

INSTITUTE	DIPLOMA STUDIES
PROGRAM	DIPLOMA ENGINEERING (CHEMICAL ENGINEERING)
SEMESTER	6
COURSE TITLE	CHEMICAL PROCESS EQUIPMENT DESIGN
COURSE CODE	09CH2601
COURSE CREDITS	6

Objective:

- 1 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

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

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	3	0	50	30	20	25	25

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.	4
3	Pressure Vessels Introduction, Operating conditions, Normal conditions, Transient conditions, Pressure vessel code, Selection of material, Vessels operating at low 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	8

Contents : Unit	Topics	Contact Hours
4	Reaction Vessels Introduction, Material of construction, Classification of reaction vessel, Heating system, Jackets, Coils, Design considerations	8
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	4
6	Supports for vessels Introduction, Bracket or lug supports, Leg supports, Skirt supports, Saddle supports, Numerical for Bracket support thickness.	6
7	Distillation Column Introduction, Basic features of columns, Determination of shell thickness at different height	8
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Tutorial 1 General design considerations	6
2	Tutorial 2 Numerical based on different stresses and strains calculations	6
3	Tutorial 3 Theory of failure	6
4	Tutorial 4 Design of pressure vessel	6
5	Tutorial 5 Design of reaction vessel	6
6	Tutorial 6 Design of heat exchanger	6
7	Tutorial 7 Numerical of supports	6
Total Hours		42

Textbook :

- 1 Illustrated process equipment design , S.B.Thakore and D.A.Shah, Mcgraw Hill, 2000

References:

- 1 Process equipment design , Process equipment design , M.V. Joshi & V.V.Mahajani, Mcmillan, 2010

References:

- 2 Chemical engineering Vol.6 , Chemical engineering Vol.6 , .M. Coulson and J.F. Richardson, Mcgraw Hill, 2000

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 / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking
40.00	40.00	10.00	10.00	0.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 <https://www.classcentral.com/course/swayam-process-equipment-design-23086>
- 2 https://onlinecourses.nptel.ac.in/noc21_ch18/preview