

**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) Environmental Engineering focuses on
 - (a) Design and technology for improving environmental quality
 - (b) Solution of environmental problem
 - (c) Human interaction with the environment
 - (d) All of these
- (ii) Venturi Scrubber is an equipment for management/control of
 - (a) Air Pollution
 - (b) Water Pollution
 - (c) Solid Waste Management
 - (d) Noise Pollution
- (iii) The source of renewable energy production is
 - (a) Coal
 - (b) Petroleum
 - (c) Solar
 - (d) All of these.
- (iv) In Composite Sampling of wastewater the following parameter is significant
 - (a) Pressure
 - (b) Temperature
 - (c) Flow
 - (d) BOD
- (v) Black Water is also termed as
 - (a) Sullage
 - (b) Sewage
 - (c) River water
 - (d) Grey water
- (vi) Which of the following is the most efficient for removal of very finely divided suspended solids and colloidal matter from the polluted water stream?
 - (a) Sedimentation tank
 - (b) Circular clarifier
 - (c) Mechanical flocculation
 - (d) Chemical coagulation.
- (vii) Identify the methodology of Solid Waste Management which is mostly practised in India.
 - (a) Landfill
 - (b) Incineration
 - (c) Open dumping
 - (d) Composting
- (viii) The Hemicellulose content in Indian Municipal Solid Waste is
 - (a) around 80%
 - (b) less than 10%
 - (c) around 50%
 - (d) zero

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

Fill in the blanks with the correct word

- (xi) Abiotic environment includes _____, temperature, precipitation.
- (xii) In electrostatic precipitator small particles follows _____ law.
- (xiii) The Waste Stabilization Pond which aerobic in daytime and anaerobic in night is called _____.
- (xiv) Alkaline Azide is used for measuring DO in _____ Method.
- (xv) CETP is the only solution for wastewater treatment for _____ industries.

Group - B

2. (a) Classify the different types of pollutants. [[CO1](Understand/IOCQ)]
 (b) Explain the nitrogen cycle with the help of a block diagram. [[CO1](Analyse/HOCQ)]
 (c) Explain, how the groundwater quality is degrading? [[CO1](Apply/LOCQ)]
5 + 5 + 2 = 12

3. (a) Deduce the following expression for cyclone separator,

$$v_r = \frac{d_p^2(\rho_p - \rho_g)(1 - n^2)Q^2}{18\mu_g W^2 r^{2n+1}(r_2^{1-n} - r_1^{1-n})^2}$$

Where,

v_r = the radial velocity of the gas in a cyclone separator at radius r

d_p = particle diameter

W = height of the entrance section of the duct

Q = volumetric flow rate

r = radius of rotation

r_1 and r_2 = inner and outer radius of the curved duct

n = exponent.

[[CO3](Remember/IOCQ)]

- (b) A plate type electrostatic precipitator for use in a cement plant for removing dust particles consists of a 10 equal channels. The spacing between the plates is 0.15 m and the plates are 2 m high and 2 m long. The unit handles 10,000 m³/hr of gas. What is the efficiency of collector? What should be the length of the plate for achieving 99% collection efficiency if other conditions are the same?

[[CO3](Analyse/HOCQ)]

7 + 5 = 12

Group - C

4. (a) A wastewater treatment plant discharges $1.0 \text{ m}^3/\text{s}$ of effluent having an ultimate BOD of 50.0 mg/L , into a stream flowing $10.0 \text{ m}^3/\text{s}$. Just upstream from the discharge point, the stream has an ultimate BOD of 2.0 mg/L . The deoxygenation rate coefficient is $0.24/\text{day}$. 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 55 m^2 what ultimate BOD would you expect to find at a point $10,000 \text{ m}$ downstream? *[(CO3)(Evaluate/HOCQ)]*
- 6 + 6 = 12**
5. (a) Discuss the principle of a Trickling Filter with a neat sketch. *[(CO3)(Analyse/IOCQ)]*
- (b) Design a trickling filter with recirculation using a suitable empirical method for data supplied: Sewage flow= $5000 \text{ m}^3/\text{day}$; Raw settled BOD= 200 mg/l ; Filter depth $D=1.8\text{m}$; Media= $7.5 -10 \text{ cm}$ diameter stones. The efficiency of the filter would be about 85% . *[(CO3)(Evaluate/HOCQ)]*
- (3 + 3) + 6 = 12**

Group - D

6. (a) Enumerate different Solid Waste Collection and Disposal Methodologies practiced in Metro cities. *[(CO2)(Remember/LOCQ)]*
- (b) Discuss the principles and operation of Sanitary Landfill. How the problem of Leachate can be solved in this method? *[(CO2)(Analyse/IOCQ)]*
- 5 + (2 + 3 + 2) = 12**
7. (a) Discuss the methodology of recycling paper with a neat flow diagram. *[(CO2)(Analyse/IOCQ)]*
- (b) Incineration is rarely practiced as a disposal method in India – Analyze the statement. *[(CO2)(Analyse/IOCQ)]*
- (4 + 4) + 4 = 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 details of Reed Bed and Root Zone Treatment with a neat sketch. *[(CO4)(Analyse/IOCQ)]*
- (b) Explain why it is helpful for small scale industries wastewater treatment. *[(CO4)(Evaluate/HOCQ)]*
- (4 + 4) + 4 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	13	54	33