Ref No: Ex/CE/PE/B/T/422F/2023

B.E. Civil Engineering Fourth Year Second Semester Examination2023

Solids and Gaseous Waste Management

Time: Three Hours (**50 marks for Part 1**& 50 marks for Part 2) Full Marks: 100

Use separate answer script for each part

Part-I

Answer briefly. Any relevant data may be assumed. σ_y and σ_z **curves** and **Pasquill stability charts** may be allowed.

1. (**CO3**) a) Mention the roles of air pollution models in an Environmental Impact Assessment Study

b) With a sketch show the probable plume pattern when both the vertical constraints (against plume propagation) are present.

c) With a sketch show NNW wind 2X3=**6**

2. (**CO4**) a) How do you ascertain the *origin* of the Coordinate system of Gaussian Air Pollution Model (GAPM)?

b) Compare *time averaged* and *instantaneous* plumes with a sketch.

c) Why is ground level center line modification of GAPM most significant?

d) With a sketch define eddy reflection

e) Mention the forces responsible for plume rise.

f) With a sketch show why σ_y is missing in the expression of GAPM for line sources.

g) What is the significance of 'flat terrain' assumption? 2x7=**14**

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Part I

3. (CO4) a) The general Gaussian expression is as follows:

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

The notations have their usual meanings. Now find expressions for following modifications, (x>xg)

(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

b) It is estimated that 50 g/sec of SO_2 is being emitted from a petroleum refinery from an effective height of 80 meters. 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 $C_{(500,50,0;80)}$? Comment on the results.

c) Answer the followingvery briefly:

(i) Give example of a Langrangian sensor and an Eulerian Sensor.

(ii) How downwind distance of a receptor with respect to a source may be assessed?

(iii) How stability class for an atmospheric condition may be known? 8+6+2X3 =**20**

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Part-I

Or

4. (**CO4**) a) A proposed source is to emit 100 g/sec of SO_2 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:

b) Answer the following very briefly:

(i) Give example of a Langrangian sensor and an Eulerian Sensor.

(ii) How downwind distance of a receptor with respect to a source may be assessed?

(iii) How stability class for an atmospheric condition may be known? 14 + 2 X 3 = **20**

5. (**CO3**) a) Draw a sketch to show absolute stability. Why is it so named?

b) Answer the following briefly:

(i) Why prediction about transport of SO_2 by GAPM may be more erroneous than that of NO_2?

(ii) What is a wind rose? 6 + 2 x 2 = **10**

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Part-I

Or

6. (**CO3**) (a) Calculate mixing height for an emission at 30°C from a 100 meter effective height & following temp. profile:

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

b) Answer the following briefly:

(i) Why prediction about transport of SO_2 by GAPM may be more erroneous than that of NO_2?

(ii) What is a wind rose? 6 + 2 x 2 = **10**

Some of the following equations may be required(notations have their usual meanings):

1) $\Delta h=2.6\,(F/uS)^{1/3}$

2) $F=gr^2v_s(1-T_a/T_s)$

3) $S=(g/T_a)(\Delta T_a/\Delta z + 0.01°C/m)$

4) $\Delta h=[1.6F^{1/3}(x_f)^{2/3}]/u$

5) $x_f= 120\,F^{0.4}$, if $F\geq 55m^4/s^3$

6) $x_f= 50\,(F)^{5/8}$ if $F\leq 55m^4/s^3$

7) $C= Q/[(2\pi)^{1/2}u\sigma_y L]$

8) $\Delta h=[v_s d/u][1.5 + 2.68x10^{-3}p\,(1-T_a/T_s)d]$

9) $C= 2q/[(2\pi)^{1/2}\sigma_z u]$

Ref No. –Ex/CE/PE/B/T/422F/2023

B.E.C.E. 4th Year EXAMINATION, 2023
(2nd Semester)
SUBJECT: Solid and Gaseous Waste Management

Full Marks 100

Time: ~~Four~~ Three hours

Use a separate Answer-Script for each part

No. of Questions	Part II(50 Marks for This Part)	Marks
	Answer all the questions. Assume any data if not provided. All the drawings should be in pencil. All the abbreviations are commonly used.	
	Section-A (CO1)	
Q1. (a)	**State true or false with proper justification. <u>Marks will be given only if the justification will be written.</u>**	2×3
	I. Composting is least preferable option than energy recovery in the hierarchy of integrated solid waste management system as specified in solid waste management rule 2016.	
	II. Weight-volume analysis is superior to use than material balance analysis for quantification of municipal solid waste.	
	III. Retention time of combustion chamber not depends on fixed carbon content of solid waste	
(b)	**Match the appropriate one for each columns**	2×3

Column A	Column B
Compaction factor	Liner system
Fusing point of ash	Moisture content
Calorific value	Aggregate
Permeability	Storage and transfer system

	Section-B (CO2)	
Q2. (a)	Differentiate between Primary collection system and secondary collection system.	2
(b)	Determine the offroute factor for the following data and compare with the conventional offroute factor as discussed in class. (i) A hauled container system, without container exchange is used. (ii) The average time spent from the garage to the 1st container is 20 min (iii) The average pick up time per container is 6 min (iv) The average time to drive between container is 6 min (v) The average time required to empty the container at the disposal site is 6 min	7+1

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B.E.C.E. 4th Year EXAMINATION, 2023
(2nd Semester)
SUBJECT: Solid and Gaseous Waste Management

Full Marks 100

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions	Part II(50 Marks for This Part)	Marks
	(vi) The average round trip distance to the disposal site is 10km/trip and the haul constants are 0.004 h/trip and 0.02 h/km	
	(vii) The average time required to redeposit a container after it has been emptied is 6 min	
	(viii) The average time spent from last container to the garage is 15 min	
	(ix) The number of container emptied per day is 10.	
Q3. (a)	**Match the followings for a trommel screen:**	1×3

Column A	Column B
Centrifusing	Rotational speed is lesser than the critical speed
Cascading	Rotational speed is equal to critical speed
Cataracting	Rotational speed is greater than the critical speed

(b)	For combusting 100 ton of solid waste of chemical formula $C_{60}H_{94}O_{38}N$ you have supplied 450 m^3 of air at normal pressure and temperature. Now writing the necessary equation check whether the supplied air is sufficient for fully combustion of the solid waste. Consider air contains 23% of oxygen and density of air is 1.3 kg/ m^3	2+5
Q4.	As per SWM Rule 2016, which types of solid waste you will recommend to dispose in landfill? A leachate collected from a landfill shows alkaline range of pH and high concentration of humic acid and fulvic acid with low nutrient concentration. With justification name the phase of biochemical reaction from which the leachate was collected. Write one management option for landfill gas. Draw a neat labelled sketch of surface sealing system of an engineered landfill.	2+2+ 1+5
Q5.(a)	What is hydrolysis in anaerobic degradation process?	2
(b)	Determine the area required for a windrow composting plant for a town generating 120 tons of waste per day. The specific density of the waste is 450 kg/m^3. The time taken for complete composting is 21 days for 3 turning cycles@ 7 days per interval. The windrow width is 3m and height is 1.5m. Space between two windrows is 1.25m. There will be a road of 7.5m in each side. Adopt longitudinal turning and turning allowance is 10%. Draw a neat labelled sketch of plan of the windrow compost plant.	5+3