(Please write your Exam Roll No.) Exam Roll No. 0082560 3414

END TERM EXAMINATION

EIGHTH SEMESTER [B.TECH] MAY-JUNE 2018

Paper Code: ETCE-422 **Subject: Environment Engineering**

Time :3 Hours **Maximum Marks :75**

Note: Attempt any five questions including Q. no.1 which is compulsory.

(5x5=25)

Q1 Attempt **any five** parts:-

(a) How do the meteorological phenomena influence the air quality? Describe in detail.

(b) Name and describe five natural mechanism that work in atmosphere to remove all pollutants.

(c) Design criteria for standard dimensions of cyclones in centrifugal collectors.

(d) What do you understand by the term leachate? What problems are posed by leachate and how it can be overcome?

(e) Explain the salient provisions of the Municipal Solid Wastes (Management and Handling) Rules 2000, indicating their limitations.

(f) Determine the air requirement to oxidize completely 3 tonnes of waste having chemical formula $C_{50}H_{100}O_{20}N$.

(g) Define settling chambers. Describe the equation required to calculate the size of particles removed with 100% efficiency in a settling chamber.

(h) Define frequency, time period, amplitude, power of sound and sound intensity.

Q2 Define the term sound pressure level with suitable equation. What value of sound velocity will you use for air as a medium at 20°C.? During noise sampling the value for fluctuating noise level 55dB(A) lasting for 10 minutes, followed by 75dB(A) lasting for 30 minutes, followed by 65 dB(A) lasting for 55 minutes, followed by 110 dB(A) for 4 minutes. What is Leq of this noise? **(12.5)**

Q3 Describe in detail about Dusts, Smokes, Mists, Fumes and Vapor. In what size range do particles most effectively reduce vision? What is the mechanism by which acid mist can cause destruction of limestone surfaces? Show the chemical reaction. **(12.5)**

Q4 Estimate the overall chemical composition of a solid waste sample. Derive an approximate chemical formula for the organic portion of a solid waste sample with the composition given in Table below. Use the resulting composition to estimate the energy content. Assume sample of 500 Kg with moisture content of 21%. **(12.5)**

Component	Wet mass (Kg)	Composition, kg					
		C	H	O	N	S	Ash
Food wastes	75	2.16	0.29	1.69	0.12	0.02	0.23
Paper	225	18.40	2.54	18.61	0.13	0.08	2.54
Cardboard	50	4.18	0.56	4.24	0.03	0.02	0.48
Plastics	50	5.88	0.71	2.23	-	-	0.98
Garden Trimmings	50	1.91	0.24	1.52	0.14	0.01	0.18
Wood	25	1.98	0.24	1.71	0.01	-	0.06

Q5 Enumerate the various methods which can be used for disposal of municipal solid waste, and explain in detail with suitable sketch the two most widely adopted methods in India. **(12.5)**

Q6 Describe in detail the methodology used for collecting particulate sample from a stack along with basic equations and sampling criteria used in stack monitoring. Estimate the theoretical volume of methane gas that would be expected from the anaerobic digestion of 1.5 tonne of a waste having the composition $C_{45}H_{90}O_{30}N$. **(12.5)**

P.T.O.

Q7 Solid waste from commercial area of Dwarka is to be collected using stationary-container collection system having 5 m^3 containers. Determine the appropriate truck capacity for the following conditions: (i) container utilization factor is 0.55 (ii) average number of containers per location is 4 (iii) collection vehicle compaction ratio is 2.5 (iv) container unloading time is 0.13 h/container (v) Average drive between container locations 0.1 h (vi) one way haul distance is 25 km with speed limit 88 km/h (vii) Time from garage to first container location = 0.3 h (viii) Time form last container location to garage is 0.35 h (ix) number of trips to disposal site per day is 3 and length of workday is 8 h. (12.5)

Q8 Differentiate between pyrolysis and incineration of solid waste management. Determine the heat available in the exhaust gases from the combustion of 250 tonnes/d of solid waste with an energy content 12,500kJ/kg and following composition. Assume the incinerator residue contains 5 percent carbon and the temperatures of the entering air and residue from the grate are 25 and 45°C respectively. The heat losses are given in Table 1 below.
Carbon=30%, Hydrogen= 6%, Oxygen =22, Nitrogen = 4%, Sulfur = 1%, Water = 20%, Inerts =20%. (12.5)

Table 1: Heat losses in combustion of solid waste

Type of losses	Remarks
	The heating value of carbon is about 32,789 kJ/kg.
Reactor	
1. Unburned carbon	Typically, the grate residue is assumed to contain from 4 to 8 percent carbon.
2. Radiation	Heat lost through the reactor walls and other appurtenances to surroundings is estimated as 0.003–0.005 kJ/kg of furnace input.
Latent heat	
3. Inherent moisture	Water content of waste. The latent heat of vaporization for water is approximately 2420 kJ/kg.
4. Moisture in bound water	
5. Moisture from oxidation of net hydrogen	
Sensible heat	
6. Sensible heat in residue	Specific heat of residue is taken as 1047 J/kg · K (10.25 Btu/lb · °F)
7. Stack gases	

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