Total number of printed pages – 7   **B. Tech**

CPEV 7305

Sixth Semester Examination – 2008

WATER AND WASTEWATER ENGINEERING – I

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory
and any **five** from the rest.
The figures in the right-hand margin
indicate marks.*

1. Answer the following questions in brief :

    2 ×10

    (a) Compare Type-I settling with Type-II settling processes. Give suitable examples.

    (b) Write the chemical reaction when alum is added to water (with bicarbonate).

    (c) Which methods are suitable for the removal of taste and odour from water ?

    (d) How zeolite is regenerated after exhaustion in the process of softening (using ion exchange) ?

    (e) Discuss the process of desalination of sea water.

    (f) Compare the principles of biological oxidation using suspended growth and attached growth system.

    (g) Which biological wastewater treatment unit consists of a series of closely spaced circular plastic disks which are partly sub-merged ?

    (h) Compare the working methodologies of aerobic lagoon with facultative lagoon.

    (i) What are the different reactors used in the modifications in the activated sludge process ?

    (j) Briefly discuss the suitability of aerobic digestion.

2. (a) A settling analysis is run on a Type-I settling/suspension. The column is 1.8 m deep and the data are shown below :

Time (min)	0	60	80	100	130	200	240	420
Concentration (mg/l)	300	189	180	168	156	111	78	27

What will be the theoretical removal efficiency in a settling basin with a loading rate of 25 m^3/m^2 day ? 5

(b) Discuss the mechanism of coagulation/flocculation in the water. What is the necessity of jar test ? 5

3. (a) Compare rapid sand filter with slow sand filter in tabular form for the following items : 1.5×4

(i) Effective size of the media and uniformity co-efficient

(ii) Rate of filtration

(iii) Cleaning methodology and cleaning interval

(iv) Removal of impurities and bacteria and efficiency.

(b) Discuss briefly the following methods of disinfection (Write two to three sentences for each type) : 4

(i) Ozonization

(ii) Ultraviolet-rays

(iii) Chlorination

(iv) Excess lime.

4. (a) Determine the size of a high rate trickling filter for the following data using the formula Efficiency, $\eta = 100 / [1+ 0.0044\sqrt{(Y/VF)}]$:

(i) Sewage flow = 4.5 MLD

(ii) Recirculation ratio = 1.5

(iii) BOD of raw sewage = 250 mg/L

(iv) BOD removal in Primary treatment = 30%

(v) Final Effluent in BOD desired = 30 mg/L

Assume any other data suitable. 5

(b) In a completely mixed activated sludge process, determine :

(i) The aeration volume (V)

(ii) Hydraulic retention time (Φ)

(iii) The F/M ratio

From the following data :

(i) Flow rate $= Q_0 = 11250 \text{ m}^3/\text{day}$

(ii) Interval BOD $(S_0) = 200 \text{ mg/L}$

(iii) BOD required for the effluent not more than 10 mg/L

(iv) Yield co-efficient (Y) = 0.6

(v) Decay rate $(K_d) = 0.06$ per day

(vi) MLSS in the aeration tank (X) = 3500 mg/L

(vii) MLSS in the clarifier sludge $(X_w) = 1500 \text{ mg/L}$

(viii) Mean cell residence time $(\Phi_c) = 10$ days.

Assume any other data necessary.   5

5. (a) Discuss the working principle of an oxidation pond with the help of a labelled diagram.   5

(b) Describe the necessity of the septic tank for the treatment of sewage of small colonies and individual homes.   5

6. (a) Discuss the constructional details of anaerobic digesters. Also write the factors that affects the sludge digestion.   5

(b) Discuss briefly the following modification to ASP :   5

(i) Tapered Aeration

(ii) Step aeration.

7. (a) Discuss the characteristics of sludge in relation with sludge disposal regulations.   5

(b) Discuss the following sludge conditioning methods (any *two*) :   5

(i) Sludge Thickener

(ii) Stabilization

(iii) Conditioning and dewatering.

8. Write short notes on the following (any *four*) :

2.5×4

    (i)   Iron and Manganese removal from water

    (ii)   Fluoridation and De-fluoridation

    (iii)   Rotating Biological Contactor

    (iv)   Secondary Sedimentation Tanks used in waste water tanks

    (v)   High Rate Trickling Filter

    (vi)   Operational problems in anaerobic digester.

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