Ref No. –Ex/CE/T/425E/2017(Old)

B.E.C.E. 4th 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 I	Marks
	Answer question no. 1 is compulsory and any three from the rest. Assume any necessary relevant data if not provided.	
Q1.	**Answer all the questions using one or two sentences. All the answers should be brief and to the point.**	
	a. Write the significance of 4-R on solid waste management system.	4×1
	b. Define integrated solid waste management system. Plot the labeled hierarchy of the integrated solid waste management system.	2+3
	c. A solid waste is of low caloric value, high moisture content and high organic content. Which processing method you will recommend and why?	1+1
	d. How will you determine the necessity of a transfer station graphically? Show with a neat sketch.	3
	e. What is RFD? By which instrument do we measure calorific value of solid waste in laboratory?	2+1
	f. A leachate is collected from a landfill of low pH and high dissolved solids and heavy metals. According to you the landfill is of which phase of operation? Write with proper justification.	1+2
Q2.	With a neat labeled sketch describe different components of a sanitary landfill. List two important factors pertinent to the selection of a landfill site.	8+2
Q3.a)	Discuss the effect of Carbon to nitrogen ratio, temperature and moisture content on composting process.	2×3
b)	Calculate the critical speed of a 3m trommel screen inclined at an angle 2° in rpm.	4
Q4.a)	Estimate the total theoretical amount of gas that could be produced under anaerobic condition from a 100 lb solid waste having chemical formula $C_{60}H_{94.3}O_{37.8}N$. Assume specific weights of methane and carbon di-oxide are 0.0448 and 0.1235lb/ft^3 respectively.	7
b)	What do you mean by pyrolysis of solid waste?	3
Q5.a)	What do you mean by proximate analysis and ultimate analysis in relation with solid waste characteristics?	3+2
b)	Estimate the size of a container to be used for a 24-storeyed building with a 192 individual living units if the container will be emptied daily. Assume the average occupancy rate for each living unit is 3.1 persons and solid waste generation rate per day are presented in the following Table	5

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No. of Questions	Part I	Ma
Q5b)		

Day	Percapita Solid waste generation (gm)
Monday	350
Tuesday	300
Wednesday	250
Thursday	325
Friday	300
Saturday	275
Sunday	250

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Bachelor of Civil Engineering Examination 2017 (Old)

(4^{th} Yr 2^{nd} Sem)

Solids and Gaseous Waste Engineering

: Three Hours

Full Marks: 100

Mai

Use separate answer script for each part

(50 marks for each part)

Part-II

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

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 development of air pollution standards?

c) Describe the assumption about atmospheric turbulence in developing GAPM.

d) Mention two limitations of GAPM.

e) Compare time averaged and instantaneous plumes.

f) Mention the parameters in GAPM which are linearly related with concentration.

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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Bachelor of Civil Engineering Examination 2017 (Old)

(4^{th} Yr 2^{nd} Sem)

Solids and Gaseous Waste Engineering

Time: Three Hours

Full Marks: 100

(50 marks for each part)

Three

2. a) The general Gaussian expression is as follows:

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

a)

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<xg.

(iii) source at GL only (iv) receptor at plume center line

b)

b) Which is the most popular modification of GAPM and why? What is the expression?

c) It is estimated that 60 g/sec of SO_2 is being emitted from a petroleum refinery from an effective heig 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

c

3. a) A proposed source is to emit 72 g/sec of SO_2 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-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:

$\Delta h = [\,v_s d/u\,][1.5 + 2.68\times10^{-3} p\,(1-T_a/T_s)d]$, notations have their usual meanings.

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

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(4^{th} Yr 2^{nd} Sem)

Solids and Gaseous Waste Engineering

: Three Hours | Full Marks: 100

(50 marks for each part)

a) Write the co-ordinates (x, y, z) 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

(v) point source which is at ground level

b) Write the assumptions of GAPM related with followings:

(i) dispersion coefficient along downwind direction

(ii) dispersion created by topography, building etc

(iii) formation of secondary particulates

(iv) gravitational settling of fine particulates

(v) wind shear

c) Name the 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. Write the equation of formation of the abovementioned photochemical oxidant. 5+5+5=**15**

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6+3+6=**15**

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12+3=**15**