

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 3164401

Date: 08/06/2026

Subject Name: Mass Transfer - II

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a)** Define Humid Volume, Wet Bulb Temperature, and Absolute Humidity. **03**
 - (b)** Wet bulb temperature is generally less than dry bulb temperature. True or False? Justify. **04**
 - (c)** Explain the theory of adiabatic saturation temperature and derive the equation for adiabatic saturation temperature determination. **07**
- Q.2**
- (a)** Define Equilibrium Moisture, Critical Moisture, and Bound Moisture **03**
 - (b)** Compare induced draft cooling tower with forced draft cooling tower. **04**
 - (c)** A wet solid of 28% moisture is to be dried to 0.5% moisture in a tray dryer. A laboratory test shows that it requires 8 hours to reduce the moisture content of the same solid to 2%. The critical moisture content is 6% and the equilibrium moisture is 0.2%. The falling rate of drying is linear in the free moisture content. Calculate the drying time of the solid if the drying conditions similar to those in the laboratory test are maintained. All moisture are expressed as percent of bone dry mass of the solid. **07**
- OR
- Q.2**
- (c)** Derive expression of time of drying in the constant and falling rate period in drying operation. **07**
- Q.3**
- (a)** List the principal adsorbents which are generally used in adsorption. **03**
 - (b)** Differentiate between physical adsorption and chemisorptions. **04**
 - (c)** Using Freundlich equation, derive the expression for a two-stage counter current adsorption operation. **07**
- OR
- Q.3**
- (a)** Define: Plait point, Selectivity and Distribution coefficient. **03**
 - (b)** Differentiate between drying and evaporation? List out the factors which affects the drying. **04**
 - (c)** Enlist different industrial liquid extractors and explain any one in detail with neat figure. **07**
- Q.4**
- (a)** With reference to crystallization, Define nucleation and crystal growth. **03**
 - (b)** Differentiate between distillation and extraction mass transfer operation with examples. **04**

- (c) A solution containing 5% acetaldehyde and 95% toluene is to be extracted with water in a 5 stage crosscurrent extraction unit to extract acetaldehyde. Toluene and water are essentially insoluble. If 25 kg of water each time are used per 100 kg feed, Calculate the amount of acetaldehyde extracted and the final concentration of the exit solution. The equilibrium relationship is given by $Y = 2.20 X$. Where $Y = \text{Kg acetaldehyde/kg water}$ and $X = \text{kg acetaldehyde/kg toluene}$. 07

OR

- Q.4** (a) Define leaching? What are the industrial applications of leaching? 03
 (b) Define Supersaturation and Explain Meir's Supersaturation theory. 04
 (c) Enlist different leaching equipment and explain any one in detail with neat figure. 07

- Q.5** (a) Classify drying equipments. 03
 (b) With reference to drying, compare batch and continuous dryer. 04
 (c) An air water vapor sample has a dry bulb temperature of 55°C and an absolute humidity of 0.03 kg water/kg air at 1 atm pressure. Determine 1) the absolute molal humidity, 2) the partial pressure of water vapor, 3) Relative humidity, 4) humid heat and 5) Humid Volume 07

OR

- Q.5** (a) Define ion exchange and List out the factors on which rate of ion exchange is dependent. 03
 (b) Discuss selection criteria for solvent in liquid-liquid extraction. 04
 (c) A hot solution at 330 K containing 30 weight % MgSO_4 is cooled to 293 K and $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ crystals are removed from it. The solubility at 293 K is 35.5 kg MgSO_4 per 100 kg water. Calculate the yield of crystals. Assume that no water is evaporated. 07
