Subject Code: 09CH1601

Subject Name: Chemical Process Equipment Design

Semester: 6th

Objective: Acquire knowledge of various chemical process equipment designs like reaction & pressure vessel, heat exchangers and distillation column also consideration of important process parameters for that design.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able to:

1) State and basic concept of process parameters consideration in equipment design
2) Mechanical design of reaction and pressure vessel
3) Design of heat exchangers and distillation column

Pre-requisite of course: Basic knowledge of heat & mass transfer and mechanical operation equipment.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid-Sem (M)	Internal (I)	Practical Exam (V)	Term work (TW)	
3	4	0	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	Basic Considerations in Process Equipment Design: Introduction, The general design procedure, Fabrication Techniques, Equipment classification, Power for rotational motion.	4
2	Design Consideration: Introduction, Material selection, Corrosion prevention, Stresses created due to static and dynamic loads, Combined stresses and theories of failure, Fatigue, Brittle fracture, Creep, Temperature effects, Radiation effects, Effects of fabrication methods Economic considerations.	6

3	Pressure Vessels: Introduction, Operating conditions, Normal conditions, Transient conditions, Pressure vessel code, Selection of material, Vessels operating at low temperature, Vessels operating at elevated temperature, Design conditions and stresses, Design stress, Design criteria, Corrosion allowance, Design of shell and its components, Cylindrical and spherical shell and numerical for shell thickness, Head or covers (theory only).	9
4	Reaction Vessels: Introduction, Material of construction, Classification of reaction vessel, Heating system, Jackets, Coils, Design considerations, Jacket Design & simple numerical for thickness.	6
5	Heat Exchanger: Introduction, Basic design procedure and theory, Overall heat transfer coefficient, Shell and tube exchangers: Construction details, Heat exchangers standards and codes, Tubes, Shell, Tube sheet layout. (Tube count), Shell types (Passes), Baffles, Shell and tube exchangers: General design considerations, Shell side heat transfer and pressure drop, Flow pattern, Kern's method.	7
6	Supports for vessels: Introduction, Bracket or lug supports, Leg supports, Skirt supports, Saddle supports, Numerical for Bracket support thickness.	5
7	Distillation Column: Introduction, Basic features of columns, Determination of shell thickness at different height.	5
	Total Hours	42

Reference Books:

1. Illustrated process equipment design by S.B.Thakore and D.A.Shah
2. Process equipment design by M.V. Joshi V.V.Mahajani
3. Chemical engineering Vol.6 by J.M. Coulson and J.F. Richardson
4. Engineering mechanics by R.S.Khurmi

List of Tutorials:

1. General design considerations
2. Numerical based on different stresses and strains calculations
3. Theory of failure
4. Design of pressure vessel
5. Design of reaction vessel
6. Design of heat exchanger
7. Numerical of supports

Instructional Method:

a. The internal evaluation will be done on the basis of continuous evaluation of students in the tutorials.
b. Practical examination will be conducted at the end of semester for evaluation of performance of students in tutorials.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
40%	40%	20%	20%	-	-