Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3171307 Date:26-11-2025

Subject Name:Design of Air Pollution Control Equipments

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Draw a scale for choice of Control Equipments with respect to particle size and enlist the collection mechanism for particulate matter used in control equipments.	**03**
	(b)	Draw plant and section of Bag filter.	**04**
	(c)	Differentiate between followings: 1. ID Fan and FD Fan 2. High Velocity system and Low Velocity System 3. Enclosing Hood and Receiving Hood	**07**
Q.2	**(a)**	To find out conventional cyclone diameter for the following duty conditions using following data: Gas Volume = 12500 m^3/hr Temperature = 200^0C Gas Density at 20^0C = 1.2 Kg/m^3. Inlet Velocity = 19 m/sec	**03**
	(b)	To find out the height of pyramid hopper for a fabric filter collecting carbon dust having valley angle of 600. Top dimensions of hopper are 3.1 m x 3.4 m and bottom dimensions of hopper are 0.3 m x 0.3 m	**04**
	(c)	It desired to determine the efficiency of conventional cyclone separator to recover solids from air stream with volumetric flow-rate of 5000 m^3/h at atmospheric pressure and temperature of 100°C. Screen analysis of the solid particle size distribution to be removed is given below with estimated density of the solid particles as 2800 kg/m^3. Assume all the suitable data.	**07**

Particle size (µm)	**Weight Fraction**
60-20	43
20-02	55
02-0	02

OR

	(c)	A horizontal parallel plate ESP consists of a single duct 7 m length and 6 m depth with a 270 mm plate to plate spacing. Given a collecting efficiency at a gas flow rate of 120 m^3/min. You are required to determine the bulk velocity of gas, drift velocity of gas, and outlet loading of ESP. Inlet loading = 6.5 g/m^3 Collection efficiency = 88%	**07**

Q.3 **(a)** Define following terms with design equations: **03**

1. Air-to-cloth Ratio
2. Number of effective turns
3. Migration velocity

(b) How to increase the efficiency of the cyclone Separator? **04**

(c) A bag house to be constructed to control emissions from a grain elevator. The filter bags to be used measure 0.3 m in diameter and 6 m in length. The system is used to control 21 m3/s of air flow. The A/C ratio is 0.0152 m/s. tr= 9 min, tc= 2.5 min **07**

Determine :

1. No. of bags
2. No. of compartments
3. No. of bags in each compartment
4. Find out the filtration time (t_F)

OR

Q.3 **(a)** Define following terms with design criteria: **03**

1. L/G ratio 2. SCA 3. Resistivity 4. Diameter of cyclone 5. CAN velocity 6. Dielectric constant for particles

(b) Draw a neat sketch of cyclonic scrubber and explain its working in detail. **04**

(c) Consider a plate type collector with an overall spacing (between two electrodes) of 24 cm applied voltage of 60 KW. The mean gas velocity through the collector is 1.5 m/s. Estimate the collecting plate length required for collection efficiency of 100% for 0.5 µm particles. Assume value of P = 2 , also assume $E_c=E_p$ and omit Cunningham coefficient . µg = 2.4 * 10^{-5} Kg/m.s @420 K. **07**

Q.4 **(a)** Define following terms: **03**

1. Adsorbent 2. Adsorbent 3. Soluability

(b) Make a necessary Mass balance of an Absorption Tower. **04**

(c) Calculate followings: **07**

a. Calculate Liquid to gas ratio for scrubber system with gas flow rate of 113.2 m^3/min and recirculation liquid flow rate of 7580 L/min.

b. Calculate inertial impaction factor for following data:

- d_p = 1.15µm
- particle density = 1500 kg/m^3
- Vr = 80 m/sec
- d_o = 96 µm
- μ_g = 1.84 x $10^{\wedge-5}$ kg/m.sec

OR

Q.4 **(a)** Highlight importance of Spray tower for gaseous pollutant removal. **03**

(b) Differentiate between adsorption and absorption tower. **04**

(c) Determine the dimensions of the venturi scrubber to control particulate matter in the flue gas from a wood fired boiler using the following data: (Assume suitable data) also draw a neat design sketch. **07**

Q = 0.87 m^3/sec

Temperature of gas = 220^0C

L/G ratio = 1.3 L/m^3.

Q.5 **(a)** Define following terms: **03**

1. Gauge Pressure
2. Capture velocity
3. Friction loss

	(b)	Enlist the points to be considered while design of duct.	**04**
	(c)	List out different types of hoods with its characteristics and industrial applications.	**07**

OR

Q.5	**(a)**	Differentiate between Centrifugal Fan and axial Fan.	**03**
	(b)	Enlist different types of dust handling equipments and explain pneumatic conveyors in detail.	**04**
	(c)	Explain following dust characteristics while selecting the air pollution control equipment: 1. Hygroscopic Dust 2. Abrasive Dust 3. Sticky Dust 4. Explosive Dust 5. Agglomerating Dust	**07**

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