

Bachelor of Civil Engineering Examination 2018 (Old)

(4th Yr 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-I:

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) 'Gaussian Air Pollution Model(GAPM) is an *empirical Eulerian* air pollution model'-explain.
- b) What may be the roll of air pollution models in Environmental Impact Assessment?
- c) Describe the assumption about molecular turbulence in developing GAPM.
- d) Mention main advantage of GAPM.
- e) Define plume.
- f) Mention the parameters in GAPM which are linearly related with concentration.
- g) How is the origin of the coordinate system of GAPM ascertained?
- h) Mention the significance of 'flat terrain' assumption of GAPM.
- i) What is wind rose?
- 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 only at GL
 (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 1000 meter?
- (ii) What is the concentration at C_(1000,100,0;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-l 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 (x, y, z) of following points in Gaussian Co-ordinate system:
- (i) any point on plume centerline
 - (ii) at the stack tip
 - (iii) any point on ground level
 - (iv) point source which is at ground level
 - (v) the virtual source to accommodate eddy reflection

- b) Write the assumptions of GAPM related with followings:

- (i) dispersion coefficient along downwind direction
- (ii) emission from source
- (iii) formation of secondary particulates
- (iv) gravitational settling of fine particulates
- (v) wind shear

- c) Name three main air pollutants from vehicles. Mention the criteria air pollutants among those. Name

the main photochemical oxidant formed from some of these air pollutants.

5+5+5=15

B.E.C.E. 4th YEAR EXAMINATION, 2018
(2nd Semester Old)
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 two from the rest. Assume relevant data if necessary.		
Q1.a)	Answer the followings using one or two sentences	5×2
	a. Write the name of two conventional methods for solid waste quantification.	
	b. Identify the chemical characteristics of solid waste from the characteristics given: specific density, moisture content, permeability, fixed carbon, field capacity	
	c. Write two environmental problems that may be managed in engineered landfill.	
	d. Write the name of two primary collection systems exist in developed countries.	
	e. Write the name of two thermochemical processes of solid waste.	
Q1.b)	Write short note on (Any two):	
	a. 4-R in connection with solid waste management	2×5
	b. Haul container collection system (with a labelled neat sketch)	
	c. Different components of a sanitary landfill (with a labelled neat sketch)	
Q2. a)	What do you mean by 'high heating value' and 'low heating value' for solid waste? Calculate the low heating value and high heating value for solid waste having chemical formula $C_{60}H_{94}O_{38}N_2S$ in Kcal/kg	2+3+7
	b) Write three factors affecting solid waste generation.	3
Q3.a)	What are the byproducts of anaerobic digestion?	3
	b) Determine the theoretical volume of methane generated from a 100 lb solid waste having chemical formula $C_{60}H_{94}O_{38}N$. Assume specific weight of methane is 0.0448 lb/ft^3 . Write the relevant equation also.	5+1
	c) Define integrated solid waste management system. Plot the labelled hierarchy of the integrated solid waste management system.	3+3
Q4.a)	With a neat labeled sketch and using binary separation theory write the expression of Recovery, purity and efficiency of a trommel screen.	5
	b) A city processes 350 T/day of solid waste for composting purposes. The density of organic solid waste is 350 kg/m^3 . Estimate the space required for windrow method of composting. The windrow width may be taken as 2.75 m and height to be taken as 1.5 m. The maturation period is assumed to be 28 days for 4 turning cycle @ 7 days interval. Adopt transverse turning. Road spaces may be taken as 7.5 m in each side. Turning allowance may be taken as 10%.	8
	c) Why transfer station is required for solid waste management.	2