

NIRMA UNIVERSITY
School of Engineering, Institute of Technology
B.Tech. in Chemical Engineering
Third Year/Semester V

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	3CH501CC24
Course Title:	Process Equipment Design
Course Type:	Core
Year of introduction:	2024-25

L	T	Practical component			
		LPW	PW	W	S
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. interpret the basic fundamentals of process plant and equipment design (BL2)
2. analyse equipment for gas-solid & liquid-liquid separation (BL4)
3. design column for component separation from liquid mixture (BL6)
4. develop equipment for heat transfer operations (BL6)

Contents

**Teaching
hours
(Total 45)
07**

Unit I	<p>Process Equipment Design and Process Flow-diagrams Criteria and factors for design, need for design, basic considerations in equipment design, materials selection and protective coating, selection criteria of the particular separation methods or equipment, nature of design, types of process, codes and standards, factor of safety, degree of freedom and design variables. Basics of flow sheeting, symbols of equipment used in flowsheet, symbols of instruments used in flowsheet, preparation of computer-aided Flow-sheet. Piping & Instrumentation Diagrams, symbols and layout</p>	07
Unit II	<p>Design of Separation Equipment liquid–liquid separator (Decanter): types of the decanter, Design of horizontal and vertical decanters Gas-solid separator (Cyclone): types of cyclones, working and construction, Design of cyclone, efficiency calculations.</p>	08
Unit III	<p>Design of Separation Column Distillation column (Tray tower): Continuous distillation, Design variables in distillation, design methods for binary systems, Multicomponent distillation: general considerations, short-cut methods for stage and reflux requirements, rigorous solution procedures, Plate efficiency, Approximate column sizing, Plate contactors, Plate hydraulic design. Absorption Column (packed tower): Types of packing, Packed-bed height, Prediction of the height of a transfer unit (HTU), Column diameter (capacity), Column internals, Wetting rates, Column auxiliaries.</p>	20

Unit IV Design of Heat Transfer Operation Equipment**10**

Shell & Tube heat exchangers, general design considerations, Tube-side heat-transfer coefficient and pressure drop (single phase), Shell-side heat-transfer and pressure drop (single phase), Kern's method, Bell's method.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on the above content of course.

Suggested Readings/References:

1. Sinnott, R. A. Y. Chemical engineering design. Vol. 6. Elsevier.
2. Ludwig, Ernest E. Applied process design for chemical and petrochemical plants. Vol. 2. Gulf Professional Publishing.
3. Thakore, S. B., and B. I. Bhatt. Introduction to process engineering and design. McGraw-Hill Education.
4. Joshi, M. V., and V. V. Mahajani. Process Equipment Design. Macmillan India.
5. Kern, D. Q. Process heat transfer. Tata McGraw-Hill Education.

L= Lecture, T=Tutorial, P= Practical, C=Credit

List of Experiments:

Sheet No.	Practical	No. of Hours
1	Discussion for importance of PFD in Process Industry along with all symbols used in it. Quiz for PFD and P&ID.	4
2	Discussion for importance of P&ID diagram in Process Industry along with all symbols used in it. Quiz for PFD and P&ID.	4
3	Design Calculations and drawing of Decanter	4
4	Design Calculations and drawing of Cyclone separator	4
5	Design Calculations, Drawing and Simulation of Absorption column	4
6	Design Calculations, Drawing and Simulation of heat exchanger	4
7	Design Calculations, Drawing and Simulation of Distillation Column	6