B.E. (Civil) Part III 6th Semester Final Examination, 2012-13
Environmental Engineering – II (CE 605)

Time: 3 hours | Full Marks: 70

Use separate answer script for each half.
TWO (2) marks are reserved for neatness in each half
Answer ANY THREE (3) questions from each half.

FIRST HALF

1. (a) Depict the relative efficiencies of the following control devices for removal of particulate matters – ESP, venturi scrubber, bag filter, spray tower.
   (b) Explain the working principle of an ESP.
   (c) Name a device which can be useful to control emissions of particulate matter as well as any of the gaseous pollutant. Briefly describe the principle of operation.
   (d) According to the Bharat Stage IV norms for automobile exhaust, which pollutants are monitored in the petrol and diesel-driven automobiles?
   (e) How the catalytic convertors are helpful in reducing the automotive pollution? What is a three-way catalytic convertor?
   (2+2+2+3+2=11)

2. (a) Mention two categories of stationary sources of air pollution with examples. What are primary and secondary air pollutants?
   (b) Ozone is an air pollutant – do you agree?
   (c) As per the CPCB norms, the ambient air quality standard for SO_2 is 50 $\mu g/m^3$ (annual average). How the 'annual average' concentration is estimated? Express the concentration in ppm
   (d) What are the precursors (which helps formation) of photochemical smog? Name some common components of photochemical smog.
   (e) Which is the air pollutant(s), the emission of which is regulated in cement industry?
   (3+2+3+2+1=11)

3. (a) Suppose the following atmospheric altitude versus temperature data have been collected.

Altitude (m)	Temperature (°C)
0	20
100	18
200	16
300	15
400	16
500	17
600	18

What would be the mixing depth?
How high would you expect a plume to rise if it is emitted at 21°C from a 100 m stack if it rises at dry adiabatic lapse rate? Would you expect the plume to be looping, coning, fanning, or fumigating?

(b) The rate of emission of SO_2 from the stack of a power plant is 126.1 g/s. The effective height of the stack is 46 m. Calculate the SO_2 concentration in ppm at a parking lot located 900 m downwind from the stack on a sunny day when the wind velocity is 4m/s. Use class 'C' stability.

(6+5=11)

4. (a) What are the principal factors that cause plume rise for a stack?
   (b) Why higher stacks may help reduce the pollution problem?
   (c) What is adiabatic lapse rate? What is unstable atmosphere with respect to vertical dispersion of air pollutants? If the temperature of the atmosphere is decreasing at a rate of 5.5°C per kilometer, how the stability of the atmosphere is characterized?
   (d) What is temperature inversion in the atmosphere? How is it caused?

(2+2+4+3=11)

5. (a) How SO_x and NO_x may generate acid by atmospheric reactions to cause acid rain? Mention two reaction pathways for atmospheric generation of each pollutant. What are the harmful effects of acid rain?
   (b) The average ozone concentration is 300 Dobson units. What is 'Dobson unit'? As O_2 can also absorb UV radiation, why presence of O_3 in the stratosphere is considered so important? Show the catalytic reaction how CFC can destroy ozone molecules.
   (c) Explain how the presence of certain gases helps warming of the Earth's lower atmosphere. What is atmospheric window?

(4+4+3=11)

SECOND HALF

6. (a) What factors are to be considered during laying out of routes for collection of municipal solid waste?
   (b) State the different steps that are processed during the layout of collection routes.
   (c) Explain the term 'break even time'.

(4+4+3=11)

7. (a) What important factors are to be considered in the design of transfer stations? Classify the transfer stations based on the method of loading the transport vehicles.
   (b) What should be the probable location criteria for transfer station?
   (c) What could be the principle means to transport solid waste?

(5+4+2=11)

8. (a) Why are the processing techniques used in solid waste management system? What factors are to be considered in evaluating on site processing equipments?
   (b) What are the important aspects in implementation of sanitary landfills?
   (c) State the factors that must be considered in evaluating potential landfill sites.

(5+2+4=11)

9. (a) Classify the various landfilling methods and state their suitability.
   (b) What are the important events that occur when solid wastes are placed in a sanitary landfill?
   (c) List the important design considerations in the design and operation of landfills.

(3+4+4=11)

10. (a) What can be the recovery of conversion products through biological processes from solid wastes?

(b) What conversion products can be recovered through the thermal processes of solid wastes?

(c) Distinguish between 'gasification' and 'pyrolysis.

(4+4+3=11)