Seat No.: Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VIII (NEW) EXAMINATION – WINTER 2020

Subject Code:2181307 Date:28/01/2021

Subject Name:Design of Air Pollution Control Equipments

Time:02:00 PM TO 04:00 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Enlist the various Physical and Chemical characteristic of dust, required to know before designing any dust Collector equipment.	**3**
	(b)	List Down the various Auxiliary equipments used in air pollution control system with it purpose in brief.	**4**
	(c)	Enlist and explain the process parameters for selecting air pollution control equipment.	**7**
Q.2	**(a)**	Give the classification fan and State the application of fan in air pollution control system.	**3**
	(b)	The tests show that filtration of a dusty air stream containing 4.5 g of particulate matter per cubic meter of air. The air flow rate is 0.085 m^3/min per square meter of filtering surface. If the exhaust volume rate is 28m^3/min, calculate the number of bag required having 0.3m diameter by 6m long.	**4**
	(c)	List down points that should be considered while design of HOODs?	**7**
Q.3	**(a)**	Define the following terms for Fabric filter : (i) Filtering Velocity (ii) Filter drag (iii) Fabric slack	**3**
	(b)	A filter with 6100m^2 of surface area is used to clean 55 m^3/s of air which has dust loading of 5g/m^3. The values of R_f and R_p are 22000kg/m^2.s and 41000sec^{-1} respectively. If it is desirable for the overall pressure drop not exceed 400 kg/m^2. Determine the maximum allowable cleaning period in hours.	**4**
	(c)	Design a bag filter for a flow of 5m^3/sec.	**7**
Q.4	**(a)**	Define the following terms: (i) Can velocity(ii) Saltation Velocity (iii) Pressure drop.	**3**
	(b)	Calculate the cut size diameter of a cyclone. Necessary data are as below. Gas viscosity :2 x 10^{-5} kg/ms Density gravity of the particle =2.9 g/cm^3 Inlet gas velocity to cyclone = 15m/s Effective numbers of turns within cyclone =5 Cyclone diameter = 3m Cyclone inlet width = 0.75m	**4**
	(c)	Enlist and explain the various performance parameter of cyclone separator.	**7**
Q.5	**(a)**	Define (a) Plate surface area (b) Drift velocity (c) Back corona	**3**
	(b)	Explain the process of removing deposited dust from Electrostatic precipitator.	**4**

(c) An Electrostatic precipitator is to be constructed to remove fly-ash particles from stack gases flowing at 10m /sec. Analysis of similar system shows that the drift velocity can be taken as $w=3.0x\ 10^5 dp$ m/sec. **7**

Determine the plate area required to collect a 0.5 µm particle with

(a) 90 % efficiency

(b) 99 % efficiency

Q.6 **(a)** Enlist the various parameters affecting the performance of venturi scrubber. **3**

(b) Explain the various collection mechanisms in Particulate scrubber responsible for removal of pollutants. **4**

(c) Particulate matter laden gas is allowed to pass through a Venturi Scrubber. The liquid flow rate to the scrubber is 1.35 L/m^3 of air and the relative velocity of gas to liquid is 91.5 m/s. The gas is air at standard temperature 298 K and particle density 1500 kg/m^3 with a flow rate of 1.6m^3 /s. Determine the efficiency of the scrubber of the composition of dust as given below. Also determine dimension of Venturi scrubber. **7**

Diameter Of particle (µm)	0.1	0.2	0.3	0.5	0.7	1	2	5
Mass fraction (mi)	0.03	0.05	0.08	0.1	0.12	0.15	0.2	0.27

Q.7 **(a)** Make a list of adsorbents used and explain any one in brief. **3**

(b) Classify the Adsorption process and also give the difference between them. **4**

(c) Differentiate between Adsorption and Absorption process with example when used for the control of air pollution. **7**

Q.8 **(a)** Discuss about the fouling in Gas Absorption column. **3**

(b) Enlist the factors that should be considered when choosing a solvent for Gas Absorption column. **4**

(c) Explain Packed Column as gas adsorption equipment with a neat diagram. **7**

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