

**WATER AND LIQUID WASTE MANAGEMENT
(CHEN 3221)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Identify the criteria which is not associated with a BOD Bottle
(a) Unique no (b) Volume= 300 ml
(c) Pet Bottle (d) Sealed glass stopper
- (ii) For existence of aquatic life in water, the dissolved oxygen content in it, should not be less than _____ ppm.
(a) 1000 (b) 500
(c) 50 (d) 5
- (iii) The term Biological oxygen demand (BOD) is used in relation to
(a) potable water (b) cooling water
(c) distilled water (d) industrial effluents
- (iv) Mohr Salt is a reagent in the analysis of
(a) BOD₅ (b) COD
(c) Total dissolved solid (d) Total solid
- (v) Stokes' law is valid for particle Reynolds no.
(a) less than 1 (b) more than 10
(c) more than 100 (d) above 1000
- (vi) Black Water is also termed as
(a) Grey Water (b) River Water
(c) Sullage (d) Sewage
- (vii) As per the CPCB standard Type B water signifies
(a) Water having requisite Bathing Standard
(b) Untreated Sewage
(c) Treated wastewater for irrigation purpose
(d) Drinking Water

- (viii) Extended Aeration System does not have any
(a) Reactor (b) Primary Clarifier
(c) Secondary Clarifier (d) Earthworm.
- (ix) The Root-zone/Reed Bed Treatment uses
(a) Neem (b) Zoo Plankton
(c) Babul (d) Typha elephantiana
- (x) The colour of wastewater is measured in terms of
(a) NTU (b) Angstrom units
(c) Hazen units (d) FTU

Group - B

2. (a) State the Water Act 1974. "The main import of the Water Act 1974 is the genesis of Central Pollution Control Board" – Discuss critically.
(b) Discuss the steps for obtaining Consent to Establish (NOC) of a water intensive industry.
(2 + 4) + 6 = 12
3. (a) Discuss various methods of Rain Water Harvesting with representative diagram wherever necessary.
(b) Enumerate the salient steps of conducting Water Audit.
8 + 4 = 12

Group - C

4. (a) (i) Discuss the Fujimoto method in BOD data analysis.
(ii) Define TS, Settleable solids, volatile solids and volatile suspended solids of a wastewater sample.
(b) For a system of wastewater containing nitrogenous matter, Show that NBOD = 4.57 TKN.
(3 + 4) + 5 = 12
5. (a) Discuss the principle of a Trickling Filter with a neat sketch.
(b) Design a trickling filter with recirculation using a suitable empirical method for data supplied: Sewage flow= 5000 m³/day; Raw settled BOD= 200 mg/l; Filter depth D=1.8m; Media= 7.5 –10 cm diameter stones. The efficiency of the filter would be about 85%. Assume standard design data, if required.
5 + 7 = 12

Group - D

6. (a) Mention the processes those are carried out in preliminary and primary treatment of wastewater. Discuss screening method.

- (b) A horizontal-flow sedimentation tank is operating with an overflow rate of $18 \text{ m}^3/\text{d. m}^2$. What percentage removal should be expected for each of the particles having following settling velocities : 0.08 mm/s, 0.16 mm/s and 1mm/s?
- (c) Why is fluoridation of water carried out? Mention the compounds used for this purpose.

3 + 3 + 4 + (1 + 1) = 12

7. (a) Write down the 'Chemical precipitation method' in case of wastewater treatment. How can phosphorus be removed using this method?
- (b) Discuss the working principle of slow sand filter for water purification. Name two chlorine compounds used as disinfectants of water. Also write an equation to represent disinfection kinetics.

(4 + 2) + (4 + 1 + 1) = 12

Group - E

8. Delineate a case study on pollution control in a cluster of Tanneries mentioning:
(i) Methodology and Concept, (ii) Treatment Technologies and (iii) Flow diagram.

(3 + 5 + 4) = 12

9. Wastewater from a fine chemical industry contains the following:
150 mg/l ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$); 100 mg/l phenol ($\text{C}_6\text{H}_6\text{O}$);
40 mg/l sulphide (S^{2-}); 125 mg/l ethylene diamine hydrate ($\text{C}_2\text{H}_{10}\text{N}_2\text{O}$) which is essentially nonbiodegradable.

- (i) Compute the COD and TOC.
(ii) Compute the BOD_5 if the k_{10} is 0.2/day.
(iii) After treatment, the BOD_5 is 25 mg/l, Estimate the COD ($k_{10} = 0.1/\text{day}$).

(4 + 4 + 4) = 12

Department & Section	Submission Link
AEIE/CSE	https://classroom.google.com/c/Mjk5ODYwMDQ2MzYw/a/MzY0NTYwNjl4MjY1/details