

UCH610: PROCESS EQUIPMENT DESIGN

L	T	P	Cr
3	2	0	4.0

Prerequisite(s): None

Course Objective:

To understand the mechanical and process design methods for various process equipment.

Introduction: General design procedure, Equipment classification, Design codes, Design pressure, Design temperature, Design stress, Factor of safety, Design wall thickness, Corrosion allowance, Weld joint efficiency factor.

Pressure vessels: Design of thin & thick wall cylindrical and spherical vessels, Tall vessels, Storage vessels, Different types of heads.

Heat Transfer Equipment: Process design calculations for heat transfer equipment, Design of shell and tube heat exchangers, Estimation of heat transfer coefficients and pressure drop by Kerns' and Bell's methods, Condenser design, Plate type heat exchanger design.

Mass Transfer Equipment: Process design calculations for multi-component distillation, Fenske-Underwood-Gilliland Method, Selection of key components, Fenske equation for minimum equilibrium stage, Gilliland correlations for actual reflux ratio and theoretical stages, Minimum reflux ratio by Underwood method, Feed stage location, types of plate contractors, tray layout and hydraulic design, Packed towers – column internals, Types of packing, General pressure drop correlation, Column diameter and height.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. determine the parameters of equipment design and important steps involved in design.
2. design pressure vessels.
3. design different types of heat transfer equipment.
4. design different types of mass transfer equipment.

Text Books:

1. *Bhattacharyya, B.C., Introduction to Chemical Equipment Design, Mechanical Aspects, CBS Publishers and Distributors (2009).*
2. *Sinnott Ray and Towler Gavin, Coulson and Richardson's Chemical Engineering series Chemical Engineering Design Volume 6, 5th edition (2013).*
3. *Kern, D.Q., Process Heat Transfer, International Student Edition, McGraw Hill (2002).*

Reference Books:

1. *Mahajani, V.V. and Umarji, S.B., Joshi's Process Equipment Design, 4th edition, Macmillan Publishers India Limited, New Delhi (2010).*
2. *I.S.: 803 – 1962, Code of practice for Design, Fabrication and Erection of vertical Mild steel cylindrical welded oil storage tanks.*

3. I.S.: 2852-1969, Code for unfired pressure vessel.
4. Ludwig E.E., Applied Process Design in Chemical and Petrochemical Plants Vol.II, III, Gulf Publishing Co. (1995).
5. Brownell, L.E. and Young, E.H., Process Equipment Design, Wiley India (P.) Limited (2004).
6. Perry, R.H. and Green, D., Chemical Engineer's Handbook, 8th Edition, McGraw Hill, New York. (2008).
7. Seader, J. D., Henley, E. J., Separation Process Principles, Wiley (2001).
8. Bausbacher Ed. And Hunt Roger, Process Plant Layout and Piping Design, PTR Prentice Hall, (1993).

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May includes tutorials/ assignments/ quiz's etc)	25