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Do Alou Garg (154) 5/2027 National Institute of Technology Hamirpur (H. P.)

B. Tech. (Chemical Engineering) – 4<sup>th</sup> Semester End Semester Examination 2022-23 CHD-223 Industrial Pollution Abatement

## Duration: 3 hrs.

## Max. Marks: 50

- This question paper consists of five questions and two pages.
- Attempt all questions. Make suitable assumptions, if necessary, by clearly stating them.
- Marks will be deducted for omitting steps.
- Draw the figure wherever needed.

1	Wastewater flow from a small community averages 3000 m <sup>3</sup> /d during the winter and 5000 m <sup>3</sup> /d during the	10
	summer. The average temperature of the coldest month is 8°C, and the average temperature of the warmest	
	month is 25°C. The average BOD <sub>5</sub> is 200 mg/L with 70 percent being soluble. The reaction coefficient k is	
	0.23 d <sup>-1</sup> at 20°C, and the value of $\theta$ is 1.06. Prepare a preliminary design for a facultative pond treatment	
	system for the community to remove 90 percent of the soluble BOD.	
2	a) A fabric filter is to be constructed using bags that are 0.3 m in diameter and 6.0 m long. The bag house is	5
	to receive 10 m <sup>3</sup> /s of air, and appropriate filtering velocity has been determined to be 2.0 m/min.	
	Determine the number of bags required for a continuous removal of particulate matter.	
	b) An electrostatic precipitator is to be constructed to remove fly-ash particles from stack gases flowing at	
	10 m3/s. Analysis of a similar system shows the drift velocity can be taken as $w = 3.0 \times 10^5 d_p \frac{m}{s}$ .	5
	Determine the plate area to collect 0.5 µm particle with i) 90 percent efficiency and ii) 99 percent efficiency.	
3	An ESP handles 107 ft3/min of gas. It uses 3.6 Amp current and has 28000 ft2 collection plate areas. At the	10
	present operating temperature, the dust resistivity is $3 \times 10^{11} \Omega$ -cm. It has been suggested that the gas cooled	
-	to reduce the dust resistivity to $7 \times 10^{10} \Omega$ -cm assuming that average dust thickness is 0.45 inch and that	
•	voltage difference between the charging walls and outer surface of the dust layer is 30 kV must be maintained	
	in both cases. Estimate the reduction in power requirement that cooling the gas to get neglect the effect of	
	gas temperature on charging and drift velocity.	
4	a) How fabric filters used for air pollution control? Discuss fabric and fiber characteristics. Also write the	10
	advantages and disadvantages.	
	b) Differentiate between physical adsorption and chemical adsorption for air pollution control.	
5	a) What are the problems arising during plastic waste management?	2.5
	b) What are the ways to reduce the impacts of plastics wastes?	2.5
	c) Describe the optimum conditions for composting.	2.5
	d) What is the thermal treatment of MSW?	25

