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**SECOND SEMESTER 2022-2023**

# Course Handout Part II

Date: 16/01/2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* :  *CHE F244*

## Course Title : Separation Processes 1

## Instructor-in-Charge : Balaji Krishnamurthy

**Scope and Objective of the Course:**

Introduction to molecular diffusion and mass transfer coefficients; interphase mass transfer. Application of the principles in design of absorption, distillation, extraction and leaching processes. The course will enable the student to design the continuous contact and tray type equipment required for mass transfer.

**Textbooks:**

**T1**. Mass Transfer Operations, Robert E. Treybal, Third Edition, McGraw Hill.

**T2**. Seperation Process Principles, Seader and Henley, Wiley student edition.

**Reference books**

**R1** Binay .K. Dutta ,“Principles of mass transfer and separation processes”, PHI Learning Pvt Ltd, India, 2007

**R2.** McCabe, W. L., Smith, J. C., Harriott, P., “Unit Operations of Chemical Engineering,” 7th Ed. (International Edition), McGraw-Hill Education (Asia), Singapore, 2005.

**Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1 | Introduction to separation processes | Unit operations and unit process, Basic concepts | Chapter 1 T1 |
| 2-4 | Molecular diffusion in fluids | Molecular diffusion and fluxes,  Molecular diffusion in Gases (stagnant film, equimolal counter diffusion), Diffusivity of gases and liquids. | Chap.2, T1 |
| 5-13 | Mass transfer coefficients, interphase mass transfer | Relations between mass transfer coefficients, Reynolds analogy.  Equilibrium, diffusion between phases, material balances, stages. | Chap 3,5 T1 |
| 14-20 | Gas absorption  (Equipment for absorption) | Equilibrium solubility of gases in liquids, one component transfer: material balance for counter – and co-current processes, multi stage operations, non-isothermal operations, calculation of height of packed absorber/desorber, multi-component systems, absorption with chemical reaction. | Chap. 6T1 |
| 21-32 | Distillation  (equipments for distillation) | Vapor-liquid equilibrium, flash vaporization, differential distillation, Continuous distillation, multistage columns, overall mass and enthalpy balances, McCabe-Thiele method, Ponchon-Savarit method, use of open steam, multiple feed, side streams, azeotropic and extractive distillations. | Chap. 9 T1 |
| 33-36 | Liquid extraction  (equipments for extraction) | Liquid-liquid equilibrium, distribution curves, triangular and solvent free coordinates, systems of three liquids-one pair partially soluble, insoluble liquids, effect of temperature, continuous counter-current multi-stage extraction, continuous counter-current extraction with reflux. | Chap. 10, T1 |
| 37-40 | Leaching(equipments for leaching) | Solid-liquid extraction, underflow and overflow locus, Multistage cross current extraction, Calculation of no. of stages for cross current flow. | Chap.13, T1 |

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid test | 90 min | 30 | 13/03 11.30 - 1.00PM | OB |
| Surprise Tests | - | 20 |  | OB |
| Assignments |  | 10 |  | OB |
| Comprehensive Exam | 3hr | 40 | 08/05 AN | CB - 10%  OB - 30% |

**Chamber Consultation Hour:** To be announced in class

**Notices:** Notices will be put in CMS and Department of Chemical Engineering Notice Board

**Make-up Policy:** Granted only to **genuine cases** with prior permission from IC.

**Grading:** At least 10% of the total marks to be obtained to obtain a valid grade

**Academic Honesty and Integrity Policy:**

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**