Ref No: Ex/CE/5/T/506C/2023(S)

B.E.(Civil Engineering) Fifth Year Second Semester Supplementary 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 **1&2** and **any two from the rest.** Any relevant data may be assumed. σ_y and σ_z **curves** and **Pasquill stability charts** may be allowed.

1. 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. 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 $\sigma_y$is missing in the expression of GAPM for line sources.

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

[Turn over

Ref No: Ex/CE/5/T/506C/2023(S)

B.E. (Civil Engineering) Fifth Year Second Semester Supplementary Examination 2023

Solids and Gaseous Waste Management

Time: Three Hours Full Marks: 100

(**50 marks for Part 1**& 50 marks for Part 2)

Use separate answer script for each part

Part I

3. 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, (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) 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?

(iv) Name the two factors needed to calculate dispersion coefficients σ_y and σ_z. 8+7 =**15**

Ref No: Ex/CE/5/T/506C/2023(S)

B.E. (Civil Engineering) Fifth Year Second Semester Supplementary Examination 2023

Solids and Gaseous Waste Management

Time: Three Hours Full Marks: 100

(**50 marks for Part 1**& 50 marks for Part 2)

Part-I

4. 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? 9 + 2 X 3 = **15**

5. 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 windrose?

Ref No: Ex/CE/5/T/506C/2023(S)

B.E. (Civil Engineering) Fifth Year Second Semester Supplementary Examination 2023

Solids and Gaseous Waste Management

Time: Three Hours | Full Marks: 100

(**50 marks for Part 1**& 50 marks for Part 2)

Part-I

5 (Contd.)

(c) Calculate mixing height for an emission at 30°C from a 100 meter effective height & following temperature profile:

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

5 + 2 x 2 + 6 =**15**

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/5/T/506C/2023(S)

B.E.(Civil Engineering) Fifth Year Second Semester Supplementary Examination2023

Solids and Gaseous Waste Management

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

Use a separate Answer-Script for each part

No. of Questions	Part II (50 Marks for This Part)	Marks
	Answer any **five questions**. Assume any relevant data if not provided. All the drawings should be in pencil.	
Q1.	With a neat labelled sketch of haul container collection system define and mark: pick up time, atsite time, haul time, uploading time and off route factor	2×5
Q2.	Define: door-to-door waste collection, fusing point of ash, volatile solid, weight volume analysis, transfer station	2×5
Q3.	Write the significances of 4-R in solid waste management stating the 4R's. Write two factors affecting solid waste generation.	2×4+2
Q4.	After ultimate analysis it was obtained for a solid waste of wet weight 79.5 kg and dry weight of 58 .065 kg, total carbon content is 27.372kg, H content is 27.372 kg, O content is 22.952 kg, N content is 0.53933 kg, S content is 0.111kg and ash content is 3.481kg. Determining the chemical formula of the solid waste with water and with sulfur determine the high heating value of the solid waste with modified Dulong's formula.	5+5
Q5.(a)	Define RDF. What are the by-products of pyrolysis process as a management method of solid waste?	2×5
(b)	With neat sketch deduce recovery, purity and efficiency of a trammel screen by binary separation method.	
Q6.	With a neat labelled sketch of an engineered landfill site explain liner, cell, lift, daily cover, benching.	2×5