Ref No. –Ex/CE/5/T/506C/2024

BE(CE)5th YEAR EXAMINATION, 2024
(2nd Semester)
SUBJECT: Solid & Gaseous Waste Management

Time: Three hours **Full Marks 100**
(50 marks for each part)

(Use separate Answer-Script for each part)

No. of Questions	Part I	Marks

Answer question number 1(compulsory) and any four questions from the rest. All the drawings should be in pencil. Assume relevant data if not provided.

Q1. (a) **Write true or false with proper justification. No marks will be given if justification is not written.** 1.5×4

a. Whenever the landfill site is located at a distance less than breakeven time is uneconomical to construct and operate a transfer station.

b. Material balance analysis is the best method to quantify municipal solid waste.

c. Community bin collection system is the best method in terms of public convenience.

d. Accessibility will one of the major factors to design one onsite storage system of solid waste.

(b) **Fill in the blanks:** 1×4

a. Full form of RDF is_____

b. If C/N ratio during composting is less than optimum value you should add_____

c. The temperature at which ash is fused and forms clinker is defined as_____

d. Calorific value is determined by _____in laboratory.

Q 2. 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 400 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 labeled sketch of plan of the windrow compost plant. Name two types of micro-organisms responsible for most of the degradation of solid waste in windrow composting process? 5+3+2

Q3. With a neat labelled sketch of binary separation write the equations to calculate purity, recovery and efficiency for a screen? For a 10 m long trommel screen of 4.0 m diameter 5+3+1+1

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and angle of inclination 2° with horizontal axis determine the angular speed in rpm for which the feed

a. Simply cascade down the length of the trommel screen

b. Simply centrifuge on the side of the screen

Q4. Draw a neat labelled sketch of bottom liner of an engineered landfill site. What do you mean by leachate pollution index? Write two methods that can be used to manage landfill gas. Leachate is of alkaline pH, low COD, BOD and heavy metals concentration and high humic acid. From which stage of biodegradation do you think the leachate was collected? 5+2+2+1

Q5. Writing the relevant equations, calculate the volume of the methane generation during stabilization of 120ton solid waste of chemical formula $C_{60}H_{120}O_{50}N$ completely by anaerobic method at STP. The specific density of methane is 0.668kg/m^3.Write two factors to be considered for designing Waste to Energy plant for an area. Write two physical processing methods for solid waste. 2+4+2×2

Q6. Draw labelled hierarchy of integrated solid waste management system as per Solid waste management Rule, 2016. Write the name of two proximate parameters that to be determined to design leachate management system of engineered landfill. What will be the difference between the quantity of solid waste generation in between Darjeeling and Kolkata? For an area of high solid waste generation rate which collection method you will recommend? Draw the labelled schematic diagram of that method. 3+2+1+1+3

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BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FIFTH YEAR SECOND SEMESTER EXAM 2024

SUBJECT: SOLID & GASEOUS WASTE MANAGEMENT

Time: 3 hours **Full Marks: 100**

Instructions: Use Separate Answer scripts for each part.

Part – II (50 Marks)

Answer questions 4, 5 and any two from the rest

Sl. No.	Question	Marks
1	(a) An industry utilizes 0.3 ML of fuel per month. It has also been estimated that for every 1 ML of fuel oil burnt in the factory, per year, the quantities of various pollutants emitted are given as: PM = 3.0 T/year, N0x = 9 T/year, HC = 0.5 T/year, SO_2 = 65 T/year, and CO = 0.6 T/year. Calculate the height of chimney required for safe dispersion of pollutants. (b) What is the guideline for minimum values of Chimney/Stack Height for general industries and thermal power plants?	[10+5]
2	(a) Briefly discuss about the effect of vertical constraint and the resulting modification of Gaussian dispersion equation. (b) A large power plant has a 260 m Stack with inside radius 2.5 m. The exit velocity of gas is 17 m/s at 120°C. Ambient temp is 20°C and wind speed at stack height as estimated to be 7 m/s. Estimate the effective stack height if (i) the atmosphere is stable with temp increasing at the rate of 2°C/km and (ii) Atmosphere is Slightly unstable class C. Use Brigg's model.	[5+10]
3	(a) Write short notes on Catalytic destruction of Ozone with pertinent reactions. (b) Write the chemical formula of (i) CFC-12 (ii) HCFC-22 (iii) Halone-1301 (c) Write a short note on Dobson Unit.	[9+3+3]
4	Write short note on Air-Fuel Ratio and calculate the stoichiometric Air-Fuel Ratio.	[10]
5	Suppose the combined radiative forcing of GHGs, aerosols, & solar intensity is 4.2 N/m², which is the forcing from that is thought to result doubling of CO_2. Using the blackbody sensitivity λ_B= 0.27°C/(W/m²) find the global equilibrium temp increase when the following feedbacks factors are included: i) g water vapor = 0.6 ii) g water vapor = 0.6, and g ice = 0.2 iii) g water vapor =0.6, and g cloud = -0.15 iv) What feedback factor will yield an equilibrium ΔT_{2X} = 4°C ?	[10]