

**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) The RBDC is  
(a) an attached growth process                      (b) a suspended growth process  
(c) a non-conventional process                      (d) a constant growth process.
- (ii) As per the CPCB standard for Type B water signifies  
(a) Untreated Sewage  
(b) Water having requisite Bathing Standard  
(c) Drinking Water  
(d) Treated wastewater for irrigation purpose.
- (iii) The flow of water in open drain is conveniently measured by  
(a) Rotameter    (b) Pitot tube  
(c) Wier    (d) Venturi meter.
- (iv) Identify the Environment Act/Rules which is related with genesis of CPCB, India  
(a) Water Act    (b) Bengal Smoke Nuisance Act  
(c) Air Act    (d) E-waste (Management) Rules.
- (v) Black water is also termed as  
(a) sullage                      (b) grit                      (c) moss                      (d) sewage.
- (vi) Grey water is also termed as  
(a) sullage                      (b) grit                      (c) moss                      (d) sewage.
- (vii) ISO 14000 series is related to Certification of \_\_\_\_\_ Standard.  
(a) Occupational Health & Safety  
(b) Environmental Management  
(c) Quality Management  
(d) Design of Environment Protection Equipments

- (viii) The Root-zone/Reed Bed Treatment uses  
(a) Neem (b) Zoo Plankton  
(c) Babul (d) Typha elephantiana.
- (ix) Trickling Filter is  
(a) an attached growth system (b) a suspended growth system  
(c) an anaerobic system (d) synonymous with venturi scrubber.
- (x) Rotating Biological Disk Contactor is  
(a) an attached growth system (b) a suspended growth system  
(c) an anaerobic system (d) synonymous with venturi scrubber.

**Group- B**

2. (a) Which was the most ancient act of environmental pollution in India? Discuss its significance. [(CO1)(Remember/LOCQ)]  
(b) Discuss the principle and operation of a Rain water harvesting process with a neat sketch. [(CO3)(Analyze/IOCQ)]  
**(1 + 3) + 8 = 12**
3. A wastewater treatment plant discharges 1.0 m<sup>3</sup>/s of effluent having an ultimate BOD of 40.0 mg/L, into a stream flowing 10.0 m<sup>3</sup>/s. Just upstream from the discharge point, the stream has an ultimate BOD of 2.0 mg/L. The deoxygenation rate coefficient is 0.22/day.  
(i) Assuming complete and instantaneous mixing, find ultimate BOD of the mixture of waste and river just downstream from the outfall.  
(ii) Assuming a constant cross-sectional area for the stream equal to 55 m<sup>2</sup> what ultimate BOD would you expect to find at a point 10,000 m downstream?  
[(CO2)(Evaluate/HOCQ)]  
**(6 + 6) = 12**

**Group - C**

4. (a) State the working principle of Trickling Filter? What are its limitations? (No Sketch is necessary). [(CO4)(Remember/LOCQ)]  
(b) Design a trickling filter with recirculation using a suitable empirical method for data supplied: Sewage flow = 5000 m<sup>3</sup>/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%. [(CO4)(Evaluate/HOCQ)]  
**(3 + 3) + 6 = 12**
5. Find L<sub>0</sub> from industrial BOD Data using Fujimoto method.

|          |   |    |    |     |     |     |     |     |
|----------|---|----|----|-----|-----|-----|-----|-----|
| t (day)  | 0 | 1  | 2  | 3   | 4   | 5   | 6   | 7   |
| BOD mg/l | 0 | 55 | 97 | 130 | 156 | 180 | 196 | 204 |

[(CO2)(Evaluate/HOCQ)]

**12**

**Group - D**

6. (a) Discuss the purification methodology of Liquid waste containing Mercury contaminants. [(CO2)(Analyze/IOCQ)]  
 (b) Discuss the drinking water standard by WHO/CPCB. [(CO2)(Remember/LOCQ)]  
**9 + 3 = 12**
7. (a) Define Bio-remediation and explain its basic principles. [(CO2)(Remember/LOCQ)]  
 (b) Evaluate the Monod model for studying Phenol degradation kinetics by bacteria stating its basic assumptions. [(CO2)(Evaluate/HOCQ)]  
**(2 + 2) + 8 = 12**

**Group - E**

8. Discuss the details of Reed Bed and Root Zone Treatment with a neat sketch and explain why it is helpful for small scale industries wastewater treatment. [(CO4)(Analyze/IOCQ)]  
**[(4 + 4) + 4] = 12**
9. Write Technical notes on:  
 (i) Ranking of wastewater treatment alternative;  
 (ii) Environment Management Plan in Pulp & Paper Industries. [(CO4)(Analyze/IOCQ)]  
**(6 + 6) = 12**

| Cognition Level         | LOCQ  | IOCQ  | HOCQ  |
|-------------------------|-------|-------|-------|
| Percentage distribution | 17.71 | 33.33 | 48.96 |

**Course Outcomes (CO):**

At the end of the course the students should be able:

1. The students will be able to identify the importance of Legislative orders prevalent in India concerning Water and Liquid Waste Management.
2. The students will be able to describe the methodology of Establishing and Operating Water and Liquid Waste intensive processes.
3. The students will be able to use the principles of Water Management in order to conserve water and solve water-shortage problems prevalent in India.
4. The students will be able to design the Water Treatment and Wastewater Treatment plants following the standard code of practice.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

