

Bachelor of Civil Engineering (Part Time) Examination 2017 (Old)

(5th Year 2nd Sem)

Solids and Gaseous Waste Engineering

Time: Three Hours

Full Marks: 100

Use separate answer script for each part

(50 marks for each part)

Part-1

Answer **Question No. 1** and any **Two** from the rest. Answers should be brief. Any relevant data may be assumed, if needed. Please answer Question No 1 first. σ_y and σ_z curves and Pasquill stability charts may be allowed.

1.
 - a) Why is air pollution models essential in a Environmental Impact Assessment Study?
 - b) Define time averaged plume boundary.
 - c) Mention limitations of Gaussian Model.
 - d) How do you decide about crosswind direction in Gaussian dispersion equations?
 - e) Why do we calculate Xg during use of Gaussian equations?
 - f) Is molecular diffusion considered in atmospheric dispersions? Give reasons.
 - g) Give examples when the origin of Gaussian coordinate system is located (i) at source and (ii) just beneath the source
 - h) Does the environmental lapse rate have anything to do with air quality? Give reasons.
 - i) What may be the role of 'windrose' in prediction by GAPM?
 - j) How is wind direction reported?

2x10=20

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2. a) 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.

- (i) receptor and source both at ground level (GL) (ii) receptor at GL and $x < x_g$.
 (iii) source at GL only (iv) receptor at plume center line
- b) Which is the most popular modification of GAPM and why? What is the expression?
- c) It is estimated that 60 g/sec of SO₂ is being emitted from a petroleum refinery from an effective height of 50 meter. In an overcast condition, the wind speed was 6m/sec.
- (i) What is the GL concentration directly downwind from the refinery at a distance of 300 meter?
- (ii) What is the concentration at $C_{(300,50,0;50)}$? Comment on the results. 6+3+6=15

3. a) A proposed source is to emit 72 g/sec of SO₂ from a stack of 30 m high with a diameter of 1.5 m. The effluent gases are emitted at a test temperature of 394 K with an exit velocity 13 m/sec. Plot on 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 20°C. Following expression may be needed:

$$\Delta h = [v_s d / u] [1.5 + 2.68 \times 10^{-3} p (1 - T_a / T_s) d], \text{ notations have their usual meanings.}$$

- b) Compare Briggs' plume rise model with Holland's plume rise model. 12+3=15

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- a) Write the co-ordinates of following points in Gaussian Co-ordinate system:
(i) any point on plume centerline (ii) the virtual source
(iii) at the stack tip (iv) any point on ground level center line
- b) Write the name of following criteria pollutants:
(i) coloured gaseous criteria pollutant (ii) secondary gaseous criteria pollutant
(iii) dissociable criteria pollutant absorbing UV ray and (iv) most abundant criteria pollutant
- c) Draw the combined absorption spectra.
- d) Correlate the product of σ_x & σ_y with maximum ground level concentration. 4+4+4+3 = 15

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Ref No. -Ex/CE/5/T/506E/2017(OLD)

B.E.C.E. (PART TIME) 5th YEAR EXAMINATION, 2017
(2nd Semester)

SUBJECT: Solid & Gaseous Waste Engineering

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	Part II	Marks
	Answer question no. 1 is compulsory and any three from the rest. Assume relevant data if necessary.	
Q1.	Answer the followings using one or two sentences	
	a. Describe the effects of source segregation and season on Solid waste generation.	2×2
	b. What do you mean by haul time and at site time?	2×2
	c. Why daily cover is required for landfilling operation?	2
	d. Differentiate between door-to-door system and community bin system of waste collection considering advantages of municipality and residents.	2×2
	e. Write the factors to check the performance of a trommel screen using binary principle.	2×3
Q2. a)	What is leachate? If leachate is collected during methanogenic phase of landfill then what may be the characteristics of leachate in terms of pH, dissolved solids, heavy metals and organic contents? Write two management option of landfill leachate?	2+1×3+2
	b) Name three methods of landfilling operation.	3
Q3. a)	Write the effect of moisture content, temperature and carbon to nitrogen ratio on composting process.	2×3
	b) Differentiate between gasification and pyrolysis.	2×2
Q4. a)	Determine the amount of air required for aerobic composting of one ton of solid waste having chemical formula $C_{60}H_{94.3}O_{37.8}N$. Consider air contains 23% O_2 by mass and the specific weight of air is equal to 0.075 lb/ft^3 . $1 \text{ ton}=2000 \text{ lb}$.	8
	b) What are the design criteria for a trommel screen?	2
Q5. a)	Write two important factors that should be kept in mind before designing an onsite storage facility.	2
	b) Estimate the size of a container to be used for a multi-storied building with a 200 individual living units if the container will be emptied twice in a week. Assume the average occupancy rate for each living unit is 3.5 persons and percapita solid waste generation rate per day is 350 gm.	5
	c) Define ultimate analysis of solid waste	3