

Bachelor of Civil Engineering Examination 2018

(4th Yr 2nd Sem)

Solids and Gaseous Waste Management

Time: Three Hours

Full Marks: 100

(40 marks for Part 1 & 60 marks for Part 2)

Use separate answer script for each part

Part-I

Answer all Questions. Answers should be brief. Any relevant data may be assumed, if needed. Please answer Question Nos. 1 & 2 first. σ_y and σ_z curves and Pasquill stability charts may be allowed.

1.
 - a) Name a Greenhouse Gas which is a (i) criteria air pollutant (CAP) (ii) ozone depleting substance (ODS)
 - b) Name a CAP which is more related with (a) line source air pollution model (APM) (b) area source APM
 - c) What is the significance of background concentration of air pollutants? 2X3=6

2.
 - a) How do you ascertain the *origin* of the Coordinate system of Gaussian Air Pollution Model (GAPM)?
 - b) Compare *time averaged* and *instantaneous* plumes.
 - c) Mention the parameters in GAPM which are *not linearly related* with concentration.
 - d) What is the basic difference between the plume rise model suggested by *Holland* and *Briggs*?
 - e) What are the significances of *ground level centerline* modification of GAPM?
 - f) With a sketch show why σ_z is missing in the expression of GAPM when both the vertical constraints is present.
 - g) Explain the following formula which is a part of general effluent standard of Central Pollution Control Board (CPCB): $H=14(Q)^{0.3}$ 2x7=14

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Part-I

3. The general Gaussian expression is as follows:

$$C_{(x,y,z;H)} = Q/(2\pi \sigma_y \sigma_z U) [\text{Exp} \{-y^2/2 \sigma_y^2\}] [\text{Exp} \{-(H-Z)^2/2 \sigma_z^2\} + \text{Exp} \{-(H+Z)^2/2 \sigma_z^2\}]$$

The notations have their usual meanings. Now find expressions for following modifications, $x > x_g$

- | | |
|---|------------------------------------|
| (i) receptor and source both at ground level (GL) | (ii) receptor at GL only |
| (iii) source at GL only | (iv) receptor at plume center line |

It is estimated that 80 g/sec of SO₂ is being emitted from a petroleum refinery from an effective height of 60 meter. In an overcast condition, the wind speed was 5m/sec.

(i) What is the GL concentration directly downwind from the refinery at a distance of 500 meter?

(ii) What is the concentration at C_(500,50,0;60)? Comment on the results. 8+6=14

Or

3. A proposed source is to emit 80 g/sec of SO₂ from a stack of 50 m high with a diameter of 1.5 m. The effluent gases are emitted at a test temperature of 400 K with an exit velocity 12 m/sec. Plot on log-log paper a graph of maximum ground level concentration as a function of wind speed for B stability class. Determine the critical wind speed. The atmospheric pressure is 970 mb and the ambient temperature is 22°C. Following expression may be needed: $\Delta h = [v_s d / u] [1.5 + 2.68 \times 10^{-3} p (1 - T_a / T_s) d]$, notations have their usual meanings. 14

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Part-I

Draw a sketch to show absolute stability and absolute unstability. Why is conditional stability so named? 6

Or

Calculate mixing height for an emission at 30°C from a 100 meter effective height and following temp. profile:

Height in meter	Temperature in °C
0	25
100	24
200	22
300	22
400	23
500	24
600	25

B.E.C.E. 4th Year EXAMINATION, 2018
(2nd Semester)
SUBJECT: Solid and Gaseous Waste Management

Time: Three hours

Full Marks 100

Use a separate Answer-Script for each part

No. of
Questions

Part II(60 Marks for This Part)

M-

Answer any **two** questions from **Section A** and any **two** questions from **Section B**. Assume any data if not provided. All the drawings should be in pencil.

Section A

- Q1. Write the significances of following characteristics in association with solid waste management: Field capacity, Specific density, Fusing point of ash, Permeability, low heating value
- Q2. Name and compare different methods available for estimating solid waste generation.
- Q3.a) Write the significances of following factors affecting solid waste generation: Collection frequency and season.
- b) Draw the hierarchy of integrated solid waste management and explain the parameters.

Section B

- Q4.a) Write the names of two methods of waste collection present in developed countries. Comment on the use of compactor for collecting municipal solid waste in developing countries.
- b) What is transfer station? With a neat sketch explain how you will determine the necessity of a transfer station.
- c) After plotting the weekly solid waste production for a half calendar of operation for a residential area in a probability paper it was obtained that the plotting position of 30, 35, 40, 45 and 50 m³/week waste generations are 30%, 65%, 90%, 98.4% and 99.9% respectively. Using these waste generation data, determine the most cost effective container size to make extra pickup trips, on call, instead of using a larger sized container. Consider the following data are given: Useful life of containers are 10 years, rate of discount 10%, Cost per trip = Rs 500/trip

Container Vol (m ³)	Capital cost (Rs)	Annual O & M cost (Rs/yr)
30	3000	150
35	3500	175
40	4000	225
45	5000	300
50	6500	400

- Q5.a) Describe the significance of moisture content, temperature, carbon to nitrogen ratio (C/N) on

