

LOK JAGRUTI UNIVERSITY (LJU)
INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Chemical Engineering
Bachelor of Technology (B.E.) – Semester - VI

Course Code:	017084602
Course Name:	Process Equipment Design
Category of Course:	Professional Elective Course-II (PEC-II)
Prerequisite Course:	Fluid Mechanics, Heat Transfer, Mass Transfer-II

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
3	0	2	4	30

Syllabus			
Unit No.	Topic	Prerequisite Topic	Teaching Hours
01	Process Design of Heat Exchanger		4 (13.33%)
	1.1 Shell & Tube heat exchangers	Concept of Shell and Tube Heat Exchanger	
	1.2 Functions of Various Parts of Shell and Tube Heat Exchanger		
	1.3 General Design Method of Shell & Tube Heat Exchanger		
	1.4 Tinker's Flow model	---	
02	Process Design of Condenser and Reboiler		4 (13.33%)
	2.1 Design of Condenser	Concept of Heat Exchanger	
	2.2 Selection Criteria for Horizontal and Vertical Condenser		
	2.3 Process Design of Vertical Thermosyphon Reboiler		
	2.4 Selection Criteria for Kettle type reboiler and Vertical Thermosyphon reboiler		
03	Process Design of Distillation Column		3 (10%)
	3.1 Introduction	---	
	3.2 Selection of Equipment for Distillation	Concept of Packed Tower and Tray Tower	
	3.3 Distillation column Design		
	3.4 Selection of key components for multi-component distillation	---	
	3.5 Selection of Tray and It's Design Parameters	Concept of Tray Tower	
	3.6 Multi – Component Distillation Design Using Fenske – Underwood – Gilliland's (FUG) Method	---	
04	Process Design of Sieve Tray Tower		4 (13.33%)
	4.1 Calculations for tower diameter & pressure drop of sieve tray tower	Concept of Tray Tower	
	4.2 Jet Flooding & down comer Flooding		
	4.3 Checking of conditions for weeping, down comer flooding, liquid entrainment		
	4.4 Different types of weirs & down comers of tray tower, their selection criteria		
05	Process Design of Absorbers		3 (10%)
	5.1 Introduction	---	
	5.2 Criteria for Selection Among Different Types of Absorption Equipment	Concept of Absorption process	
	5.3 Process Design of Packed Tower Type Absorber, Selection of packing	Concept of Packed Tower	
5.4 Selection Criteria of Liquid Distributors, Redistributors & Packing support			
06	Process Design of Different Absorption Equipment		2 (6.67%)
	6.1 Process design of Venturi Scrubber	---	
	6.2 Process design of Spray chamber or Spray tower type absorber		
07	Introduction to Mechanical Design		3 (10%)
	7.1 Concept of Internal and External Design Pressure	---	
	7.2 Design Stress and Design Temperature		
	7.3 Static and Rotary Equipments, Different Types of Static Equipments		
	7.4 Joint Efficiency, Radiography		
7.5 Corrosion Allowance			
08	Mechanical Design of Pressure vessel		3 (10%)
	8.1 Mechanical Design of Shell		
	8.2 Different Types of Head and Their Selection Criteria		
	8.3 Mechanical Design of Heads		
	8.4 Different Types of Nozzles, Their Selection Criteria		
09	Mechanical design of Storage Tank		2 (6.67%)
	9.1 Capacity of Storage Tank, It's Diameter and Height		
	9.2 Design of Shell and Bottom Plate for Storage Tank		
	9.3 Design of Self Supported Roof		
10	Design of Supports		2 (6.67%)
	10.1 Mechanical Design of Bracket Support		
	10.2 Mechanical Design of Skirt Support		

Sr No.	Practical Title	Link to Theory Syllabus
1	Process design suitable heat exchanger for no phase change using MS Excel.	Unit 1
2	Process design suitable condenser for given duty using MS Excel.	Unit 2
3	Determine number of trays in distillation column by FUG method using MS Excel.	Unit 3
4	Determine sieve tray tower diameter and pressure drop using MS Excel.	Unit 4
5	Process design venturi scrubber using MS Excel.	Unit 6
6	Mechanical design of nozzle pad using MS Excel.	Unit 8
7	Determine heat exchange area, heat duty for given heat exchanger using DWSIM.	Unit 1
8	Design absorption column for given duty using DWSIM.	Unit 5
9	Mechanical design of pressure vessel for given duty using MATLAB.	Unit 8
10	Mechanical design of bracket support using MATLAB.	Unit 10

**Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)**

L:	3	T:	0	P:	2
-----------	----------	-----------	----------	-----------	----------

Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.

Each Test will be of 25 Marks.

Each Test Syllabus Weightage: Range should be 20% - 30%

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage	
Theory	3	4	MCQ	19%	25	
Theory			Theory Descriptive	26%	35	
Theory			Formulas and Derivation	0%	0	
Theory			Numerical	30%	40	
Expected Theory %	75%			Calculated Theory %	75%	100
Practical	1		Individual Project	13%	50	
Practical			Group Project	0%	0	
Practical			Internal Practical Evaluation (IPE)	13%	50	
Practical			Viva	0%	0	
Practical			Seminar	0%	0	
Expected Practical %	25%		Calculated Practical %	25%	100	
Overall %	100%			100%	200	

Course Outcome

1	Design process equipment and modify the design of existing equipment to new process conditions or new required capacity.
2	Build a bridge between theoretical and practical concepts used for designing the equipment in any process industry.
3	Create understanding of equipment design with mechanical concept.
4	Review the importance of design concepts in process industry.

Suggested Reference Books

1	Introduction to Process Engineering and Design by S B Thakore and B I Bhatt, Tata McGraw Hill
2	Illustrated Process Equipment Design, S B Thakore and D A Shah, Atul Prakashan
3	Plant Design and Economics for Chemical Engineers, M. S. Peters and K. D. Timmerhaus, McGraw - Hill
4	Perry's Chemical Engineers, Don W. Green, Robert H. Perry, McGraw -Hill
5	Joshi's Process Equipment Design, M.V.Joshi & V V Mahajan, Trinity Publication