# ENVIRONMENTAL ENGINEERING
## (CHEN 4133)

**Time Allotted : 2½ hrs** **Full Marks : 60**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.***

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

## Group – A

1. Answer any twelve: **12 × 1 = 12**

*Choose the correct alternative for the following*

(i) Identify the oldest act for protection of Environment in India.
(a) Water Act (b) Bengal Smoke Nuisance Act
(c) Air Act (d) E-waste (Management) Rules.

(ii) The host country of World Environment Day 2022 celebration centralized programme was
(a) Sweden (b) India (c) China (d) Coulmbia.

(iii) NBOD interference would not take place if the CBOD experiment is conducted within
(a) 10 days (b) 20 days
(c) 8 days (d) not dependent on time limit.

(iv) Black Water is also termed as
(a) Grey water (b) River water
(c) Sullage (d) Sewage.

(v) 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.

(vi) Typha Elephantiana class of plants are used in
(a) Activated Sludge Process
(b) Extended Aeration System
(c) Root-zone Treatment
(d) Trickling Filter.

(vii) As per the CPCB standard for discharge of liquid waste into inland surface water the values of COD in mg/l for treated waste water is
(a) Less than or equal to 150 (b) 30 (c) > 150 (d) 0.

(viii) Root-zone treatment is basically
(a) Activated Sludge Process (b) Non-conventional System
(c) Waste Stabilization Pond (d) Trickling Filter.

(ix) A permit which allows a country to produce a certain amount of carbon emissions and which can be traded if the full allowance is not used is known as:
(a) Carbon footprint (b) Carbon Flip Bond
(c) Carbon Credit (d) All of the above.

(x) Identify the noise level which exceeds 65 db.
(a) Whisper (b) a hen's cluck
(c) a normal conversation (d) Rock music.

*Fill in the blanks with the correct word*

(xi) Baghouse is required for Controlling _____ emission.

(xii) _____ is used for reduction of volume of solid waste in metro cities.

(xiii) _____ was basically a dreadful incident involving mercury pollution.

(xiv) UASB process is an efficient yet _____ process.

(xv) _____ pond is of partially aerobic and partially anaerobic in nature.

## Group - B

2. (a) State the Air Act 1981. *[(CO1)(Remember/LOCQ)]*
(b) Explain its importance. *[(CO1)(Analyze/IOCQ)]*
(c) A factory uses 2,00,000 litres of furnace oil ( specific density 0.97) per month. If for one million litres of oil used per year, the particulate matter emitted is 3.0 tonnes per year, $SO_2$ emitted is 59.7 tonnes per year, $NO_X$ emitted is 7.5 tonnes per year, hydrocarbons emitted are 0.37 tonnes per year, and carbon monoxide is 0.52 tonnes per year, calculate the height of the chimney required to be provided for safe dispersion of the pollutants. *[(CO3)(Evaluate/HOCQ)]*

**2 + 2 + 8 = 12**

3. (a) State the working principle of an ESP. *[(CO3)(Remember/LOCQ)]*
(b) Analyze the operation of the ESP. *[(CO3)(Analyze/IOCQ)]*
(c) Draw a neat sketch of the equipment. *[(CO3)(Evaluate/HOCQ)]*

**4 + 4 + 4 = 12**

## Group - C

4. (a) Analyze the concept of $BOD_5$ at 20°C from historical perspective. *[(CO3)(Analyze/IOCQ)]*
(b) Find $L_0$ from industrial BOD Data using Fujimoto method. *[(CO3)(Evaluate/HOCQ)]*

| t (day) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| BOD mg/l | 0 | 55 | 102 | 134 | 156 | 178 | 196 | 207 |

(c) Using the value of $L_0$, Calculate $BOD_8$ assuming k=0.22/day. *[(CO3)(Evaluate/HOCQ)]*

**4 + 4 + 4 = 12**

5. (a) Enumerate four typical examples of suspended growth system. *[(CO3)(Remember/LOCQ)]*

(b) Explain the essential criteria of a conventional activated sludge system. *[(CO3)(Analyze/IOCQ)]*

(c) How does it differ in complete mixing activated sludge system? *[(CO3)(Analyze/IOCQ)]*

**4 + 4 + 4 = 12**

## Group - D

6. (a) Enumerate different Solid Waste Collection methods practiced in Metro cities of India. *[(CO2)(Remember/LOCQ)]*

(b) Incineration is rarely practiced as a disposal method in India – Analyze the statement. *[(CO2)(Analyze/IOCQ)]*

(c) The efficacy of Solid waste management system is essential segregation of non biodegradable wastes --- Explain. *[(CO2)(Analyze/IOCQ)]*

**4 + 4 + 4 = 12**

7. (a) State the basic assumptions of Phenol degradation kinetics by bacteria. *[(CO2)(Remember/LOCQ)]*

(b) Evaluate the Monod model for studying Phenol degradation kinetics. *[(CO2)(Evaluate/HOCQ)]*

(c) State the methods of Chromium remediation. *[(CO2)(Analyze/IOCQ)]*

**4 + 4 + 4 = 12**

## Group - E

8. (a) Discuss the details of a Root Zone Treatment. *[(CO3)(Remember/LOCQ)]*

(b) Draw a neat sketch of the system. *[(CO3)(Analyze/IOCQ)]*

(c) Explain why it is helpful for compact Sewage treatment. *[(CO3)(Analyze/IOCQ)]*

**4 + 4 + 4 = 12**

9. (a) Analyze various alternatives of Ranking of wastewater treatment. *[(CO4)(Analyze/IOCQ)]*

(b) According to this methodology, evaluate two efficient alternatives. *[(CO4)(Evaluate/HOCQ)]*

(c) Evaluate an Environment Management Plan in Pulp & Paper Industries. *[(CO4)(Evaluate/HOCQ)]*

**4 + 4 + 4 = 12**

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| Cognition Level | LOCQ | IOCQ | HOCQ |
|---|---|---|---|
| Percentage distribution | 22.92 | 43.75 | 33.33 |

**Course Outcome (CO):**

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

1. To apply the knowledge of Legislation concerning Environmental Engineering & Pollution Control prevalent in India.
2. To utilize the knowledge base of Solid Waste Management in order to achieve Swachh Bharat Mission.
3. To solve problems of Air Pollution and Water Pollution in batch and flow system and design suitable instruments / equipments.
4. To design Environmental Management Plan for chemical industries.

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