



**MRT 381-2 Water Treatment Methods**

Number of Questions : Seven (07)

Answer all questions

Time Allocation : Two (02) hours

Total Marks : 100

Illustrate your answers with sketches where necessary

1. Water treatment is carried out to remove suspended solid from water by gravity. This process is basically involved with coagulation, flocculation, sedimentation and filtration. The suspended solid separated from the water is known as sludge. Discuss about the sludge generation points with respect to the treatment process, its composition and the general treatment process in detail with sketches as needed. (10 marks)
2. The following water quality results were obtained by a chemical laboratory of a water regulating agency in Sri Lanka.

	Min	Max
Turbidity / (NTU)	10	300
pH	6.0	7.5
DO / (mg/l)	6.8	7.2
SS / (mg/l)	25	600
Color (Pt-Co)	15	35
Conductivity ( $\mu$ S/cm)	450	800

- a. A process engineer has decided to introduce aeration, chemical mixing and contact filtration for above water as the key processes of treatment. Discuss about the treatment capability of suggested process. (05 marks)
- b. What type of unit processes would you suggest to treat the above water to meet the SLS water quality parameters for drinking water as given below? (20 marks)

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	$\mu$ S/cm	750	3500

- c. Sketch the process flow diagram including proposed treatment processes to meet the stringent SLS requirements. (05 marks)
3. Groundwater in dry zone of Sri Lanka has been extensively discussed with respect to the Chronic Kidney Disease (CKDu). As a professional practicing in the water of sector Sri Lanka, comment on the possible causes of the issue. (05 marks)
4. Assume that you are a process design engineer and have been asked to design a water treatment plant. The basic design requirements are given below.

Design data

Number of families in the area	: 50,000
Number 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

- a. List the additional factors with appropriate values for calculating the daily raw water extraction rate at the intake. (05 marks)
- b. Assume that there are three raw water pumps placed at the intake of the above treatment plant to extract the daily water need. Hence, calculate the required pumping rate ( $\text{m}^3/\text{hr}$ ) of the above pumps. (10 marks)
- c. Design the sedimentation tank dimensions (width, length and height) based on the following guidelines. (10 marks)

Parameter	Design Value
Surface Loading rate ( $\text{m}^3/\text{m}^2.\text{d}$ )	20-60
Mean horizontal velocity (m/min)	0.15-0.90
Water depth (m)	2-3
Detention time (h)	2-4
Weir loading rate ( $\text{m}^3/\text{m}^2.\text{d}$ )	100-200
<i>Solid loading rate (<math>\text{kg}/\text{m}^2.\text{d}</math>)</i>	
+ Primary sedimentation	15-34
+ Secondary clarifier	49-98

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5. Describe the different combinations of oxidizers used in advanced oxidation. (10 marks)

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6. Explain the practical use of activated sludge process in wastewater treatment. (10 marks)

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7. Describe the use of resins in softening process for reducing hardness from groundwater. (10 marks)

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