B. E. (Civil) 6th Semester Final Examination, May 2006

Environmental Engineering – 1 (CE 606)

Full Marks: 100   Time: 3 h

FIRST HALF

Answer questions 1 and 2 and any two from the rest

1. A power plant burns 200 tons per day of coal containing 3 percent sulphur. (a) Calculate the rate of emission of SO_2, in grammes per second, from the power plant's stack? (b) If the volume flow rate of flue gas containing the SO_2 is 250000 m^3/hr at 150°C and 1.1 bar, and the molar mass of the gas is 28.5, determine the ppm of SO_2 in the flue gas.

OR

What is p_{rms} for sound? What is sound pressure level? If two sound sources are emitting sound with p_{rms} of 3000 µPa and 4000 µPa, simultaneously. What will be the resultant sound pressure level?

(8)

2. What kinds of diversities are included in 'biodiversity'? Why is it important to preserve biodiversity? Write the salient characteristics and climatic features of 'tropical rain forest' and 'desert'.

OR

Name one biogeochemical (nutrient) cycle that does not contain any gaseous form. What is 'cultural eutrophication'? Distinguish between the characteristics of oligotrophic and eutrophic lakes.

OR

Many of the synthetic organic chemicals pose a grave risk of toxicity to different life forms due to 'bioaccumulation' and 'biomagnification'. Explain.

(14)

3. (a) What is albedo? The albedo of Venus is about 2.5 times that of the Earth which predicts lower average surface temperature of Venus compared to Earth. However, the actual temperature of Venus is 2.5 times higher than that of Earth. What is the main factor for this difference? Which are the gases that have potential for global warming?

(b) How the stratospheric ozone layer acts as a shield against the incoming ultraviolet radiation from Sun? What is CFC-12? How the CFC is highly destructive for the ozone layer?

(14)

4. (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) At a given location the ground-level air temperature is 18°C, while the normal maximum surface temperature for that month is known to be 30°C. At an elevation of 700 m, the temperature is measured as 15°C. What is the maximum mixing depth? A weather station anemometer at 10 m height shows winds averaging 4 m/s, what would be the ventilation coefficient?

(14)

5. (a) 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}.

(d) What are L_E and L_N? How the background noise level in a locality may be assessed?

(14)

6. (a) How the acid rain forms in the atmosphere? What are the harmful effects of acid rain?

(c) What are primary and secondary pollutants? How the photochemical smog is formed in the atmosphere? Why ozone is considered to be a pollutant in the troposphere? Why smaller sized SPM are considered a greater nuisance/pollutant? What is $PM_{2.5}$? The ambient air quality standards are prescribed for annual average values. How this annual average is estimated?

(14)

SECOND HALF

Answer questions 11 and any two from the rest
(Two marks are reserved for neatness)

7. (a) Name the physical and chemical water quality parameters of concern to environmental engineers.
(b) A 200ml sample of water with an initial pH of 10 is titrate with 0.02 N H_2SO_4 sample reaches pH 8.3 after an addition of 8.8ml of the acid, an additional 5.5ml is required to bring the sample to pH 4.5. Identify the speeches of alkalinity present and determine the concentration (mg/L of each).

(8+8=16)

8.   (a) Define 'hardness' of water, note the two classifications of hardness and discus the source and impacts of hardness. Would hard water be acceptable in most drinking water supplies? Why or why not?

(b) A sample of water from a surface stream is analysed for the common ion's with the following results

$$Ca^{2+} = 98mg/L, \ Cl^- = 89mg/L, \ HCO_3^- = 317mg/L, \ Mg^{2+} = 22mg/L \quad Na = 71mg/L \ and \ SO_4^{2-} = 125mg/L$$

     i)   What is the percent error in the cation-anion balance?

    ii)   Draw a bar diagram for the water.

(c) What are the sources and impacts of dissolved solid in water supplies?

$$(8+8=16)$$

9.   (a) Define bio-degradable and non bio-degradable organics. Give examples, discuss sources and access the impacts of them in water.

(b)   How can you quantify the non bio-degradable organics in water?

(c)   The BOD_5 of a wastewater is determine to be 150mg/L at 20^0C. the K value is known to be 0.23 per day. What would the BOD_8 be if the test were run at 15^0C.

$$(6+2+8=16)$$

10 (a) What is an indicator organism? Discuss the characterise of the ideal pathogen indicator and indicate which organism most nearly exhibit these characteristic . Discuss the use of total coliform and fecal coliform tests in the measurement of pathogens.

(b) Define methemoglobinemia and discuss it as a water related illness.

(c) Discuss the source and impacts of fluoride in drinking water supplies.

$$(6+5+5=16)$$

11. (a) What do you understand by characterisation of solid waste? Why is it necessary?

(b) Distinguish between 'HCS' and 'SCS'. What is break-even time?

(c) What do you understand by the term sanitary land filling? Draw a neat sectional sketch of a sanitary landfill site.

$$(4+6+6=16)$$