

**Instructions to the candidates if any:-**

1. Question No .1 is compulsory
2. Attempt any three questions from the remaining five questions
3. Assume suitable data wherever necessary
4. The figures to the right indicate full marks

**Q. No. 1**

- a. The relative volatility for a Benzene-Toluene system is 2.34. Generate the VLE data for this system and plot the same on a x-y plot. [05]
- b. Discuss the criteria for selection of solvent for liquid-liquid extraction operation. [05]
- c. Derive the equation of the q-line [05]
- d. Discuss the Mier's theory of supersaturation. [05]

**Q. No. 2**

- a] 100 moles of benzene and Toluene mixture containing 50 mole% Benzene is subjected to a differential distillation at atmospheric pressure till the composition of Benzene in the residue is 33% mole. Calculate the total moles of the mixture distilled. Given:  $\alpha_{avg} = 2.16$  [10]
- b] Discuss the various membrane separation operations. [10]

**Q. No. 3**

- a] With neat diagram explain countercurrent multistage extraction material balance. [15]
- b] Explain the Reactive distillation. [05]

**Q. No. 4**

- a] Discuss the adsorption in fixed bed .Explain breakthrough curve and adsorption zone [10]
- b] Discuss the single stage leaching and derive the equations for single stage leaching. [10]

**Q. No. 5**

- a] Discuss the Adsorption Isotherms [10]
- b] A feed solution of 2268 kg at 327.6 K (54.4 °C) containing 48.2 kg MgSO<sub>4</sub>/100 kg total water is cooled to 293.2 K (20°C), where MgSO<sub>4</sub>•7H<sub>2</sub>O crystals are removed. The solubility of the salt is 35.5 kg MgSO<sub>4</sub>/100 kg total water. The average heat capacity of the feed solution can be assumed as 2.93 kJ/kg.K. The heat of solution at 291.2 K (18 °C) is -13.31 x 10<sup>3</sup> kJ/kg mol MgSO<sub>4</sub>•7H<sub>2</sub>O. Calculate the yield of crystals and make a heat balance to determine the total heat absorbed,  $q$ , assuming that no water is vaporized. [10]

**Q. No. 6**

- Write short notes on the following (Any four)- [20]
- a. Binodal solubility curve
  - b. Ball Extractor
  - c. Steam distillation
  - d. Discuss Minimum boiling Azeotropes
  - e. Characteristics of adsorbent's