

Name:
Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2020

Course: Mass Transfer-II
Program: B. Tech CERP
Course Code: CHCE-3029

Semester: V
Time 03 hrs.
Max. Marks: 100

Instructions:

SECTION A (30 Marks)

S. No.		Marks	CO
Q.1	Describe the physical significance of number of transfer unit and height of transfer unit.	5	CO1
Q.2	Differentiate between type I and type II ternary system in liquid-liquid extraction.	5	CO2
Q.3	Explain any two factors affecting the rate of extraction in leaching?	5	CO2
Q.4	Differentiate between dry bulb temperature and wet bulb temperature of air.	5	CO4
Q.5	Explain any two applications of adsorption process.	5	CO5
Q.6	Explain the difference between equilibrium and critical moisture content in drying operation.	5	CO3

SECTION B (50 Marks)

Q. 1	A solute present in gas stream is to be absorbed into non-volatile solvent at 1 atm total pressure and 30 °C. The feed gas has 4.5 mole % of the solute and exit gas has 0.1 %. The ratio of molar rates of solvent and gas is 2.8 and the equilibrium relation is given by $y = 2.6 x$. Determine the equation of the operating line and number of overall gas-phase transfer units	10	CO1
Q. 2	A cooling tower is required to cool water from 43°C to 32°C by countercurrent contact with air of dry-bulb temperature 31°C and wet-bulb temperature of 22°C. The water rate is 5500 kg/m ² .h and air rate is 3300 kg/m ² .h (dry basis). The humidity of inlet air is 0.01295 kg water/kg dry air. Determine the terminal points of operating line.	10	CO4
Q. 3	In a laboratory test run, the rate of drying was found to be 5×10^{-4} kg/m ² .s when the moisture content reduced from 0.4 to 0.1. The critical moisture content of the material is 0.08 on a dry basis. A tray drier is used to dry 100 kg (dry basis) of the same material under identical conditions. The surface area of the material is 0.04 m ² /kg of the dry solid. Calculate the time required to reduce the moisture content of the solids from 0.3 to 0.2.	10	CO3

Q. 4	What is Langmuir isotherm? Explain the procedure for estimation of parameters from adsorption data in Langmuir isotherm.	10	CO5
Q. 5	Define the distribution coefficient and its significance of a solvent in liquid-liquid extraction? A 500 kg feed (solute concentration = 0.4) is brought into contact with 400 kg of pure solvent. The amount and solute concentration of extract are 550 kg and 0.33. Calculate the distribution coefficient of the mixer-settler	10	CO2
Section C (20 Marks)			
Q. 1	<p>A non-hygroscopic filter cake is to be dried in a continuous countercurrent dryer from 35 % to 3 % moisture (wet basis) at a rate of 1000 kg per hour. The material enters the dryer at 27°C and leaves at 52°C. Fresh air is mixed with a part of the moist air leaving the dryer and heated to a temperature of 120°C in a finned air heater using low pressure steam (4 kg/cm², gauge). The following data and information are given: temperature of fresh air = 29° C; humidity = 0.018 kg/kg dry air; humidity of the air leaving the heater = 0.03 kg/kg dry air; humidity and temperature of the air leaving the dryer = 0.05 kg/kg dry air, 70°C; specific heat of the dry solid = 920 J/kg.K Calculate</p> <p>(a) the rate of flow of fresh air,</p> <p>(b) the fraction of air leaving the dryer that is recycled</p>	20	CO3