Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3163511   **Date:06-07-2023**
Subject Name:Air Pollution Contol - II
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)**	Discuss the various mechanisms to control particulate matter.	**03**
	(b)	Write a note on hydrodesulphurization of coal.	**04**
	(c)	A cyclone is designed with an inlet width of 14 cm and 6 effective turns. The inlet gas velocity is to be 12 m/s, and the particle density is 1.65 g/cm3. Estimate the particle size that will be collected with 50% efficiency, if the gas is air and its temperature is 350 K. Assume viscosity of air at 350 K is 0.0748 kg/m.hr.	**07**
Q.2	**(a)**	Given the following information for a packed countercurrent gas scrubber, determine the liquid flow rate in lbmol/hr.ft^2. Gas flow rate = 27 lbmol/hr.ft^2 The mole fractions of pollutant in inlet and outlet gas are 0.08 and 0.002, respectively The mole fractions of pollutant in inlet and outlet liquid are 0.003 and 0.07, respectively.	**03**
	(b)	Discuss the Features of AERMOD.	**04**
	(c)	A horizontal parallel-plate ESP consists of a single-duct 38ft high and 20ft deep with a 11-inch plate-to-plate spacing. A collection efficiency of 92.7% is obtained with a flow rate of 2800 acfm. The inlet loading is 6.29 gr/ft^3. Calculate the following: (a)What value of ϕ will yield an efficiency of 99.8%? (b) What will be the drift velocity for the system? (c) What will be the outlet loading? (d) What will the efficiency be if the collection area doubles, while the drift velocity and the volume rate of flow remain the same for ϕ_{old}? (e) What will the efficiency be if the drift velocity doubles, while the collection area and the volume rate of flow remain the same ϕ_{new}? (f) What will the efficiency be if the volume rate of flow doubles, while the drift velocity and the collection area remain the same ϕ_{new}?	**07**

OR

	(c)	Two cyclones are connected in series. Inlet width and height of 1st cyclone is 1.8 ft and 4.2ft respectively. If given density is 0.081 lb/ft3 and inlet flow is 8500 acfm, calculate the pressure drop across 1st cyclone. Also calculate overall	**07**

efficiency and overall penetration, if efficiency of 1st cyclone is 68% and penetration of 2nd cyclone is 7.5%.

Q.3	**(a)**	Discuss the assumption and limitation of Gaussian Plume modelling.	**03**
	(b)	Design a gravity settler to remove all iron particulates of 40 μm from a dust laden gas stream having flow as 120 ft^3/s and velocity as 11 ft/s. Consider density of particles as 7.62 g/cm^3	**04**
	(c)	Discuss the Control of Sulphur dioxide emission by wet scrubbing methods.	**07**

OR

Q.3	**(a)**	Explain in detail about Girbotol process and Claus process for sulphur removal during combustion.	**03**
	(b)	A dust laden gas of 100 μm particle diameter passes through a Howard type gravity settler having dimensions of 25 cm wide, 46 cm long and having 11 plates and channel thickness of 0.13 cm. The gas flow rate is 9.5 L/min, and it is observed that it operates at an efficiency of 72.4%. How many plates would be required to have the unit operate at 90% efficiency?	**04**
	(c)	Discuss control of oxides of nitrogen by modification of operating conditions and modification of design condition.	**07**

Q.4	**(a)**	What are the limitations of deterministic models?	**03**
	(b)	Explain Chemico process in detail.	**04**
	(c)	A cyclone currently operates with an efficiency of 74%. Assuming that the flow rate is increased by 43%, estimate a revised efficiency.	**07**

OR

Q.4	**(a)**	What are the limitations of statistical models?	**03**
	(b)	Write a note on Alkalized Alumina process.	**04**
	(c)	A 6 μm diameter particle traveling through an ESP is subjected to an electric field of 5 kV/cm. What is the maximum charge in coulombs (C) that can be acquired by the particle? (Assume p = 1)	**07**
Q.5	**(a)**	What are the sources of SO2?	**03**
	(b)	Explain GLC determination in detail.	**04**
	(c)	Discuss the control of oxides of nitrogen from effluent gas by catalytic decomposition and reduction.	**07**

OR

Q.5	**(a)**	What the sources of NOx?	**03**
	(b)	Write a note on Reinluft process.	**04**
	(c)	Discuss the control of oxides of nitrogen from effluent gas by adsorption and absorption.	**07**

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