Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VIII (NEW) - EXAMINATION – SUMMER 2017
Subject Code: 2181307   **Date: 02/05/2017**
Subject Name: Design of Air Pollution Control Equipments
Time: 10:30 AM to 01:30 PM   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Describe the process parameters for selecting air pollution control equipment. **07**
(b) Explain the physical characteristics of dust which are required to be known prior selection of air pollution control equipment. **07**

Q.2 **(a)** Draw a neat and labeled sketch of cyclone separator. State stairmand norms for high efficiency cyclone. Also define "Cut size diameter" and "Saltation velocity" with their equations. **07**
(b) A conventional cyclone with a diameter of 1 m handles 5 m^3/s of standard air carrying particles with a density of 2000 kg/m^3 for Ne = 6. Determine the cut-size diameter. Also calculate efficiency for removal of particle with diameter 5.22 µm. Assume μ_g = 1.84 * 10^{-5} kg/ m. s and density of gas = 1.185 kg/m^3. **07**

OR

(b) Estimate the overall collection efficiency of a cyclone separator with following design considerations: **07**
  1) Maximum particle collection efficiency 98710 m^3/hour of gas stream at 100°C with D_c (cyclone diameter) to be 1.47 m.
  2) Air releasing 550 g/s of dust.
  3) Dust mean diameter is 12 µm.
  4) Density of particle 1200 kg/m^3.
  5) Assume μ_g = 2.1 * 10^{-5} kg/ m. s. at 100°C.
Use the below tabulated size fraction of dust sample:

% Passing	Average diameter of Particle in µm	Mass fraction (m_i)
>75	50	0.25
55-75	19	0.20
40-55	11.5	0.15
30-40	7.8	0.10
25-30	5.5	0.05
20-25	5	0.05
15-20	4.1	0.05
10-15	3.2	0.05
5-10	2.3	0.05
<5	1.3	0.05

Q.3 **(a)** Enlist and explain any seven type of fabrics used in fabric filters. **07**
(b) Design a pulse jet bag filter for the flow of 7 m^3/s. Also show the arrangement **07**

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of bags in the unit and total height of the bag filter with a neat diagram. Make necessary assumptions.

OR

Q.3 **(a)** Explain the parameters affecting performance of Electrostatic Precipitator. **07**

(b) An Electrostatic precipitator with a specific collection area of 0.984 $m^2/(m^3/min)$ is found to have an actual overall collection efficiency of 97 % of the value of A/Q is increased to 1.312 $m^2/(m^3/min)$, estimate the anticipated collection efficiency on the basis of Deutsch equation and Hazen-type equation with n value of 4. **07**

Q.4 **(a)** Enlist various available designs of Wet scrubbers. And explain working principle and theory of any one with neat sketch **07**

(b) 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 90 m/s. The gas is air at standard temperature 298 K and particle density 1400 kg/m^3 with a flow rate of 0.6 m^3/s. Determine the efficiency of the scrubber of the composition of dust as given below. Also determine dimension of Venturi scrubber. **07**

Diameter Of particle (μm)	0.1	0.2	0.3	0.5	0.7	1	2	5
Mass fraction (m_i)	0.03	0.05	0.08	0.10	0.12	0.15	0.20	0.27

OR

Q.4 **(a)** Explain the importance of ducts in dust control system. **07**

(b) Write a note on Absorption tower. **07**

Q.5 **(a)** Enlist various types of Adsorption towers and explain any one in detail. **07**

(b) Write a detailed note on "HOODS" with a neat sketch. **07**

OR

Q.5 **(a)** Enlist the types of Fan and explain anyone in detail. **07**

(b) Explain the working of "Rotary Air Lock" as a dust handling equipment with a neat sketch. **07**

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