



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



## II SEMESTER M.TECH (CHEMICAL ENGINEERING & INDUSTRIAL POLLUTION CONTROL) END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: ADVANCED SEPARATION PROCESS (O.E) (CHE 550) REVISED CREDIT SYSTEM

Time: 3 Hours

## MAX. MARKS: 100

## **Instructions to Candidates:**

Answer any **FIVE FULL** questions. Missing data may be suitably

1	For the propylene-propane separation using distillation column, compute the following							
	quantities in SI units:							
	(a) The condenser duty, Qc ; (b) The reboiler duty, QR							
	(c) The irreversible entropy production, assuming 303 K for the condenser cooling-water sink							
	and 378 K for the reboiler steam source ; (d) The lost work, assuming $To = 303$ K							
	(e) The minimum work of separation ; (f) The second-law efficiency							
	Phase Enthalpy $(h)$ , Entropy $(s)$ ,							
	Stream		Condition	kJ/kmol	kJ/kmol-K			
	Feed (F)		Liquid	13,338	-4.1683			
	Overhead vapor	$r(\mathbf{OV})$	Vapor	24,400	24.2609			
	Distillate (D) an $D_{1}$	nd reflux (R)	Liquid	12,243	-13.8068			
20	Bottoms (B)	- 1		14,08/	-2.3880	-		
Za	What are the advantages and disadvantages of membrane process than conventional							
2h	separation methods							
20	Explain the following							
	1) ICD detector							
	ii) FID detector							
3a	Explain the gas chromatography with the help of diagram							
Ju	Explain the gas enrollatography with the help of diagram							
3b	A company required to design a tank to export the $CO_2$ of 100 kmol at 500 kPa and 500 K							
	Calculate the size of tank using following equations a) Van der Waals Equation b) Ideal gas							
	Law? Take $a=363.077 \times 10^{-3}$ b= 0.043 \times 10^{-3}							
	$1aw : 1ake a = 303.077 \times 10^{-1}, D = 0.043 \times 10^{-1}$							
3c	Briefly explain the Expanded bed adsorption chromatography							
	Brieny explain the Expanded bed adsorption enrollatography							
4	The system n-Pentane (1), n-Hexane (2), n-Heptane (3) forms an ideal solution. Calculate the							
	bubble and dew temperature and the composition at 760 torr The solution follows the Antoine							
	equation, constants are given below with the units for Temp as <sup>0</sup> C and for pressure is Torr.							
	$\{ Log P = A-(B) \}$	/[t+C])}						
	component	Composition	A	В	С			
	1	0.5	6.87632	1075.78	233.205			
	2	0.3	6.91058	1189.64	226.28			
	3	0.2	6.89386	1264.37	216.64			

5a	Explain the liquid chromatography and various parts with the help of diagram	15	
5b	Give expected chromatogram of guard column problems in liquid chromatogram		
6	Ethanol and Benzene form azeotrope at 33.2 % (mole fraction) of ethanol. This mixture boils at 331.9 K at 101.3 KPa. At 331.9 K the vapour pressure of ethanol is 44.25 KPa and hexane is 72.24 KPa. Determine Van-Laar constants and Margules three suffix equation constants and approach with both models.	20	
	and compare the $\gamma$ vs x graph with both models		