# ENVIRONMENTAL ENGINEERING AND POLLUTION CONTROL
## (CHEN 3132)

**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) Example of non-biodegradable wastes is
(a) Municipal solid wastes (b) DDT
(c) Paper (d) All of these

(ii) The noise threshold limits in residential area in day time is
(a) 75 dB (A) $L_{eq}$ (b) 55 dB (A) $L_{eq}$
(c) 40 dB (A) $L_{eq}$ (d) 60 dB(A)$L_{eq}$

(iii) Which one is the type of electrostatic precipitator?
(a) Cuboid precipitator (b) Square precipitator
(c) Wire and pipe precipitator (d) Flat plate collector.

(iv) The host country of World Environment Day 2024 celebration centralized programme was
(a) China (b) India (c) Saudi Arabia (d) UK.

(v) In Grab Sampling of wastewater the following parameter is significant
(a) Pressure (b) Enthalpy
(c) Flow (d) None of the above

(vi) As per Plastic Waste Management (Amendment) Rules 2021, the minimum thickness of plastic carry bags is
(a) 20 microns (b) 10 microns
(c) 120 microns (d) 40 microns

(vii) The problem of Leachate is most abundant in
(a) Landfill (b) Incineration
(c) Air Pollution (d) zero

(viii) Identify the category of Industry, the effluent of which has highest BOD level
(a) Sulphuric Acid plant (b) Electrochemical Industry
(c) Dairy (d) Petroleum Refinery

(ix) The Solar power plant is a
(a) Red Category Industry (b) Green Category Industry
(c) White Category Industry (d) Orange Category Industry.

(x) The centre of focus of EMP in Kudankulam is
(a) Air Pollution (b) Noise Pollution
(c) Water Pollution (d)Nuclear Radiation and its effect on Livestock.

*Fill in the blanks with the correct word*

(xi) Pollution generation can be reduced by _____.

(xii) The Primary Wastewater treatment is sufficient for effluent with BOD <= _____.

(xiii) Alkaline _____ is used for measuring DO in Winkler's Method.

(xiv) _____ is used for detection of CO pollution.

(xv) In India, Anatomical Waste should be disposed using _____ bags.

## Group - B

2. (a) A MSW based power plant is emitting 45,000 $m^3/h$ flue gas. It is proposed to install an ESP with a collection efficiency of 96.8%. Calculate the total area of the collection electrodes. If the collection efficiency is 99.5%, how much additional collection electrode area would be needed? Drift velocity of the particles has been determined experimentally as 0.13 m/s. *[(CO3)(Analyse/HOCQ)]*

(b) Which type of collector is widely used in industry to absorb the gaseous pollutant in the liquids?Briefly discuss the operating principle of thisgas absorbing device with a help of diagram. *[(CO3)(Understand/IOCQ)]*

**6 + 6 = 12**

3. (a) A venturi scrubber is to be used to collect particulates matter from a an industrial operation. The liquid flow rate through the scrubber is 10 gallons per minute per 1000 cubic feet per minute of gas and the relative velocity of the gas to liquid is 300 ft/sec. The gas is air at STP of 298 K and pressure of 1 atm carrying particles of density 1000 $kg/m^3$. Determine the efficiency of the scrubber as a function of particles diameter. Consider the viscosity of the gas as $1.8 \times 10^{-5}$ Kg/m–s.
*[(CO3)(Analyse/HOCQ)]*

(b) Discuss the advantages and disadvantages of a wet scrubbers.
*[(CO3)(Remember/LOCQ)]*

**8 + 4 = 12**

## Group - C

4. (a) A wastewater treatment plant discharges 2.0 $m^3/s$ of effluent having an ultimate BOD of 50.0 mg/L, into a stream flowing 10.0 $m^3/s$. Just upstream from the discharge point, the stream has an ultimate BOD of 2.0 mg/L. The de-oxygenation rate coefficient is 0.22/day.
Assuming complete and instantaneous mixing, find ultimate BOD of the mixture of waste and river just downstream from the outfall. *[(CO3)(Evaluate/HOCQ)]*

(b) Assuming a constant cross-sectional area for the stream equal to 60 $m^2$ what ultimate BOD would you expect to find at a point 10,000 m downstream?

*[(CO3)(Evaluate/HOCQ)]*

**6 + 6 = 12**

5. (a) Find $L_0$ from industrial BOD Data using Fujimoto method. (A mm graph paper will be needed).

| t (day) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| BOD mg/l | 0 | 63 | 100 | 134 | 158 | 178 | 196 | 210 |

*[(CO3)(Evaluate/HOCQ)]*

(b) For a small scale industry which is being developed stage wise you are to select an aerobic attached growth wastewater treatment process. Indicate the process with suitable reasons. *[(CO3)(Analyze/IOCQ)]*

**7 + 5 = 12**

## Group - D

6. (a) Discuss the detailed methodology of Hydro-pulping for paper recycling practised in India. *[(CO2)(Analyse/IOCQ)]*

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

**6 + 6 =12**

7. Write Technical notes on (any two):
   (i) Bio-medical Waste Management
   (ii) Electrochemical Oxidation of Dye waste
   (iii) Treatment of Hazardous waste by Fenton's reagent. *[(CO2)(Analyse/IOCQ)]*

**(6 × 2) = 12**

## Group - E

8. (a) Explain the salient steps of treatment of Wastewater in a Refinery using Extended Aeration System. *[(CO4)(Analyse/IOCQ)]*

(b) Outline the pre-treatment methods when the Influent contains sufficient oily emulsions. *[(CO4)(Remember/LOCQ)]*

**7 + 5 = 12**

9. (a) Discuss the salient steps for developing Environment Management Plan in a large Fertilizer Industry. *[(CO4)(Analyse/IOCQ)]*

(b) State the major advantages of Bio-fertilizer Complex over a Conventional one. *[(CO4)(Evaluate/HOCQ)]*

**8 + 4 = 12**

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| Cognition Level | LOCQ | IOCQ | HOCQ |
|---|---|---|---|
| Percentage distribution | 9.37 | 52.09 | 38.54 |