

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VIII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2181307
Date: 29/11/2018
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.

- Q.1**
- (a) Define: 1) Cut size diameter 2) Saltation velocity. 03
 - (b) Enlist the physical characteristics of dust which are required to be known prior selection of an air pollution control equipment. 04
 - (c) Describe the process parameters for selecting air pollution control equipment. 07

- Q.2**
- (a) State the operation and maintenance problems of a Wet scrubber. 03
 - (b) Draw a neat and labeled sketch of cyclone separator. State stairmand norms for high efficiency cyclone. 04
 - (c) An Electrostatic precipitator with a specific collection area of $0.984 \text{ m}^2/(\text{m}^3/\text{min})$ is found to have an actual overall collection efficiency of 97 % of the value of A/Q is increased to $1.312 \text{ m}^2/(\text{m}^3/\text{min})$, estimate the anticipated collection efficiency on the basis of Deutsch equation and Hazen-type equation with n value of 4. 07

OR

- (c) A conventional cyclone separator with a diameter of 1 m handles $3 \text{ m}^3/\text{s}$ of standard air carrying particles with density of 2000 kg/m^3 with number of turns $N_e = 6$. Determine cut size diameter. Assume $\mu_g = 1.84 \times 10^{-5} \text{ kg/m.s}$ & density of gas = 1.185 kg/m^3 . 07
- Q.3**
- (a) Write design criteria of Bag filter. 03
 - (b) Explain Absorption tower in short. 04
 - (c) Particulate matter laden gas is allowed to pass through a Venturi Scrubber. The liquid flow rate to the scrubber is 1.37 L/m^3 of air and the relative velocity of gas to liquid is 100 m/s . The gas is air at standard temperature 298 K and particle density 1500 kg/m^3 with a flow rate of $0.7 \text{ m}^3/\text{s}$. Determine the efficiency of the scrubber of the composition of dust as given below. 07

Diameter of particle (μm)	0.1	0.2	0.3	0.5	0.7	1.0	2.0	5.0
Mass fraction (mi)	0.03	0.05	0.08	0.10	0.12	0.15	0.20	0.27

OR

- Q.3**
- (a) Write down the importance of following equipments: 03
 1. Vortex finder 2. Air lock rotary valve 3. Demister
 - (b) What points are to be considered while designing Ducts? 04
 - (c) Design a pulse jet bag filter for the flow of $7 \text{ m}^3/\text{s}$. Also show the arrangement of bags in the unit and total height of the bag filter with a neat diagram. Make necessary assumptions. 07
- Q.4**
- (a) Define the following terms ; 03
 1. Migration velocity 2. Resistivity 3. Plate surface area
 - (b) Enlist and explain disadvantages of ESP. 04
 - (c) Write a short note on types of Fan. 07

OR

- Q.4** (a) Highlight the importance of Auxiliary equipments. **03**
(b) Differentiate between high velocity system duct and low velocity system duct. **04**
(c) Explain the working principle and theory of any one type of Wet scrubber with neat sketch. **07**
- Q.5** (a) Explain the factors affecting efficiency of ESP. **03**
(b) Enlist the types of material used for bags in a bag filter. Explain any two in detail. **04**
(c) Explain the working of "Rotary Air Lock" as a dust handling equipment with a neat sketch. **07**
- OR**
- Q.5** (a) Define following terms with design equation in context with bag filter: **03**
(i) A/C ratio (ii) Can velocity (iii) Filter drag
(b) Enlist various types of HOODS & draw neat sketch of any one type of HOOD. **04**
(c) Write a detailed note on Adsorption tower. **07**

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