Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–V • EXAMINATION – WINTER 2013**

**Subject Code: 150404** **Date: 02-12-2013**

**Subject Name: Principles of Process Engineering - II**

**Time: 10.30 am - 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. **Notations used have their conventional meaning.**

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|---|---|---|---|
| **Q.1** | **(a)** | Explain ternary equilibria and change in the shape of binodal solubility curve for different types of system in case of liquid extraction. | **10** |
| | **(b)** | Enlist various factors to be considered while making a choice of solvent for liquid – liquid extraction. | **04** |
| **Q.2** | **(a)** | Discuss various mechanical problems encountered during operation of packed tower. | **07** |
| | **(b)** | Give stepwise procedure to determine minimum liquid gas ratio for absorber. | **07** |
| | | **OR** | |
| | **(b)** | Explain the concept of HETP, HTU and NTU in a packed-bed absorption column. | **07** |
| **Q.3** | **(a)** | Write a short note on Percolation tanks used for leaching with neat diagram. | **07** |
| | **(b)** | Describe the methods of preparation of solids for leaching operations. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | What is leaching? Discuss the different types of equilibrium diagram for leaching. | **07** |
| | **(b)** | Explain counter current multiple contact, Shanks system of leaching. | **07** |
| **Q.4** | **(a)** | Discuss important characteristics of packing materials used in packed tower. | **04** |
| | **(b)** | Differentiate between direct and indirect mass transfer operations in detail. | **06** |
| | **(c)** | Define and explain molecular and eddy diffusion with examples. | **04** |
| | | **OR** | |
| **Q.4** | **(a)** | State fields of usefulness of liquid-liquid Extraction in brief. | **04** |
| | **(b)** | Define and explain F-type and k-type mass transfer coefficients along with their units. | **06** |
| | **(c)** | Write a short note on “Diffusion through Solids”. | **04** |
| **Q.5** | **(a)** | Starting from Fick’s first law of diffusion for binary liquid phase, derive an expression of $N_A$ for steady state molecular diffusion of A through non-diffusing B. | **07** |
| | **(b)** | Calculate the rate of diffusion of Acetic acid (A) across a film of non-diffusing water (B) solution 1 mm thick at $17^oC$ when the concentrations on opposite sides of the film are respectively, 9 and 3 weight % acid. The diffusivity of acetic acid in the solution is $0.95 \times 10^{-9}$ $m^2/s$. Density of 9 and 3 weight % aqueous solutions is 1012 and 1003.2 $kg/m^3$ respectively. $M_A = 60$, $M_B = 18$ | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Explain the concept of equilibrium and principles for interphase mass transfer between two insoluble phases. | **06** |
| | **(b)** | Derive statement of penetration theory of mass transfer coefficient along with neat sketches and assumptions used in it. | **08** |

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