

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATIONS/2025)

CLASS: BTECH
BRANCH: CHEMICAL ENGG.

SEMESTER : VI
SESSION : SP/2025

SUBJECT: CL353 POLLUTION CONTROL AND EQUIPMENT DESIGN

TIME: 02 Hours

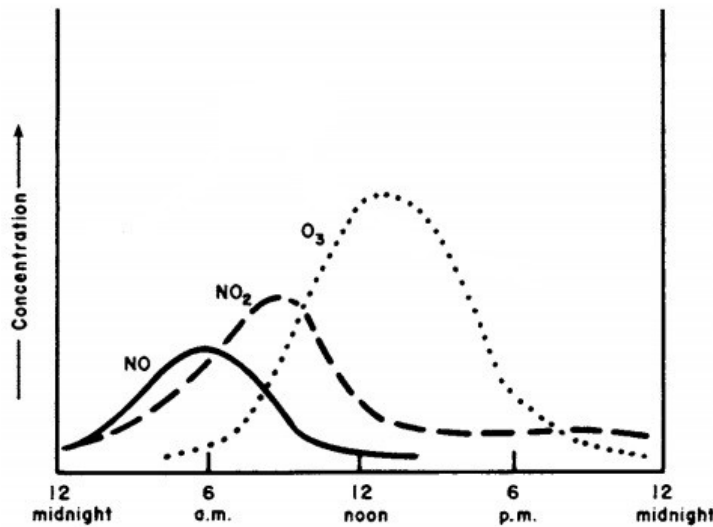
FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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|--------|---|---|----|----|
| 1 | Answer the following questions. | | CO | BL |
| Q.1(a) | An automobile emits 50000 ppm CO at 80 °C. Estimate the mass density of CO at the tailpipe. [2] | 2 | 2 | 2 |
| Q.1(b) | Use 3R strategies to address the pollution caused by construction material accumulated after a building is razed. [3] | 1 | | 3 |

2 Answer the following questions based on the sketch below.



- | | | | | |
|--------|--|-----|--|---|
| Q.2(a) | Write two reactions determining the concentrations of NO, NO ₂ , and O ₃ . [2] | 2 | | 2 |
| Q.2(b) | Explain the dynamics of NO, NO ₂ , and O ₃ using physical arguments. [3] | 1,2 | | 4 |

3 Answer the following questions pertaining to the Gaussian plume model given by

$$C(x, y, z) = \frac{Q}{2\pi u \sigma_y \sigma_z} \exp\left(-\frac{y^2}{2\sigma_y^2}\right) \times \left\{ \exp\left[-\frac{(z+H)^2}{2\sigma_z^2}\right] + \exp\left[-\frac{(z-H)^2}{2\sigma_z^2}\right] \right\}$$

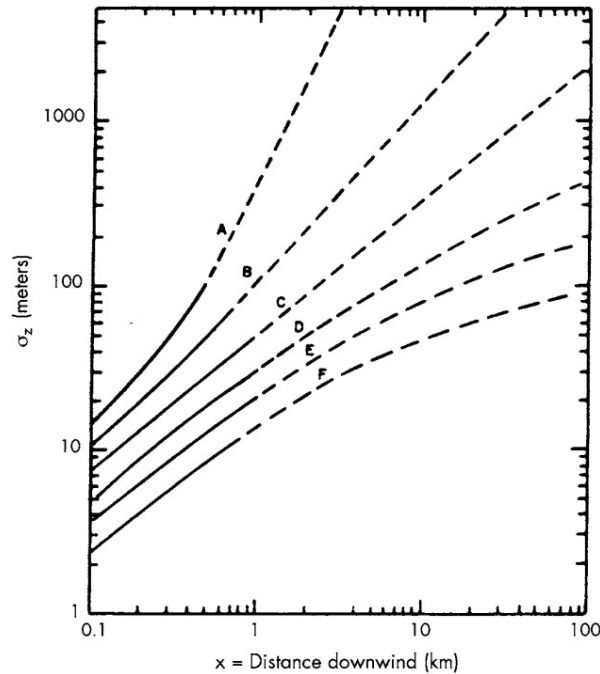
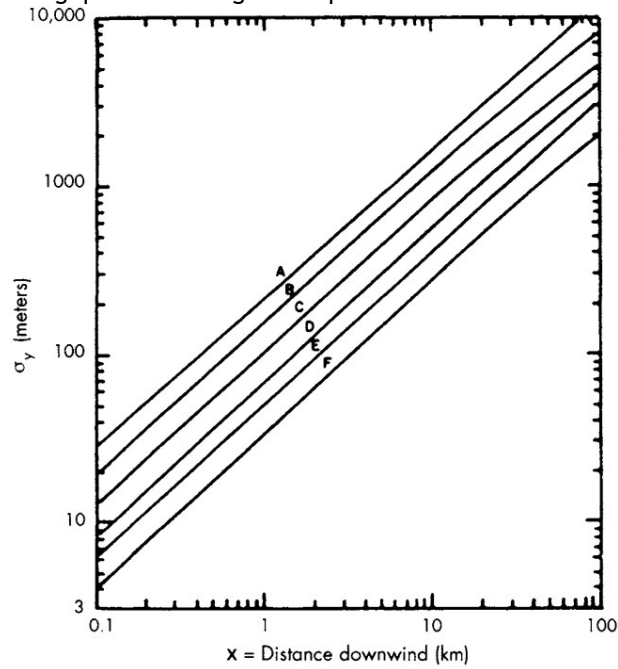
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|--------|--|---|--|---|
| Q.3(a) | Sketch the C(x,y) at two downwind locations away from a source at ground; (i) x → 0 and (ii) x → ∞. Assume that coordinate system originates at source and a coning plume is formed. [2] | 2 | | 4 |
| Q.3(b) | Derive simplified form of the model equation for maximum concentration on ground. [3] | 2 | | 4 |

4 Answer the following questions.

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|--------|---|---|--|---|
| Q.4(a) | Explain hi-vol sampling. [2] | 2 | | 3 |
| Q.4(b) | Air flow rates used in a hi-vol sampler were 2, 1.8, 1, and 0.5 m ³ /min over 24 hr interval. Find the dust concentration if filter weight increased by 0.5 %. [3] | 2 | | 4 |

PTO

5 Answer the following questions using the dispersion curves.



Q.5(a) An automobile emits 0.5 g/min of CO while idling at a traffic junction on a summer day, with hardly any wind. Obtain the CO concentration 100 m downwind from the tailpipe. [2] 2 4

Q.5(b) A thermal power plant emits 0.005 g/min of SO_2 from a 60 m high stack with a highly stable ambient and wind speed of 2.5 m/s. Comment on the shape of plume formed downwind and use that information to estimate the ground concentration of SO_2 100 m downwind. [3] 2 4