B.E. (Civil) Part III 6th Semester Final Examination, 2012

Environmental Engineering – II (CE 605)

Time: 3 hours | Full Marks: 70

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

FIRST HALF

1. (a) What are the general sources and types of municipal solid wastes?

   (b) Why is the information on the properties of solid wastes important? List the information needed on physical and chemical composition of a solid waste sample.

   (c) What is the recommended technique to assess the individual components within the domestic waste?

   (3+4+4)

2. (a) How reduction, reuse and recovery of materials can be attempted in a solid waste management programme in your community?

   (b) Describe and draw the interrelationship of various functional elements of a solid waste management system.

   (c) What factors affect municipal solid waste generation rates?

   (4+3+4)

3. (a) Show with sketches the two categories of collection system based on their mode of operation.

   (b) Explain the term 'break-even time'.

   (c) What important factors to be considered during the design of a transfer station?

   (4+3+4)

4. (a) What factors must be considered in evaluation potential landfill sites?

   (b) What are the biological, physical and chemical events occur when solid wastes are placed in a sanitary landfill?

   (c) Classify the principal landfilling methods and discuss their applicability.

   (4+4+3)

5. (a) What are the important design considerations for aerobic composting processes?

   (b) State briefly the various combustion processes.

   (c) Draw a line diagram of a mass-fired incinerator.

   (4+4+3)

SECOND HALF

6. (a) Consider a thermoelectric power plant of 915 MW total capacity with a load factor of 72.5 per cent and an efficiency of 40 per cent. Determine the amount producd of particulates, CO2 and SO2 if coal is used. The ultimate analysis and calorific value of coal is a follows:

Moisture	Ash	Carbon	Hydrogen	Nitrogen	Sulphur	Oxygen	Calorific value
8%	7.7%	77%	3%	1.25%	1.0%	2.05%	29.7 MJ/kg

(b) How NO_x reduction can be achieved in coal-fired thermal power plants during the combustion process (mention one process)? Discuss about one process of pre-combustion control that is applied to reduce SO_2 emissions from fossil-fuel combustion.

(6+5)

7. (a) What is adiabatic lapse rate? 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? When the plume emitting from a stack takes the 'lofting' shape?

(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 in meters? If the wind speed at 10 m altitude is 3 m/s in a rough terrain, what will be the ventilation coefficient?

(5+6)

8. (a) Name four greenhouse gases in the Earth's atmosphere. How do these gases cause increase of the average temperature of the globe? What is atmospheric window?

(b) Show the catalytic reaction how CFC can destroy ozone molecules in the stratosphere.

(c) How SO_x and NO_x may generate acid by atmospheric reactions to cause acid rain? Mention one reaction pathway for atmospheric generation of each pollutant. What are the adverse effects of acid rain?

(5+2+4)

9. (a) Why higher stacks may help reduce the pollution problem?

(b) What are the principal factors that cause plume rise for a stack?

(c) A ground-level source is emitting pollutants at an unknown rate. At 1 km directly downwind of the source the measured ground-level concentration of the pollutant is 10 micrograms/m^3. The stability category is A. Estimate the emission rate of the source, if the wind velocity is 2 m/s.

(d) Briefly explain the principle of operation of fabric filter or electrostatic precipitator as an air pollution control device.

(2+2+4+3)

10. (a) Compare the pollutant emissions from diesel-driven and petrol-driven automobile engines. How does the pollution level of the exhaust from a petrol engine vary with the A/F ratio?

(b) Briefly describe the functioning of a catalytic convertor installed in petrol-driven vehicles. How does the effectiveness of a catalytic convertor depend on the air-fuel ratio?

(c) An automobile exhaust is having CO concentration of 110 ppm. The temperature of the exhaust is 120°C. How the concentration will be expressed as ppm under standard condition of pressure and temperature?

(5+4+2)

$$\sigma_z = ax^b$$

Pasquill Stability Category	x (km)	a	b
A*	<.10	122.800	0.94470
	0.10 - 0.15	158.080	1.05420
	0.16 - 0.20	170.220	1.09320
	0.21 - 0.25	179.520	1.12620
	0.26 - 0.30	217.410	1.26440
	0.31 - 0.40	258.890	1.40940
	0.41 - 0.50	346.750	1.72830
	0.51 - 3.11	453.850	2.11660
	>3.11	**	**

Pasquill Stability Category	c	d
A	24.1670	2.5334
B	18.3330	1.8096
C	12.5000	1.0857
D	8.3330	0.72382
E	6.2500	0.54287
F	4.1667	0.36191