

## CHE-241: Mass Transfer

**Credit Hours:** 2-0

**Pre-requisites:** None

### Course Objectives

- To study mass transfer for analysis of chemical engineering operations involving mass transfer, differential and stage wise separation processes, mass transfer accompanied by chemical reaction, general design and operation of mass-transfer equipment
- Film dominance and solubility. Schmidt, Sherwood, Stanton and Marshall numbers
- Find extensive application in chemical engineering problems

### Course Contents

- i. Introduction to mass transfer; gradient driven transport
- ii. Fundamentals: Fick's law, diffusivity, diffusion through gases and liquids, equimolar counter diffusion, diffusion through a stagnant gas
- iii. Mass transfer Theories; The two-film theory, the penetration theory, surface renewable theory, concentration profiles, mass transfer at gas/liquid interfaces
- iv. Concept of resistance to mass transfer, mass transfer coefficients(overall and film)
- v. Countercurrent mass transfer and concept of transfer units
- vi. Transient and convective mass transfer
- vii. Dimensionless and dimensional analysis in mass transfer
- viii. Phase equilibrium and phase diagrams; single component systems, multi component systems, gas-liquid equilibrium
- ix. Calculation of the number of theoretical stages for various cases of countercurrent and co current operations
- x. Liquid-Liquid extraction
- xi. Case studies to solve mass transfer problems

### Course Outcomes

After completing this course, student will be able to:

- Fundamental understanding of basics in mass transfer theories.

- Develop familiarity with major chemical process separations units.
- Apply appropriate criteria for selecting among alternative separation technologies.
- Apply mass transfer fundamentals to calculate rates of mass transfer for practical situations and to identify rate-limiting processes.

### ***Recommended Books***

- McCabe, W. L., Smith, J. C., & Harriott, P. (2005). Unit Operations of Chemical Engineering (7th ed.). McGraw Hill Inc.
- Coulson, J. M., & Richardson, J. F. (2002). Chemical Engineering Vol-II (5th ed.). The English Book Society and Pergamon Press.
- Incropera, F. P., & De Witt, D. P. (1990). Fundamentals of Heat and Mass Transfer (3rd ed.). John Wiley and Sons.
- Treybal, R. E. (1981). Mass Transfer Operations. McGraw Hill Book Company.
- Schweitzer, P. A. (1979). Handbook of Separation Techniques for Chemical Engineers. McGraw Hill Book Co.
- Coulson, J. M., & Richardson, J. F. (1999). Chemical Engineering Vol-I. The English Book Society and Pergamon Press.
- Foust, A. S., & Wenzel, L. A. (1980). Principles of Unit Operations (2nd ed.). John Wiley & Sons.
- Basmadjian, D. (2004). Mass Transfer: Principles and Applications. CRC Press.