Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3171307 Date:03/06/2022

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.**

			MARKS
Q.1	**(a)**	Draw a design sketch of Venturi Scrubber.	**03**
	(b)	Define following terms: 1. Vortex Finder 2. Migration Velocity 3. Air to Cloth Ratio 4. Liquid To Gas Ratio	**04**
	(c)	A conventional type cyclone separator has 1 m diameter. Flow is 150 m3/min and particle density is 1600 kg/m3. • Find out the collection efficiency for following particle size distribution. Assume suitable data.	**07**

PARTICLE SIZE , µm	MASS FRACTION
0-2	1 %
2-4	9%
4-6	10%
6-10	30%
10-18	30%
18-30	14%
30-50	5%
50-100	1%

Q.2	**(a)**	Differentiate between adsorption and absorption tower.	**03**
	(b)	Draw plan and section of Bag filter.	**04**
	(c)	To determine the efficiency of dust collector and the dust collected at the bottom of the hopper for the following data. Volume = 157000 m3 /hr Temp. = 150℃ Inlet dust concentration = 89 gm/m3 outlet dust concentration = 100 mg/m3	**07**
		OR	
	(c)	A bag house filter having 20 compartments, 360 bags per compartment and each bag having diameter of 11m and length of 30m with gas flow rate is 12 lakh m^3/min. Calculate A/C ratio. Assume that 2 compartments are out of service when calculating A/C ratio.	**07**
Q.3	**(a)**	Differentiate between ID fan and FD fan.	**03**
	(b)	Enlist Auxiliary Equipments and explain any one in detail.	**04**
	(c)	In the test of measuring R_F and R_P, the following data were obtained: ΔP after cleaning = 400 N/m^2 =ΔP_F. ΔP before cleaning = 2100 N/m^2 = ΔP_O. Q= 0.5 m^3/s	**07**

Mass collected = 55 kg
Filter area = 40 m^2.
Determine R_F and R_P.

OR

Q.3 **(a)** Enlist various types of fans used with neat sketch. **03**

(b) Define duct system and explain basic principles in duct design. **04**

(c) A test is carried out to determine values of RP and RF. The following data were measured: **07**
ΔP after cleaning = 4 mbar = 400 N/m2.
Mass collected = 44 kg.
ΔP after test run= 21 mbar = 2100 N/m2.
Filter area= 36 m2
Flow Rate (Q)= 0.48 m3/s
Determine RF and RP.

Q.4 **(a)** Write a short note on hood. **03**

(b) Draw a neat sketch of ESP. **04**

(c) An ESP with specific collection area of 0.984 m^2/m^3.min is found to have an actual overall efficiency of 97 %. If the value of A/Q is increase to 1.5 m^2/m^3.min. Estimate anticipated collection efficiency on basis of deutsch equation and hazen equation. Assume n = 4 **07**

OR

Q.4 **(a)** Discuss the operation and maintainace issues of Bag Filter. **03**

(b) Our cyclone separator operating with D_{cut} = 5µ. It is now necessary to increase the flow rate to cyclone by 30 %. Nothing else will be changed. Estimate new D_{cut}. **04**

(c) The efficiency of ESP is 98 %. The efficiency of ESP drops to 93 % as a result of flow rate changes. Calculate t he ratio of flow rate of above situation. **07**

Q.5 **(a)** Discuss the operation and maintainace issues of Cyclone separator. **03**

(b) 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 between 30 to 120 m/s. = 60 m/sec Diameter of particle = 5µm. take angle of Convergent section is 17 and for divergent section is 6 **04**

(c) Write a short note on Spray Tower with neat sketch. **07**

OR

Q.5 **(a)** Discuss the operation and maintainace issues of venturi Scrubber. **03**

(b) Calculate gas velocity at throat of venturi scrubber, if the flow of flue gas is 5 m^3/Sec. The diameter of throat is 150 mm. Draw the design sketch. **04**

(c) Write a short note on cyclonic scrubber with neat sketch. **07**

****