
Conductivity at 25 °C	µS/cm	750	3500

(10 marks)

III. Sketch the process flow diagram including proposed treatment processes to meet the stringent SLS requirements.

(10 marks)

02) Assume that you are a process design engineer and have been asked to design a water treatment process for the water body shown in Section I. You are needed to size the intake channel with bar screeners, sedimentation tanks and filters.

Design data

No of families in the area	: 50,000
No of average persons in a single family	: 05
Per capita consumption of water	: 140 – 180 l/day/head
Commercial water requirement	: 30 % of the domestic requirement
Intuitional and other requirement	: 25% of the domestic requirement

I. Find out the total domestic demand in the area and hence calculate the total water requirement in the proposed service area.

(10 marks)

II. Design the intake cannel width and height. Calculate the head loss at the screen bars where bar and opening are in sizes of 5mm and 10 mm respectively. You may use the following equations as needed.

$$h_L = \frac{1}{0.7}\left(\frac{V^2 - U^2}{2g}\right)$$

Where,

h_L = Head loss (m)

0.7 = An empirical discharge coefficient to account for turbulence & eddy losses

V = Velocity of flow through the openings of the bar (m/s)

U = Velocity in approach channel (m/s)

g = Acceleration due to gravity (m/s^2)

$$U = V\left(\frac{\text{Bar Spacing}}{\text{Bar Spacing} + \text{Bar With}}\right)$$

(10 marks)

III. Design the sedimentation tanks dimensions (width, length and height) based on the following guidelines.

Parameter	Design value
Surface loading rate ($m^3/m^2.d$)	20 - 60
Mean horizontal velocity (m/min)	0.15 – 0.90
Water depth (m)	2 – 3
Detention time (h)	2 – 4
Weir loading rate ($m^3/m^2.d$)	100 - 200
Solid loading rate ($kg/m^2.d$)	
• Primary sedimentation	15 – 34
• Secondary clarifier	49 – 98

(10 marks)

IV. Calculate the width and length of filters. Assume filter media height as 1200 mm and they are packed on a concrete slab with air nozzles placed at equal distances.

Clue: Use the filtration rate as 120 $m^3/m^2/day$

(10 marks)

PART - B

03)

I. Fresh water is a limited resource and there is a growing scarcity for it in world over. As water professionals, we all are responsible on managing this issue. Describe your responsibility as a young water treatment expert with the suggestions to minimize the threats from drinking water scarcity.

(15 marks)

II. The scarcity of water linked with the challenges faced with the effects of global warming and the resulting climatic changes. As water professional and as an expert in water treatment technology describe briefly methods of combating water scarcity as a result of global warming.

(15 marks)