SEPARATION PROCESSES

Course Code: 15CH2112	**L**	**P**	**C**
	3	**0**	**3**

Prerequisites: The student should have knowledge of mass transfer operations.

Course outcomes: On successful completion of the course, the student should be able to

CO1: Define and explain the equilibrium and rate governed separation processes.

CO2: Assess the degrees of freedom of any separation process.

CO3: Solve for thermodynamics of a process.

CO4: Analyze and design any equipment for separation operation.

CO5: Apply rate based models.

UNIT-I (10-Lectures)

Characteristics of separation processes: Mass and energy agents, equilibrium processes and rate-governed processes. Selection of separation processes- Factors influencing the choice of a separation process, Degrees of freedom analysis for an absorber, two product distillation column, Patterns of change in concentrations and temperature distribution along the columns for binary and multicomponent multistage separations.

Thermodynamic analysis of processes: concept of availability and lost work, calculations on lost work for a simple two product distillation column.

UNIT-II (10-Lectures)

MESH models for computer solution (only teach how the equations are arranged to ease a computer solution, no simulation). Heat integrated and divided wall distillation columns to minimize energy consumption.

UNIT-III (10-Lectures)

Azeotropic distillation, extractive distillation and pressure swing distillation. How to select entrainers for azeotropic and extractive distillation. Industrial applications of these distillation techniques. Residue Curve Maps: Introduction, explaining the concepts using ternary diagrams, direct and indirect splits, distillation boundaries, identifying feasible and infeasible products in distillations, and their use in selecting entrainers for distillation.

UNIT-IV (10-Lectures)

Reactive Distillation: Introduction, industrial applications and mathematical model development (only the model development no simulation).

Batch distillation: Introduction, industrial applications and mathematical model development assuming Fenske assumption (only the model development no simulation).

UNIT-V (10-Lectures)

Rate based separation processes: Introduction, applications and mathematical model development (only the model development no simulation).

Introduction of adsorbers, Cryogenic separations, Supercritical fluid extraction, chromatographic separations, Membrane separations (qualitative treatment only), Membrane Reactors.

TEXTBOOKS:

1. Judson King C, *"Separation process"*, McGraw Hill, 1982.
2. Sieder J and Henley E.J *" Separation Processes Design"*, WileyPublishers, 1998

REFERENCES

1. Perry *"Chemical Engineering Handbook",* 7th Edition, McGraw Hill, 1999.
2. Mulder M.H.V, *"Membrane Separations"*, Springer Publications, 2007.