

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE : PROCESS EQUIPMENT DESIGN
(COURSE CODE : 3385502)**

Diploma Programme in which this course is offered	Semester in which offered
Fabrication Technology	8 th Semester

1. RATIONALE

This course provides the knowledge and practice regarding reading and preparation of industrial fabrication 2-D and 3-D drawings. Students can design various machine elements and process equipments as per different codes and standards. Students can acquire knowledge about ASME- BPVC Sec VIII Div.1. Students can use various softwares for designing complete process equipment.

2. LIST OF COMPETENCY

The course content leading to the achievement of the following competencies:

- Able to read and prepare industrial process equipments 2-D and 3-D drawing.
- Able to design various parts of process equipment as per ASME- BPVC Sec VIII Div. 1.
- Able to design various machine elements used in process equipment.

3. COURSE OUTCOMES (CO's)

1. Describe basic design considerations for process equipment design.
2. Select materials of construction for components of given process equipment job.
3. Calculate shaft diameter from given design data.
4. Describe design considerations for machine elements.
5. Describe design considerations of various process equipments.
6. Draw 3D drawing using AutoCAD for given job.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	-	2	6	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;; ESE - End Semester Examination; PA - Progressive Assessment.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-Topics
Unit – I Basic Consideration In Process Equipment Design	1 a. Describe design consideration of process equipment	BASIC DESIGN CONSIDERATION IN PROCESS EQUIPMENT DESIGN 1.1 Introduction 1.2 The general design procedure 1.3 Fabrication techniques 1.4 Equipment classification 1.5 Power for rotational motion 1.6 Drives for process equipment 1.7 Factors affecting design of process Equipment Failures in pressure vessel 1.8 Loadings on pressure vessel 1.9 Design of cylindrical shell and spherical head as per ASME sec VIII Div-1 1.10 Comparison of ASME Sec VIII Div-1,2 & 3 1.11 Stresses in pressure vessel
Unit– II Material Of Construction	2 a. Describe different types of corrosion occurs in process equipment & its prevention techniques 2 b. Select material for process equipment considering various application	MATERIAL OF CONSTRUCTION 2.1 Mechanical properties 2.2 Material types 2.3 Corrosion 2.4 Corrosion prevention 2.5 Selection of material
Unit– III Design Of Machine Elements	3 a. Describe design consideration for different machine element 3 b. Perform design calculation for shaft	DESIGN OF MACHINE ELEMENTS 3.1 Shaft 3.2 Coupling 3.3 Bearing 3.4 Gear box 3.5 Packing and gasket 3.6 Stuffing Box & gland 3.7 Mechanical seal
Unit– IV Design Of Reaction Vessel (Mixer)	4 a. Describe design consideration of reaction vessel	DESIGN OF REACTION VESSEL (MIXER) 4.1 Introduction & material of construction 4.2 Agitation & types of agitator 4.3 Classification of reaction vessel 4.4 Heating system 4.5 Design consideration

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-Topics
Unit– V Design Of Heat Exchanger	5 a. Describe design consideration for shell & tube heat exchanger	DESIGN OF HEAT EXCHANGER 5.1 Introduction , 5.2 types of heat exchanger 5.3 Design of shell and tube types heat-exchanger
Unit– VI Design Of Evaporators And Crystallizers	6 a. Describe design consideration for evaporators & crystallizers	DESIGN OF EVAPORATORS AND CRYSTALLIZERS 6.1 Introduction & types 6.2 Entrainment separators 6.3 Design consideration
Unit– VII Design Of Distillation Column And Absorption Tower	7 a. Describe design consideration for distillation column & absorption tower	DESIGN OF DISTILLATION COLUMN AND ABSORPTION TOWER 7.1 Introduction 7.2 Basic features of tower / column 7.3 Tower / column internals 7.4 design and construction features of column internals
Unit – VIII Process Hazards And Safety Measures In Equipment Design	8 a. Describe various process hazards & safety measures in industry 8 b. Describe various safety measures in process equipment design	PROCESS HAZARDS AND SAFETY MEASURES IN EQUIPMENT DESIGN 8.1 Introduction 8.2 Hazards in process industries 8.3 Analysis of hazards 8.4 Safety measures 8.5 Safety measures in equipment design 8.6 Pressure relief device
Unit – IX Computer Aided Drafting	9 a. Draw 3D solid modelling drawing of process equipment using AutoCAD	COMPUTER AIDED DRAFTING 9.1 Introduction to different AutoCAD commands 9.2 Simple 2D and 3D drafting of process equipment 9.3 Solid modelling

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	Basic Consideration In Process Equipment Design	6	0	7	0	7
2	Material Of Construction	4	0	7	0	7
3	Design Of Machine Elements	8	0	7	7	14
4	Design Of Reaction Vessel (Mixer)	8	7	0	0	7
5	Design Of Heat Exchanger	8	0	7	0	7
6	Design Of Evaporators And Crystallizers	4	0	7	0	7
7	Design Of Distillation Column And Absorption Tower	6	0	7	0	7
8	Process Hazards And Safety Measures In Equipment Design	4	7	0	0	7
9	Computer Aided Drafting	8	0	0	7	7
	Total	56	14	42	14	70

Legends:

R = Remember; U = Understand; A = Application and above levels (Revised Bloom's taxonomy)

NOTE :-

Suggested specification table shall be treated as only general guidance for students and teachers. The actual distribution of marks in the question paper may vary from above table.

7. SUGGESTED LIST OF EXERCISE/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, If these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus overall development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes

S. No.	Unit No.	Exercise /Practical (Outcomes in psychomotor domain)	Approx. Hrs. Required
1	IX	Perform Exercise On Process Equipment Drawing Reading	2
2	IX	Perform AutoCAD 2D & 3D Exercise	6
3	I	Perform exercise on ASME SECTION VIII, DIVISION 1	2
4	I	Perform exercise on calculation of thickness of cylindrical shell and spherical head of Pressure Vessel as per ASME Sec VIII Div 1.	2
5	I	Perform Design Exercise Of Pressure Vessel By using Software	2
6	I	Perform Design Exercise Of Pressure Vessel Heads using Software	2
7	II	Perform Material Selection Exercise As Per ASME Sec.VIII Div. 1&2 by using Software	2
8	III	Perform exercise on Design calculation Of Shaft	2
9	IV	Describe design consideration of Reaction Vessel (Mixer).	2
10	V	Describe design consideration of Shell & Tube Heat Exchanger.	2
11	VII	Describe design consideration of Distillation Tower And Column	2
12	VIII	Prepare Report On Process Hazards And Safety Measures In Process Equipment Design	2
Total Hrs.			28

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities:

- 8.1 Prepare sketchbook of drawing of various topics of syllabus
- 8.2 Prepare a question bank.
- 8.3 10 min PPT presentation on the given topic from the syllabus and beyond the syllabus
- 8.4 Report writing on various topics from syllabus and beyond syllabus
- 8.5 Fill up lab manual.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange industrial visit.
- ii. Arrange expert lecture.
- iii. Show video films/animation films/photographs of different Process Equipment Design and Manufacturing and discuss their features.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Title of Books	Author	Publication
1	Joshi's Process Equipment Design	V.V.Mahajani S. B. Umreji	Trinity press
2	A text book of machine design	R.S.khurmi J.K.gupta	Euresia Publishing House (Pvt.) Ltd.
3	Chemical Equipment Design	B. C. Bhattacharya	CBS publications & distributors
4	Materials & Metallurgy	O.P.Khanna	Dhanpat Rai Publication
5	Pressure vessel design manual	Deniss R More	Gulf publishing company
6	Pressure vessel design – Guide & procedure	Mr. Ghader Ghanbari Mr. Mohammad Ali Liaghat	

B. List of Major Equipment/ Instrument

1. Computers

C. List of Software/Learning Websites

1. Microsoft excel
2. AutoCAD
3. ProE
4. Catia V

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. P. B. Pathak**, I/C HOD, Deptt. of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. B. K. Gandhi**, Sr. Lecturer, Deptt. of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. S. Y. Merchant**, Sr. Lecturer, Deptt. of Fabrication Technology, Sir B.P.I., Bhavnagar

Co-coordinator and Faculty Members from NITTTR Bhopal