Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3171307 **Date: 03/06/2026**

Subject Name: Design of Air Pollution Control Equipments

Time: 02:30 PM TO 05:00 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.**

Q.1	**(a)**	Explain the importance of capture velocity in hood design.	**03**
	(b)	Explain the different types of hoods used in Air Pollution Control. systems.	**04**
	(c)	Compare the different types of cleaning methods for Bag filter.	**07**
Q.2	**(a)**	Draw neat sketch of Bag filter.	**03**
	(b)	Explain the different types of fans used in Air Pollution Control Systems.	**04**
	(c)	Analyze the Selection Criteria for Air Pollution Control Equipment (APCE).	**07**
		OR	
Q.2	**(c)**	Analyze the role of different auxiliary equipment in an Air Pollution Control System.	**07**
Q.3	**(a)**	Factors affecting ESP performance.	**03**
	(b)	Draw and explain working of spray tower with neat sketch.	**04**
	(c)	Derive the equation for mass balance of an Absorption Tower.	**07**
		OR	
Q.3	**(a)**	Write the definition of the following: Cut Size Diameter, Saltation Velocity, Velocity ratio	**03**
	(b)	A cyclone separator handles air with volumetric flow rate Q = 0.1 m^3/s. The inlet duct is circular with diameter D = 0.15 m. Assume friction factor f=6 and gas density ρ=1.5 kg/m^3. Calculate pressure drop across the cyclone.	**04**
	(c)	Explain the working principle of Adsorption Tower.	**07**
Q.4	**(a)**	Discuss advantages and limitations of Venturi Scrubber.	**03**
	(b)	Draw and explain working of ESP with neat sketch.	**04**
	(c)	Calculate drift velocities in m/s at 25℃ of air particles with the diameter of: (a) 0.5 μm (b) 01 μm (c) 2 μm (d) 5 μm (e) 10 μm. The charging and collecting voltages are 50000 and 30000 volts respectively. The anode cathode spacing is 10 cm. Assume dielectric factor is 2.5 and Viscosity is$1.84*10^{-5}$ Kg/m*s	**07**
		OR	
Q.4	**(a)**	Write the definition of the following: A/C Ratio, Filter Drag, Collection Efficiency	**03**
	(b)	For a fixed drift velocity and volumetric flow rate what % change in electrode collection area is required, to increase the collection efficiency from (a) 90 - 99% and (b) 95 - 99.5% on the basis of dutsch Equation.	**04**

(c) Calculate the length and width and Hight of bag filter and hopper dimension and design a bag filter for a flow of 8 m^3/s. A/C ratio is 1.5 cm/s. Bag diameter = 0.2m. Bag height = 2.5m **07**

Q.5 **(a)** Write the definition of the following: **03**
Migration velocity, Resistivity in ESP, Aspect ratio

(b) A cloth filter has RF and RP resistance value of 25000 kg/m^{2*}s and 50000 1/s respectively. The filter area is 15000 m^2 and volumetric flow rate of air is 10 m^3/s with dust loading of 10 g/m^3. Determine pressure drop at startup in N/m^2 and milibar. **04**

(c) Design a cyclone separator of maximum particle collection efficiency for 90000 m^3/hr gas stream at 100℃. Consider the gas to be air releasing 500 gm/s of dust. The dust mean diameter is 10 µm and ρ_p =2000 kg/m^3. Estimate the pressure drop and collection efficiency of cyclone separator. Take flue gas viscosity as $2.1*10^{-5}$ at 100 ℃. Gas Density = 0.9466 kg/m^3, G = 551.3 **07**

OR

Q.5 **(a)** Write the definition of the following: **03**
Pressure Drop, Liquid to Gas Ratio, Capture Velocity in Hood

(b) A Conventional cyclone with a diameter of 1.5 m handles 8 m^3/s of standard air carrying particles with a density of 1800 kg/m^3. Determine cut size diameter for 5 nos. of effective turn with gas density of 1.2 kg/m^3. Assume flue gas viscosity = $1.85 * 10^{-5}$ kg/m*sec **04**

(c) Design a venturi scrubber for a flow of 10,000 m^3/hr with following data: L/G ratio = 2.5 L/m^3, assume relative velocity 80 m/s. Diameter of particle = 5µm. take angle of Convergent section is 16 and for divergent section is 8. **07**

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