Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CHE) /SUPPLE/SEM-8/CHE-803/2010

2010

ENVIRONMENTAL ENGINEERING

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

   i) What is the major constituents of waste/polluted water discharged from textile, pulp & paper, tanning, distillery, dairy and meat packing industries ?

   a) Radioactive substances

   b) Natural organic products

   c) Inorganic pollutants

   d) None of these.

ii) Radioactive substances present in the polluted water stream can be removed by

a) biological oxygen treatment

b) coagulation and filtration

c) adsorption in ion exchange materials

d) none of these.

iii) Which of the following industries discharge mercury as a pollutant ?

a) Chloro-alkali industry

b) Tanneries

c) Beverage plant

d) Phosphoric acid plant.

iv) Industrial workers working in leather tanning & manufacturing units are prone to suffer from

a) respiratory ailments (e.g. bronchitis)

b) skin diseases (e.g. dermatities)

c) silicosis.

d) blurred vision.

v) The biological decomposition of organic substances in wastes controlled conditions is called

a) incineration b) biological oxidation

c) composting d) none of these.

vi) The most commonly used chemical coagulant in water treatment is

a) ferrous sulphate b) alum

c) lime d) hydrazine.

vii) Which of the following is not a natural source of air pollution ?

a) Volcanic eruptions

b) Biological decay of vegetable matter

c) Terpenes from forests

d) Mercaptans.

viii) CO is a pollutant, which causes

a) Asthma (respiratory disease)

b) Asphyxiation (suffocation)

c) Retardation of crop growth

d) Damage of building materials.

ix) Most efficient fine dust removal equipment is

a) Scrubber

b) Cyclone separator

c) Gravity separator

d) Electrostatic precipitation.

x) Air quality monitoring means

a) ambient air quality measurement

b) stack monitoring

c) sampling and measurement of air pollutants

d) all of these.

xi) BOD is

a) direct measure of oxygen requirement and direct measure of biodegradabale organic matters

b) indirect measure of oxygen requirement and indirect measure of biodegradable organic matters

c) indirect measure of oxygen requirement and direct measure of biodegradable organic matters

d) direct measure of oxygen requirement and indirect measure of biodegradable organic matters.

xii) Saturation concentration of D.O. in fresh water increases with

a) increase in temperature

b) decrease in temperature

c) independent of temperature

d) increases in a particular temperature range and then decreases.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Discuss with a flow chart the pollution control in fertilizer industry.

3. Discuss in detail the methodology of removal of mercury from liquid streams.

4. Discuss about the emission inventory source classification of air pollutants.

5. Discuss the zone settling.

6. The number of years (T) required to deplete a quanity of reserves (R), when the present rate of consumption is P_0 and the consumption grows exponentially at the rate r per cent per year, is given by the equation

$$T = \frac{1}{r} \ln\left(\frac{rR}{P_0} + 1\right)$$

Derive the equation.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Draw any one type of gravity settler and explain its principles of operation. 5

b) Flue gases from a thermal power station, flowing at the rate of 1000 m^3/min and containing particles in the size range of 1 - 100 microns, are sent to a multi-tray settling chamber for preliminary separation of particles. The settling unit, 5 m long and 5 m wide contains 25 trays including the bottom self, spaced uniformly 30 cm apart.

Determine the maximum particle size that can be separated in the unit. Assume Stoke's law is applicable. Data is given : Temperature of gases = 200° C

Density of gases = 0·001 gm/cc

Viscosity of gases = 0·035 cP

Density of particles = 2·2 gm/cc 10

8. a) The following BOD results are observed for a sample of raw sewage at 20°C :

t (days)	0	1	2	3	4	5
BOD (ppm)	0	65	109	138	158	172

Calculate the reaction rate constant and the ultimate BOD. 10

b) Show that the ratio of the $2\frac{1}{4}$ day, 35°C BOD to the 5-day 20°C BOD is approximately unity. 5

9. a) A completely mixed activated sludge process is to be used to treat a waste water flow of 1000 m^3/hr having a BOD of 250 mg/L. Design criteria are as follows :

Design parameter	Value
Growth coefficient	0·4 mass of microorganism produced per unit mass of substrate utilized
Maximum specific substrate utilization rate	8 day^{-1}
Microbial decay coefficient	0·1 day^{-1}
Saturation constant	75 mg/L
Mean cell residence time	5 days
Concentration of biological solids (microorganisms)	2000 mg/L MLSS

Calculate the substrate exit concentration and the volume of the aeration tank. 10

b) Discuss the oxygen sag curve. 5

10. Discuss in detail the methodology of environmental management in paper and pulp industries. 15

11. a) In what way does land fill protect the environment ? 4

b) What are the advantages and disadvantages of land fill ? 3

c) What are the incineration and composting ? What are their advantages ? 5 + 3