

**Indian Institute of Technology, Delhi**  
**Centre for Energy Studies**  
**Semester 2, 2016-2017**  
**ESL 330: Energy Ecology and Environment**

Minor-II Examinations  
Duration: 60 minutes

Marks: 20  
22 Mar. 2017

**Answer all questions**

**[General instruction: Any variable used or assumptions made should be written clearly]**

1. Is the following statement True or False. *If False, provide the correct statement or else marks will not be given:*

- a. Volcanic emissions are primary sources of sulphur compounds in the sulphur cycle.
- b. Incomplete decay of carnivores results in the formation of fossil fuels.
- c. Stack driven infiltration improves indoor air quality with increasing air changes per hour (ach).
- d. Majority of carbon monoxide polluting air is through the stationary sources. [2]

2. Considering that the major pollution in Delhi is caused by Particulate Matter (PM):

- a. What are the conventional classifications of PM in terms of phase and size?
- b. Name the other criteria pollutants that are of importance in terms of air pollution.
- c. Using a simplified analysis, estimate the settling velocity ( $v$ ) of a spherical PM of density  $\rho$  and diameter  $d$ . One can consider air viscosity to be  $\eta$ . [3.5+2.5+1=7]

3. Considering the variation of temperature of the troposphere:

- a. Derive the relation of the dry adiabatic lapse rate.
- b. When does the saturated adiabatic lapse rate occur?
- c. Are there any representative values for the two lapse rates mentioned above? If yes, state them. If not, explain why one cannot estimate it.
- d. State the conditions under which sub-adiabatic and super-adiabatic conditions occur. What is the effect on the stability of the pollutants dispersed in these ambient conditions? [2.5+1+1.5+2=7]

4. A certain population "A" is experiencing exponential growth, with the following statistics:

Population size = 50; Birth = 10; Death = 4

- a. Calculate the individual growth rate ( $r$ ). This is also known as the per capita reproduction rate.
- b. Calculate the population growth rate. (Individuals added to the population in one generation.) [1+1=2]

5. Which of the following

a. is likely to be in the lowest trophic level?

- i. Cardinal,
- ii. Maple tree,
- iii. Caterpillar,
- iv. King snake,
- v. Fox

b. terms refer to the feeding level of categories of organisms in a community?

- i. Tertiary consumers,
- ii. Producers,
- iii. Primary consumers,
- iv. Secondary consumers,
- v. Trophic level

[1+1=2]

x-----x