Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination (Assignment), July 2020

Course: Mass Transfer Equipment Design and Separation Processes **Semester: II**
Program: M.Tech. Chem. Engg. (with spl in PDE) **Time: 3 hrs**
Course Code: CHPD7010 **Max. Marks: 100**
No of pages: 02
Instructions: Assume suitable data, if necessary.

Answer all questions

Q. No.	Numericals and descriptive type questions.	Marks	CO
Q 1	A distillation column is to separate 4750 mol/h of feed containing 32 mol% iso-pentane, 21 mol% n-pentane, 10 mol% n-hexane and rest n-butane. The column operates at an average pressure of 3 atm a and produces a distillate containing only two components, n-butane and iso-pentane. The bottom product is allowed to contain no more than 570 mol/h of n-butane. What will be the mol% of iso-pentane in distillate. The flow rate of bottom product is 3500 mol/h.	**8**	**CO1**
Q.2	A gas containing 2% by volume of organic vapors enters the bottom of the absorber, with a flow rate of 0.250 m^3/s. The inlet temperature of the gas is 26^oC. Same has been maintained throughout the tower. The tower operates at a total pressure of $1.07*10^5$ N/m^2. What will be the flow rate of solvent gas/dry gas (G_s) in kmol dry gas/s. Assume the gas to be an ideal gas.	**8**	**CO2**
Q.3	100 kg of a solution of acetic acid(C) and water (A) containing 30 wt% acid is extracted with fresh isopropyl ether (B) at 20^0C, in a single stage cross-current liquid extraction. The quantity of solvent used is 40 kg. Determine the wt% of C in extract. The raffinate contains 25.8 wt% C. The quantity of raffinate is 96.4 kg. Assume equilibrium condition.	**13**	**CO3**
Q.4	An aqueous solution was colored by small amounts of an impurity. So it was reduced by a single stage adsorption. Initial concentration of color was 9.6 units of color / kg solution. The color was reduced to 10% of its original value. Estimate the concentration of color in adsorbent in kg units of color/kg carbon. A fresh carbon of 32 kg was used as an adsorbent. Assume equilibrium condition. The quantity of feed solution was - - - *kg. *Last three digits of your SAP ID in the same order.	**13**	**CO4**

Q.5	A feed consisting of n-propane, n-butane, n-pentane and n-hexane enters the distillation column at a flow rate of - - - -* mol/h. The column top pressure is 1600 kPa. A distillate contains 90 mol% n-butane while the bottom product contains 20 mol% n-butane. Determine the number of theoretical stages required for desired separation for actual reflux ratio of 2, 3 and 4 respectively. Use following Data/Equations. Justify your answers. *Last four digits of your SAP ID in the same order. **Data:** Minimum reflux ratio (R_m) = 1.4509 Minimum number of theoretical stages (N_m) = 4.117 **Gilliland's correlation:** $$f(N) = \frac{N - N_m}{N + 1} = 1 - \exp\left[\left(\frac{1 + 54.4\psi}{11 + 117.2\psi}\right)\left(\frac{\psi - 1}{\psi^{0.5}}\right)\right]$$ where, $$\psi = \frac{R - R_m}{R + 1}$$	**13**	**CO1**
Q.6	Give the advantages and disadvantages of supercritical extraction over conventional liquid-liquid extraction.	**15**	**CO3**
Q.7	Describe with neat diagram, construction and working of a Higgins contactor.	**15**	**CO4**
Q.8	Define and explain osmosis and reverse osmosis. Also, give applications of reverse osmosis along with advantages.	**15**	**CO5**