

B.E. (CE) Part-III 6th Semester Examination, 2007

Environmental Engineering-I
(CE-606)

Time : 3 hours

Full Marks : 100

Use separate answerscript for each half.

Answer SIX questions, taking THREE from each half.

Two marks in First half & Half Mark in Second half are reserved for neatness.

Assume any data, if required, reasonably.

FIRST HALF

1. a) What is p_{rms} for sound? What is sound pressure level? What is the sound pressure level generated by a sound source with intensity of $9.9 \times 10^{-9} \text{ W/m}^2$? If five similar sources generate sound simultaneously with same intensity of $9.9 \times 10^{-9} \text{ W/m}^2$, find the resultant sound level.
- b) What are dbA and dbC for noise level measurement?
- c) What is L_{eq} in connection with noise level measurement? The following noise level measurements were taken in a locality.

Time (h)	Sound level (dbA)
0000 – 0600	42
0600 – 0800	55
0800 – 1000	65
1000 – 2000	70
2000 – 2200	68
2200 – 0000	57

Calculate the L_{eq} .

(8+3+5)

2. a) In which layer of the earth's atmosphere is the ozone layer found? How the ozone layer acts as a shield against solar UV radiation? Why the chlorofluorocarbons are considered to be damaging for the ozone layer?
 - b) How acid rain is caused? Why acid rain is a cause for concern?
 - c) Name at least four gases that are responsible for global warming. (6+6+4)
3. a) If the biomass of each trophic level is put together, it assumes the form of a pyramid; i.e. biomass decreases as we go up the food chain. Explain the reason.

(CE-606)

- b) In any ecosystem, the food chain is normally limited within few trophic levels. Why there cannot be too many trophic levels in any ecosystem?
- c) Write a scenario of what would happen to an ecosystem or to the human system in the event of all decomposers and detritus feeders are eliminated. (6+6+4)
4. a) A large number of fish are suddenly found floating dead on a lake. You are called to investigate the problem. You find an abundance of phytoplankton and no evidence of toxic dumping. Suggest a reason for the fish kill.
- b) Why is it important to preserve biodiversity?
- c) Explain bioaccumulation and biomagnification as related to chemical pesticides. (5+5+6)
5. a) What is adiabatic lapse rate? If the environmental (ambient) lapse rate is 6°C per km, how is the stability of the environment characterised? What is inversion in the context of environmental lapse rate?
- b) Scrubbers can be used for removal of SO₂. Name a suitable chemical that can be used for this purpose. Also write pertinent chemical equation.
- c) Show a schematic sketch of a cyclone separator and briefly explain its operation. (6+4+6)

SECOND HALF

6. a) What are the quality parameters for drinking water? What is their significance as drinking water quality standards?
- b) Tests for common ions are run on a sample of water and the results are shown below. Draw the bar diagram and calculate total hardness, calcium hardness, magnesium hardness, temporary hardness, permanent hardness, carbonate hardness, non-carbonate hardness, sulfate hardness and chloride hardness. Constituents : Ca²⁺ = 60 mg/L; HCO₃⁻ = 180 mg/L; Mg²⁺ = 24 mg/L; SO₄²⁻ = 63 mg/L; Na⁺ = 65 mg/L; Cl⁻ = 91.5 mg/L. And concentration of CO₂ (g) = 20 mg/L. [8½+8]
7. a) What are the different types of solids that may present in water? How they are related to turbidity.
- b) What are the alpha and beta particles? What are their units of measurements? What are their impacts on environment?
- c) If 5 gram of acetic acid (CH₃COOH) is added to enough distilled water to make 1 liter of solution, what will be the acetate ion concentration and pH of the solution? K_A = 1.75 × 10⁻⁵. [4½+6+6]

(CE-606)

8. a) Write short notes on Arsenic problem in India and Bangladesh.
- b) A sample of water from the overflow of the recarbonation basin that follows a precipitation/softening process has a pH of 9.0; 200 mL of the water require 3.1 mL of 0.02 N H₂SO₄ to titrate it to the phenolphthalein endpoint and additional 22.9 mL of 0.02 N H₂SO₄ to titrate it further to the orange endpoint. Assuming the sample contains no calcite particles, what are phenolphthalein alkalinity and the total alkalinity in mg/L as CaCO₃? At what concentration of different 'alkalinity causing species' are present in the sample?
- c) What is Kjeldahl nitrogen? Why nitrite and nitrate tests are important in a waste water treatment plant? [5+6½+5]
9. a) What are basic differences between BOD and COD? Explain with diagram the 1st stage and 2nd stage BOD. Why usually 5 day BOD at 20°C is considered as standard?
- b) Describe the different zones of DO sag curve.
- c) The BOD₅ at 27°C of a waste has been measured as 600 mg/l. If $k = 0.23/\text{day}$ at 20°C, what is the ultimate BOD of the waste. What proportion of the ultimate BOD would remain unoxidised after 17 days? Given Temperature of waste is 30°C. [6½+4+6]
10. a) What are the management procedure of Bio-medical waste and Industrial solid waste?
- b) Draw a flow-chart of the modern management system (treatment and disposal only) of Municipal Solid Waste.
- c) Estimate the moisture content, density and energy content (as discarded and dry) of a solid waste sample that has following components.

Component	% by mass	Moisture content (%)	Typical Density (kg/m ³)	Energy content (kJ/Kg)
Food waste	50	70	290	4650
Paper	30	6	85	16750
Plastics	8	3	65	32600
Yard waste	12	60	105	6500

[6+5½+5]

— — —

(CE-606)

8. a) Write short notes on Arsenic problem in India and Bangladesh.
- b) A sample of water from the overflow of the recarbonation basin that follows a precipitation/softening process has a pH of 9.0; 200 mL of the water require 3.1 mL of 0.02 N H_2SO_4 to titrate it to the phenolphthalein endpoint and additional 22.9 mL of 0.02 N H_2SO_4 to titrate it further to the orange endpoint. Assuming the sample contains no calcite particles, what are phenolphthalein alkalinity and the total alkalinity in mg/L as $CaCO_3$? At what concentration of different 'alkalinity causing species' are present in the sample?
- c) What is Kjeldahl nitrogen? Why nitrite and nitrate tests are important in a waste water treatment plant? [5+6½+5]
9. a) What are basic differences between BOD and COD? Explain with diagram the 1st stage and 2nd stage BOD. Why usually 5 day BOD at 20°C is considered as standard?
- b) Describe the different zones of DO sag curve.
- c) The BOD_5 at 27°C of a waste has been measured as 600 mg/l. If $k = 0.23/\text{day}$ at 20°C, what is the ultimate BOD of the waste. What proportion of the ultimate BOD would remain unoxidised after 17 days? Given Temperature of waste is 30°C. [6½+4+6]
10. a) What are the management procedure of Bio-medical waste and Industrial solid waste?
- b) Draw a flow-chart of the modern management system (treatment and disposal only) of Municipal Solid Waste.
- c) Estimate the moisture content, density and energy content (as discarded and dry) of a solid waste sample that has following components.

Component	% by mass	Moisture content (%)	Typical Density (kg/m ³)	Energy content (kJ/Kg)
Food waste	50	70	290	4650
Paper	30	6	85	16750
Plastics	8	3	65	32600
Yard waste	12	60	105	6500

[6+5½+5]

— — —