I CHE471 Chemical Plant Design

Course Outline

- **Title:** Chemical Plant Design
- **Code number**: CHE 471
- **Semester:** 7th
- **Credit hours:** 3
- **Pre-requisites course requirements/ skills**: CHE 231, CHE 361
- **Learning outcomes:**

  Upon successful completion of the course, the students will be able to

  1. Review design basics and related terminology
  2. Analyze design information and data
  3. Evaluate suitable process equipment for engineering applications
  4. Design process equipment like heat exchangers and separation columns

- **Contents**

  Unit I: Elements of Chemical Plant Design:

  1.1 Nature of chemical plant design

  1.2 Chemical plant design considerations

  Unit II: Design Information and Data:

  2.1 Sources of information on chemical processes

  2.2 Sources of information on physicochemical property data

  2.3 Estimation of physical properties

  Unit III: Design of Heat Transfer Equipment:

  3.1 Industrial heat transfer equipment

  3.2 Design of double pipe heat exchangers

  3.3 Shell-and-tube heat exchanger design methods

  3.3 Design of shell-and-tube heat exchangers

  3.4 Design basics of condensers, reboilers, air-cooled heat exchangers, and fired heaters

  3.5 Heat exchanger design through a software such as Aspen EDR

Unit IV: Design of Mass Transfer Equipment:

4.1 Mass transfer equipment: Liquid dispersed and gas dispersed

4.2 Overall column efficiency in distillation and gas absorption columns

4.3 Tray tower internals

4.4 Tray tower diameter

4.5 Sieve tray design

4.6 Packed column internals

4.7 Packed column diameter and pressure drop calculations

4.8 Vapor Liquid Separator Design

Unit V: Mechanical Design of Process Equipment:

5.1 Pressure vessel codes and standards

5.2 General pressure vessel design considerations

5.3 Wall thickness of thin-walled pressure vessels

5.4 Vessel supports and flanged joints

5.5 Liquid storage tanks

- **Teaching-learning Strategies**

1. Lectures by the instructor for clear explanations of the subject matter
2. Problem solving in groups under the instructor's supervision
3. Use of slides, writing screen, software, and videos for teaching augumentation
4. Reading material to students: Slides, hand-outs, and homework problems

Lectures: 3 hours per week

- **Assignments- Types and Number with calendar**

One or more assignments to be submitted before the written exam of final term

- **Assessment and Examinations**

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written examination at the mid-point of the semester.
2.	Formative Assessment	25%	It includes classroom participation, attendance, and assignment/s.

3.	Final Assessment	40%	Written examination at the end of semester.

- **Textbooks and Reference-books**

1. Sinnot, R; Towler, G (2018) Chemical Engineering Design, 6th ed. Butterworth-Heinemann.
2. Peters, MS; Timmerhaus, KD; West, RE (2003) Plant Design and Economics for Chemical Engineers, 5th ed. McGraw-Hill.
3. Serth, RW; Lestina, TG (2014) Process Heat Transfer: Principles and Applications and Rules of Thumb. Academic Press, Singapore.
4. Seider, WD; Lewin, DR; Seader, JD; Widagdo, S; Gani, R; NG, KM (2017) Product and Process Design Principles: Synthesis, Analysis and Evaluation, 4th ed. Wiley.
5. Treybal, RE (1972) Mass Transfer Operations. 3rd ed. McGraw-Hill Book Co. Singapore.
6. Kern, DQ (1950) Process Heat Transfer. McGraw-Hill.
7. Couper, JM; Penney, WR; Fair, JM; Walas, SM (2012) Chemical Process Equipment: Selection and Design, 3rd ed. Butterworth-Heinemann.
8. Elliott, JR; Diky, V; Knotts IV, T; Wilding, WV (2023) The Properties of Gases and Liquids. 6th ed. McGraw-Hill.
9. Green, DW; Southard, MZ (2018) Perry's Chemical Engineers Handbook. 9th ed. McGraw-Hill.
10. Coker, AK (2007) Ludwig's Applied Process Design for Chemical and Petrochemical Plants, Vol. 1-3, 4th ed. Gulf Professional Publishing.