

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
B.E. (Civil) 5th SEMESTER FINAL EXAMINATIONS, 2011
Environmental Engineering I (CE 504)

Full Marks: 70

Time: 3 hrs

Answer any 3 (three) questions from each half.
2 (two) marks are allotted for neatness in each half.
Assume any data necessary, if not given

FIRST HALF

1. Write the basic objective of surface water and wastewater treatment. Draw a typical flow sheet of ground water treatment. List various treatment methods under 'physical' and 'chemical' categories. (3+4+4)
2. Write the mechanism of plain sedimentation. How can you determine the 'settling velocity' of a discrete particle from Stokes' law?
Estimate the settling velocity of the discrete particles with diameter 0.1 and 0.2 in a water tank at 25°C. The specific gravity of the particle is 2.6. The kinematic viscosity of water at 25°C may be taken as $0.893 \times 10^{-6} \text{ m}^2/\text{s}$. (3+4+4)
3. How would you conduct 'coagulation-flocculation'? Differentiate between 'slow sand' and 'rapid sand' filtration process.
Water at 25°C is allowed to pass through a filter bed of uniform sand at the rate of $5 \text{ m}^3/\text{hr}/\text{m}^2$. If the depth of the bed is 0.70 m and porosity before and during backwashing are 0.45 and 0.60 respectively, determine the amount of its expansion. (4+3+4)
4. Write the principle of 'Lime-soda softening' for the removal of hardness from water. What are the limitations of this softening process?
Analysis of a raw water sample reveals the following results.

pH	7.9
CO ₂	24
Total Hardness	430
Calcium (as Ca ⁺²)	100
Total Alkalinity	200

Note : All the values are given in mg/L as CaCO₃ except pH and Calcium

If the final desired hardness is 100 mg/L as CaCO₃ then estimate the Caustic soda and Soda ash requirement to soften the above water. (4+2+5)

5. Draw a typical flow-sheet of municipal wastewater treatment using Activated Sludge Process. Differentiate between 'primary', 'secondary' and 'tertiary' treatment of wastewater. Also list various 'physical', 'chemical' and 'biological' methods applicable for wastewater treatment. (4+3+4)

SECOND HALF

6. (a) What is an indicator organism? Discuss the characteristics of the ideal pathogen indicator and indicate which organism most nearly exhibits these characteristics.
- (b) Define methemoglobinemia and discuss it as a water related illness. (6 + 5 =11)
7. (a) How the total quantity of water required by a town is estimated? What are the various factors which directly affect the per capita demand of a town?
- (b) What points should be kept in mind while selecting a site for intake works? Show with sketches the various types of intake works. (6 + 5 =11)
8. (a) What are confined, unconfined and perched aquifer? Explain with the help of neat sketch. What is well shrouding and well development?
- (b) State briefly the various methods of distribution system. Show the different layouts of distribution system and mention. (6 + 5 =11)
9. (a) (i) Compare between separate system and combined system of sewer.
- (ii) Show with sketches the various patterns of sewage collection system and their applicability.
- (b) Explain the causes for corrosion of sewers. What preventive measures can be taken to avoid such problems? (6 + 5 =11)
10. Write short notes on the followings (Any three)
- (b) Population forecast; (b) Corrosion of water supply pipes;
- (f) Pressure relief and air relief valves
- (g) Storm water regulators; (e) Inverted syphons;
- (h) Drawdown, inverted cone of depression and circle of influence.