| 22PCM310T | | | | | Petrochemical Process Design | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme | | | | | Examination Scheme | | | | | |
| L | T | P | C | Hours/Week | Theory | | | Practical | | Total Marks |
| | | | | | MS | ES | IA | LW | LE/Viva | |
| 3 | 1 | 0 | 4 | 4 | 25 | 50 | 25 | -- | -- | 100 |

**COURSE OBJECTIVES:**

- To explain the basic concepts of classification and standards of heat exchanges
- To familiarize various components of distillation columns
- To explain the design of columns for separation operations
- To enumerate the basics of reactor design

**UNIT I**: **Heat Exchanger Equipment** **12 Hr.**

Classification of Heat Exchanger, TEMA Classification; Shell & Tube heat exchangers, Functions of various parts of shell & Tube Heat exchanger, General design method of shell & tube heat exchanger, Criteria of selection among Fixed Tube sheet, U Tube & Floating Head heat exchanger. Tinker's flow model, Air-cooled heat exchangers and air heaters, plate heat exchangers, etc. TEMA classification.

**UNIT II: Distillation Systems** **14 Hr.**

Introduction, Various types of Distillation columns, Criteria of selection, Distillation column design, Selection of key components for multicomponent distillation, Determination of operating pressure and temperature for a distillation column, Determination of nos. of theoretical stages for multi-component distillation by Fenskey - Underwood-Gilliland's method. Introduction to rigorous methods, elements of distillation sequencing.

**UNIT III: Column Design** **14 Hr.**

Colum design for Extraction, absorption, distillation, Plate vs packed column; types of packing, packed bed height, prediction of the height of transfer unit, column diameter, wetting rates. Column design for extraction and absorption process. Selection of trays, Calculations for tower diameter & pressure drop of sieve tray tower, Checking of conditions for weeping, down comer flooding, liquid entrainment, etc, tray efficiency, Jet Flooding & down comer Flooding, Different types of weirs & down comers of tray tower, their selection criteria.

**UNIT IV: Reactors** **12 Hr.**

Reactor classification, Reactor principle, Space velocity and space-time, Design equation of industrial reactors. Estimation of the number of stages in an adiabatic reactor, Airlift reactor, vapour phase tubular reactor, Design consideration in bubble column and fluidized bed reactor. Design of catalytic reactor systems.

**Max. 52 Hrs**

**COURSE OUTCOMES**

On completion of the course, student will be able to;

**CO1:** Classify various heat exchanging devises
**CO2:** Design of heat exchangers using Kern and NTU method
**CO3:** Select various internal components of distillation columns
**CO4:** Calculate number of equilibrium stages required for separation using distillation
**CO5:** Design of the plate and packed columns for the mass transfer operations
**CO6:** Design of chemical Reactors for various Applications

**TEXT& REFERENCE BOOKS:**


1. Max S. Peters, K.D. Timmerhaus and R.E. West, Plant Design and Economics for Chemical Engineers (5th Ed), McGraw-Hill International Editions (Chemical Engineering Series), New York, USA, 2003.
2. Sinnott R. K, Coulson and Richardson's Chemical Engineering Series, Chemical Engineering Design, Vol. VI, 5th Ed., Butterworth-Heinemann 2018
3. Ernest E.Ludwig Ludwins Applied Process Design for Chemical and Petrochemical Plants, Volume 1,2 and 3
4. S. B. Thakore, B. I. Bhatt, Introduction to Process Engineering and Design, 4th Ed., McGraw Hill education, 2010
5. B. C. Bhattacharya, Introduction to Chemical Equipment Design, CBS Publisher, 2003
6. D. Q. Kern, Process Heat Transfer, McGraw Hill, 1950
7. Stanley M. Walas ,Chemical Process Equipment- Selection and design , Butterworth and Heinemann, 1990


**END SEMESTER EXAMINATION QUESTION PAPER PATTERN**

| **Max. Marks: 100** | **Exam Duration: 3 Hr.** |
|---|---|
| Part A: 10 Questions each carrying 5 marks | 50 Marks |
| Part B: 5 Questions each carrying 10 marks | 50 Marks |