

Name:	
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

Course: Chemical Engineering II (Unit Operations) (HSFS2013) **Semester: IV**
Program: BTech Fires and Safety Engineering
Time: 03 hrs. **Max. Marks: 100**

Instructions: Students are advised to answer questions sequentially and start each answer of a new sheet of paper.

SECTION A
All the questions are compulsory (Max marks 6 x 5 = 30)

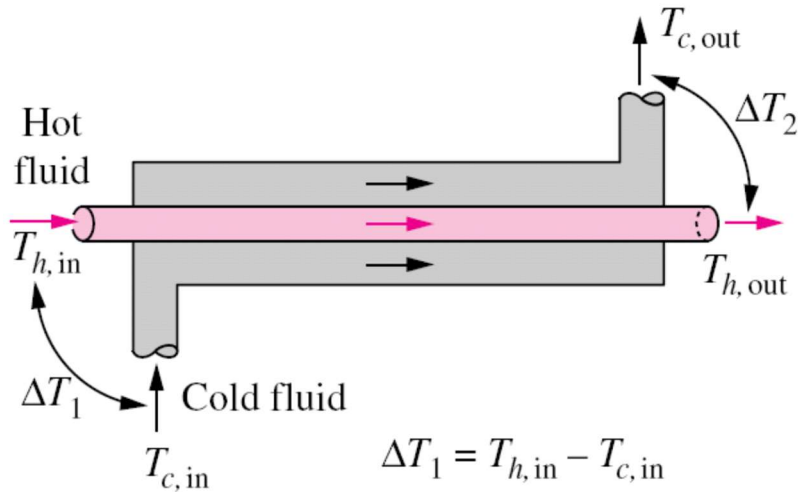
S. No.		Marks	CO
Q1	What are limiting and excess reactants in a reacting system?	5	CO1
Q2	Describe the steps involved in making activated carbon.	5	CO1
Q3	Under what conditions use of conveyor belts is more advantageous over manual handling for transportation of material.	5	CO4
Q4	What are the factors which affect the operation of a distillation column?	5	CO2
Q5	Define the working of a multi-effect evaporator (MEE). How many stages are practically possible in a MEE?	5	CO4
Q6	List various types of screens used in water/wastewater treatment and their corresponding size.	5	CO1

SECTION B
All questions are compulsory. Q10 has an internal choice. (Max marks 5 x 10 = 50)

Q7	Give the classification of heat exchangers. What is overall heat transfer coefficient in a heat exchanger? Explain the role of overall heat transfer coefficient in the design of a heat exchanger.	10	CO3
Q8	What is 'comminution' and how is it achieved? What are the characteristics of comminuted products?	10	CO5
Q9	What are the various methods used for crystallization? What is the basic requirement for any crystallizer? What is the role of solubility curve of the solute in crystallization?	10	CO2
Q10	With the help of a diagram describe the working of a rapid sand filter in detail. <i>Or</i> With the help of a diagram describe the working of a slow sand filter in detail.	10	CO1
Q11	What will be the effect on the overall economy of the process if the thermodynamic state of the feed is changed from saturated liquid to saturated vapour mixture?	10	CO5

SECTION-C (1 x 20 = 20)
All questions are compulsory. Q12 has an internal choice. (Max marks 20)

Q12	Derive the expression for expression for log mean temperature difference for a co-current heat exchanger as shown in the following figure. Explain all the assumptions made in solving the problem and clearly define all the variable used in the derivation. Between counter and co-current heat exchangers, which one is more efficient and why?	20	CO5
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$$\Delta T_1 = T_{h,in} - T_{c,in}$$

$$\Delta T_2 = T_{h,out} - T_{c,out}$$

Or

Consider a flat wall constructed of a series of layers (A, B and C). Let the thickness of the layers be B_A , B_B and B_C and the average conductivities of the material of which the layers are made be k_A , k_B and k_C , respectively. Also let the area of the compound wall, perpendicular to the direction of heat transfer, be A. Let ΔT_A , ΔT_B and ΔT_C be the temperature drops across the layers A, B and C, respectively. Derive an equation for calculating the rate of heat flow through the series of layers and show how the rate can be calculated as the ratio of the overall temperature drop ΔT to the overall thermal resistance of the wall.