

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: FABRICATION TECHNOLOGY-II
(Code: 3345505)

Diploma Programme in which this course is offered	Semester in which offered
Fabrication Technology	4 th Semester

1. RATIONALE

This course focuses on different types of process equipment fabrication work. This course also helps students to understand application of different tools, equipment & machineries used in fabrication of process equipment. This course also tries to develop safety consciousness & constructiveness for process equipment fabrication work. Students also become conversant with related manufacturing codes & standards of process equipment e.g. ASME, TEMA, BIS - 2825, BS - 5500. This also provides opportunity for hands on practice for student to understand basic technical requirement for process equipment fabrication. This course provides necessary knowledge and skills required in the process equipment fabrication industry, and hence it is a key course for fabricating engineers.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Plan and supervise fabrication of different process equipment using various fabrication standards, codes and safety norms.**

3. COURSE OUTCOMES (CO's)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Describe Process Equipment Fabrication process.
- Interpret given Process Equipment Fabrication drawing.
- Draw different Process Equipment Fabrication set-ups and fit-ups.
- Select proper cutting method for given Process Equipment Fabrication.
- Apply different Process Equipment Fabrication codes and standards in a given Situation.

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	150

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 (Outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Introduction To Process Equipment	1a. Describe terminology of process equipment 1b. Explain need, scope & importance of equipment used in process- industries.	1.1 Need, scope & importance of process equipment in industries. 1.2 Definition, classification & function of process equipment (e.g. heat exchanger, pressure vessels & reaction vessels) 1.3 Terminology of heat exchanger, pressure vessels & reaction vessels 1.4 Sequence of operations for manufacturing different parts of heat exchanger, pressure vessels & reaction vessels 1.5 Fundamental SI / MKS / FPS units and their conversion 1.6 Simple fabrication calculation for volume, weight & cost calculations of various shapes and cross sections of process equipments
Unit– II Codes & Standards	2a. Develop qualities for fabrication shop supervisor 2b. Interpret various codes and their field of application.	2.1 Introduction to types of fabrication code use for process equipment fabrication like ASME, TEMA, BS-5500, BIS-2825. 2.2 Commercial forms of metal as per BIS 2.3 Material test certificate (MTC) 2.4 Third party inspection agencies (TPI) for process equipment. 2.5 Qualities of shop floor supervisor in process equipment fabrication industry
Unit– III Shell Fabrication	3a. Fabricate a shell and setup with another shell and cone 3b. Identify defects in shell fabrication	3.1 Definition & classification 3.2 Rolling of shell 3.3 Long seam and circular seam set up of shell. 3.4 Run-in, run-out plate and PTC 3.5 Defects in shell fabrication 3.6 Shell to shell setup 3.7 Shell to cone setup
Unit– IV Dished End Fabrication	4a. Calculate dished end blank diameter 4b. Identify the types of dished end 4c. Make dished end	4.1 Definition & classification 4.2 Fabrication calculation for dished end e.g. blank diameter calculation and volumetric capacity 4.3 Toro spherical dished end template

Unit	Major Learning Outcomes (Outcomes in cognitive domain)	Topics and Sub-topics
	template and dished end inspection report	marking 4.4 Typical inspection report of simple dished end 4.5 Tan line marking, trimming/ reference line marking, 4.6 Orientation marking of dished end 4.7 Fit-up & set-up of shell to dished end for welding
Unit– V Nozzle & Flange Marking	5a. Calculate fabrication calculations of flange & nozzle 5b. Fabricate a nozzle and setup it on shell and dished end.	5.1 Definition & classification of nozzle and flange 5.2 Nozzle fabrication 5.3 Fabrication calculation of flange & Nozzle 5.4 Nozzle schedule table 5.5 R.F.Pads & tail tale Holes(T.T. Holes) 5.6 Nozzle elevation, height and orientation marking 5.7 Typical inspection report of simple nozzle 5.8 Template marking for nozzle cut outs and checking of edge preparation 5.9 Nozzle setup & fit-up to shell and dished End 5.10 Flange marking (4,6,8,12,16,32 etc. hole marking) 5.11 Flange weight & cost calculation 5.12 Fasteners tightening / fastening sequence
Unit– VI Miscellaneous Elements / Parts of process equipment	6a. Describe various elements of process equipment with their advantages and limitations 6b. Make different supports, limpet coils, external & internal and lifting lugs	6.1 Support : definition, classification, selection, fabrication, advantages/ application, limitations 6.2 Shell to support setup & fit-up 6.3 Dished end to support setup & fit-up 6.4 Inspection of saddle support setup 6.5 Limpet coil : definition, classification, fabrication, advantages/application, limitations 6.6 Limpet coil marking on shell 6.7 Inspection report of limpet coil marking on shell 6.8 External & internals of process

Unit	Major Learning Outcomes (Outcomes in cognitive domain)	Topics and Sub-topics
		equipment like insulation, ladder, supports, platform cleat, trays and tray support ring 6.9 Lifting lugs : definition, classification, fabrication, application.
Unit– VII Tube Bundle Fabrication for Heat Exchanger	7a. Explain tube bundle elements, classification and marking. 7b. Describe the process of assembly of heat exchanger and its applications	7.1 Tube bundle : definition, classification 7.2 Elements of tube bundle : tube sheet, tube, Baffles, Tie rod, spacers, impingement plate 7.3 Tube sheet : classification, marking 7.4 Typical inspection report of tube sheet 7.5 Assembly of tube bundle 7.6 Application of draw lug
Unit– VIII Fabrication Aids	8a. Explain different fabrication aids. 8b. Describe the application of pulling & lifting equipment.	8.1 Template : Definition, classification, storage, application 8.2 Tank rotator & their fabrication calculation. 8.3 Spider : concept, classification and Fabrication 8.4 Ovality : concept, calculation and its removal 8.5 Pulling & lifting equipments 8.6 Miscellaneous fabrication aids

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
I	Introduction to Process Equipment	8	5	5	0	10
II	Codes & Standards	4	3	3	0	6
III	Shell Fabrication	8	0	5	5	10
IV	Dished End Fabrication	6	0	4	4	8
V	Nozzle & Flange Marking	8	0	4	4	8
VI	Miscellaneous Elements / Parts of process equipment	8	0	5	5	10
VII	Tube Bundle Fabrication for Heat Exchanger	8	0	5	5	10
VIII	Fabrication Aids	6	4	4	0	8
Total Hrs		56	12	35	23	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISE/PRACTICAL

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 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 over all 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 (Outcomes in psychomotor domain)	Approx Hrs. Required
1	I	Prepare list of tools & equipment used in fabrication laboratory	02
2	II	Interpret given Material Test Certificate (MTC)	02
3	III	Identify cutting tools, equipment & accessories, safety equipments & protective clothing for cutting and gauging operation	02
4	III	Perform Shell template making operation.	02
5	III	Perform shell fabrication operation : shell plate marking, cutting, rolling and long seam setup	04
6	III	Calculate & fabricate moon plate	02
7	III	Identify defects on given fabricated shell & suggest its remedies	02
8	III,IV	Perform Shell to shell and shell to dished end/cone setup	04
9	V	Perform marking of different number of holes on given flange	02
10	V	Perform marking of nozzle orientation on given shell	02
11	IV	Perform marking of template for given Toro spherical dished end.	02
12	VII	Calculate dimensions and perform marking of given Tube sheet.	02
Total Hrs			28

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities in sketch book:

- i. Prepare sketchbook of drawing of various exercise of process equipment fabrication
- ii. Ten Minutes Power point presentation from the topic of syllabus and beyond the syllabus
- iii. Report writing on various topics from syllabus and beyond syllabus

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange a visit to fabrication industry where process equipment are being fabricated and discuss various fabrication processes.
- ii. Show video/animation films photographs depicting different fabrication work.

10. SUGGESTED LEARNING RESOURCES**A. List of Books**

S.No.	Title of Books	Author	Publication
1	Process Equipment Design	V.V.Mahajani	Macmillan Publishers India Ltd.
2	Chemical equipment design	B.C.Bhattacharya	CBS publishers
3	Perry's Chemical Engineer's Handbook ISBN: 9780071422949	Don W. Green & Robert H. Perry	McGraw-Hill, Delhi
4	Westerman tables for the metal trade	Hermaan Juez	New Age International (P) Ltd. Publishers , New Delhi
5	Welder fitter guide	John P. Stewart	D.B.Tarapurwala
6	Design data handbook	PSG	PSG College of Technology
7	Introduction to Chemical Engineering	Salil K Ghosal & Siddhartha Datta	Tata Mc graw Hill
8	Welders guide handbook	Jems E. Brumbaugh	D.B.Tarapurwala
9	ASME Sec - VIII	James R. Farr & Maan H. Jawad	ASME
10	TEMA Standards	TEMA	Tubular Exchanger Manufacturers Association, Inc.
11	IS 2825 : Code for Unfired Pressure Vessels	BIS	Bureau of Indian Standards

B. List of Major Equipment/ Instrument

- i. Three roll plate bending machine
- ii. Welding transformer / rectifier
- iii. Safety equipment
- iv. Personal protective equipment.
- v. Oxy acetylene cutting kit
- vi. Fabrication aids
- vii. Marking & measuring instruments

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. P. B. Pathak**, Convener & HOD, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. B. K. Gandhi**, Sr. Lecturer, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. S. Y. Merchant**, Sr. Lecturer, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. A. K. Sarathe**, Associate Professor, Department of Mechanical Engineering.
- **Prof Sharad Pradhan**, Head and Associate Professor, Department of Mechanical Engineering.