



## INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

EV20001 Environmental Science  
End-Semester Exam - Section 1  
B. Tech. (AG and AE); No. of Students: 105

Autumn 2018  
Total Time: 3 Hrs  
Total Marks: 50

*Instruction: Answer all questions. Write answers to all parts of a question at one place.*

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- 1 (a) A parcel of dry air rising over a bush fire has a temperature of  $60^{\circ}\text{C}$  at an altitude of 10 m. (4)  
Assuming a dry adiabatic lapse rate, determine the temperature of the air parcel at an altitude of 810 m.
- (b) Draw a figure and explain different atmospheric stability regions. Show the region that favours (4)  
the dispersion of the pollution.
- 2 Write short notes on the following: (2x4=8)
- (a) Mixing depth
- (b) Fumigation
- (c) Impulse noise
- (d) Temperature inversion
- 3 A town is 20 km wide perpendicular to the wind direction and 50 km long in the direction of (8)  
the wind. Wind enters the town at a speed of  $4\text{ m s}^{-1}$ . Prevailing meteorological condition has  
created an inversion layer above the city at an altitude of 1 km. Carbon monoxide (CO) is  
emitted from the town at a rate of  $300\text{ kg s}^{-1}$ . What is the steady-state concentration of CO in  
the town? Assume the CO is conservative and completely mixed in city atmosphere. Assume  
limited capability for the CO to disperse horizontally or vertically except in the direction of the  
prevailing winds.
- 4 A power plant emits 458 kg of  $\text{SO}_2$  per hour. The wind velocity at the effective stack height of (8)  
75 m is  $6\text{ m s}^{-1}$ . At a distance of 2.0 km downwind the plant, the plume dispersion coefficient  
 $\sigma_y = 280\text{ m}$  and  $\sigma_z = 170\text{ m}$ . Determine:
- (a) the plume centerline ground level concentration of  $\text{SO}_2$  at a distance of 2.0 km.
- (b) the ground level concentration of  $\text{SO}_2$  at a crosswind distance of 0.4 km on either side of the  
plume centerline at 2.0 km.

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- 5 For a new developmental project, the environmental parameters that are likely to get affected are listed below. For each parameter, the relative importance (also known as Parameter Importance Unit, PIU) and the environmental quality (EQ) scores (in a scale of 0 to 1; 0 indicates very poor quality and 1 indicates very good quality) for "without project" and "with project" scenario are given below in the table. (8)

Parameter	PIU	EQ score	
		Without project	With project
Landuse	12	0.9	0.4
Noise	4	0.8	0.6
Soil erosion	14	0.8	0.5
Crops	14	0.5	0.4
Employment	13	0.4	0.7
Housing	13	0.2	0.3

What is the environmental impact (also known as Environmental Impact Unit, EIU) of the proposed project?

- 6 (a) A source produces sound levels of 80 dBA for the first 10 min, 70 dBA for the next 25 min, 80 dBA for the next 15 min, 70 dBA for the next 5 min and 80 dBA for the last 5 min, measured continuously over a total sampling period of 1 hour. Calculate the energy equivalent sound level. (5)
- (b) The lower frequency of an octave band is 11360 Hz. What is the central band frequency? (5)  
What are the upper frequencies of the corresponding 1/2 and 1/3 octaves?

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