Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3171307 Date:07-12-2024

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.**

Q.1	**(a)**	How does temperature affect air pollution control systems and what are the temperature and pressure corrections used for?	**03**
	(b)	What is the difference between a fan and a blower in the context of air pollution control systems?	**04**
	(c)	Write a short note on Auxiliary equipment's used in air pollution control system.	**07**
Q.2	**(a)**	What is the principle behind the functioning of a hood in an air pollution control system?	**03**
	(b)	Define pressure, and differentiate between Absolute pressure, Gauge pressure and differential pressure.	**04**
	(c)	A cyclone with body diameter 1m processes 4.5 m^3 /s of air having temperature of 100° C .Determine the cut size diameter if density of particles is 1300 Kg/ m^3. Assume number of turns to be 5 and kinematic viscosity as 2.01 x 10^{-5} Kg/m-s and density of air is 1.014 Kg/ m .	**07**
		OR	
	(c)	What is the key process parameters involved in the selection of air control equipment? Explain each in detail.	**07**
Q.3	**(a)**	Define and explain the term "centrifugal separation" in the context of cyclone separator.	**03**
	(b)	What is the role of dust characteristics in selecting air pollution control equipment?	**04**
	(c)	A cloth filter has R_f and R_p resistance values of 30,000 Kg/m2 -s and 18000 s1 respectively. The filter area is 3000 m2 and flow rate of air is 60 m3 /s with dust lading of 5 g/m3 .If the total pressure drop is to be kept at 450 N/m2 , determine : (1) Pressure drop at start up in N/m2 and Pa (2) Pulse pressure drop in N/m2 and Pa (3) Duration of operation	**07**
		OR	
Q.3	**(a)**	Describe the basic principle behind the operation of a fabric filter.	**03**
	(b)	What is the key design parameters used in cyclone separator calculations?	**04**
	(c)	Explain the principle, construction and working of cyclonic scrubber along with neat sketch.	**07**
Q.4	**(a)**	State advantages and disadvantages of electrostatic precipitator.	**03**
	(b)	List common maintenance tasks for ensuring the effective operation of fabric filters.	**04**
	(c)	Calculate gas velocity at throat of venturi scrubber, if the flow of flue gas is 3 m3 /Sec. The diameter of throat is 150 mm. Draw the design sketch.	**07**

OR

Q.4	**(a)**	Define the terms "drift velocity" and "collection efficiency" as they relate to ESPs.	**03**
	(b)	How does the throat section of a venturi scrubber contribute to pollutant removal?	**04**
	(c)	Calculate the dimensions of a venturi scrubber for the following conditions: Volumetric flow rate of process gas stream= 18 m^3 / min Density of dust = 1400 kg/m^3 . Liquid-to-gas ratio = 0.4 l/m^3 . Average particle size = 5 µm Water droplet size = 41 microns or µm Throat velocity = 75 m//s	**07**
Q.5	**(a)**	Define and explain "throat velocity" in the context of a venturi scrubber.	**03**
	(b)	What are the selection criteria's of Fans?	**04**
	(c)	An ESP with specific collection area of 0.998 m2 /m3 .min is found to have an actual overall efficiency of 95 %. If the value of A/Q is increase to 1.3 m^2/m^3 .min. Estimate anticipated collection efficiency on basis of deutsch equation and hazen equation. Assume n = 4	**07**

OR

Q.5	**(a)**	What is the difference between physical adsorption and chemical adsorption?	**03**
	(b)	Discuss the operation and maintenance issues of Bag Filter.	**04**
	(c)	A bag house filter having 15 compartments, 360 bags per compartment and each bag having diameter of 12m and length of 30m with gas flow rate is 10 lakh m3 /min. Calculate A/C ratio.	**07**

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