
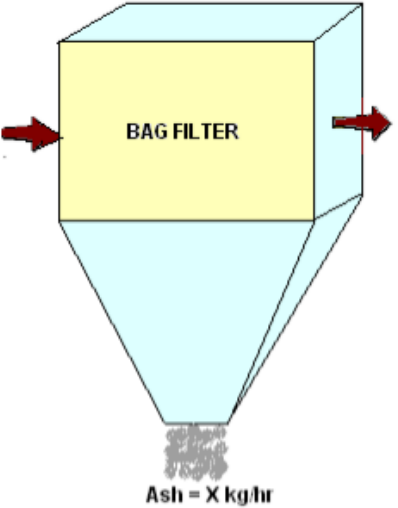
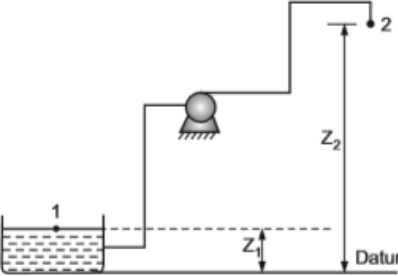


Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Chemical Engineering II (Unit Operations) Program: B.Tech in Fire Safety Engineering Course Code: HSFS 3026		Semester: V Time : 03 hrs. Max. Marks: 100	
<ul style="list-style-type: none"> • Instructions: <ul style="list-style-type: none"> ✓ This question paper contains three sections. Answer all sections. ✓ Any data missing may be suitably assumed and stated. ✓ Draw figures, wherever necessary to support your answer. 			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	i. Convert a pressure of 1.5 atm into kPa. ii. Convert a volumetric flow rate of 10,000 l/s to m ³ /s.	2+2=4	CO1
Q 2	Explain unit operations and their role in any chemical process industry?	4	CO1
Q 3	Highlight the impact of chemical engineering in sustainable development of company.	4	CO5
Q 4	A pressure gauge on a tank reads 48 psig on a day when the barometer reads a pressure of 30 inches of mercury. Find the absolute pressure in the tank in psi.	4	CO1
Q 5	List out the types of size-reduction machines. Briefly explain any one type.	2+2=4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q 6	i. Pressure is measured with the help of a Gauge. ii. When the point of application of one newton force moves one meter in the direction of the applied force, then the work done is Joule. iii. The basis for material balance calculations of any unit process is the law of conservation of iv. What is the relation between a cubic meter and a cubic centimeter? v. Convert a volumetric flow rate of 100000 l/s to m ³ /hr.	10	CO1
Q 7	A fabric bag filter is used to remove the ash from the inlet gas stream so that outlet gas stream meets the required emission standards in a chemical industry. During an air pollution monitoring study, the inlet gas stream to a fabric bag filter is 2200 cubic meters per minute and the ash loading is 5000 milligram per cubic meter. The outlet gas stream from fabric bag filter is 50 cubic meters per second and the ash loading is 60 milligram per cubic meter. What	10	CO3

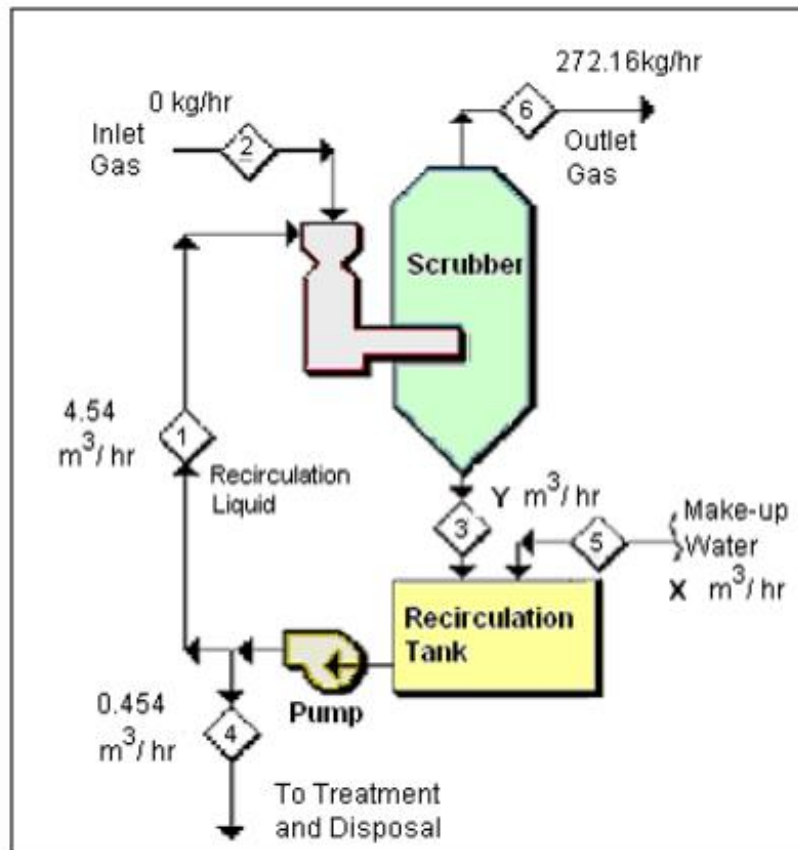
	<p>is the maximum quantity of ash that will have to be removed per hour from the fabric bag filter?</p> 		
Q 8	<p>Skim milk is prepared by the removal of some of the fat from whole milk. This skim milk is found to contain 90.0 % water, 4.3 % protein, 4.8 % carbohydrate, 0.1 % fat and 0.8 % ash. If the original milk contained 4.8 % fat, calculate its composition assuming that fat only was removed to make the skim milk and that there are no losses in processing.?</p>	10	CO2
Q 9	 <p>Pl refer the following figure and explain:</p> <ol style="list-style-type: none"> The principle behind lifting the fluid from point 1 to point 2. Bernoulli's equation between points 1 and 2. 	5+5=10	CO4
<p>SECTION-C (2Qx20M=40 Marks)</p>			
Q 10	<p>Dairy Industries now a days plays a significant role in the Indian economy. Milk is an essential Commodity which is to be consumed by all aged people. The production processes cover Fresh Liquid Milk, Fermented Milk, Butter, Chanch, Paneer, Skim Milk Powder, Ghee, ice-cream. Milk was collected from farmers of different locations & transported through tankers for its processing at factory through different processes like filtration, pasteurization, homogenization, heat treatment, refrigeration etc. During the operational</p>	10+10=20	CO4

activity at different sections, various hazards exists which may harm employees & surrounding if adequate measures not ensure.

Please explain associated hazards and control measures required to avoid any untoward incident in dairy industry.

Q
11

A scrubber is used to remove the fine material or dust from the inlet gas stream with a spray of liquid (typically water) so that outlet gas stream meets the required process or emission standards. How much water must be continually added to wet scrubber shown in Figure below to keep the unit running? Each of the streams is identified by a number located in a diamond symbol. Stream 1 is the recirculation liquid flow stream back to the scrubber and it is $4.54 \text{ m}^3/\text{hr}$. The liquid being withdrawn for treatment and disposal (stream 4) is $0.454 \text{ m}^3/\text{hr}$.



**ENVIRONMENTAL FUME TREATMENT SCRUBBER
MATERIAL FLOW DIAGRAM**

Assume that inlet gas stream (number 2) is completely dry and the outlet stream (number 6) has 272.16 kg/hr of moisture evaporated in the scrubber. The water being added to the scrubber is stream number 5.

10+10
=20

CO3