



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Fabrication Technology

Course / Subject Code: DI03055041

Course / Subject Name: Fabrication Technology-2

w. e. f. Academic Year:	2024-25
Semester:	3 rd
Category of the Course:	PCC

Prerequisite:	-
Rationale:	<p>This course focuses on different types of process equipment fabrication work. Student will develop capability to read and interpret process equipment drawing. 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 fabrication engineers.</p>

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe process equipment fabrication process.	U
02	Interpret given process equipment fabrication drawing.	A
03	Determine method to make shell, cone & dish end for pressure vessel.	A
04	Describe different attachments for process equipments.	U
05	Determine the method to assemble different parts of process equipment.	A

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to process equipment 1.1 Need, scope & importance of process equipment in industries. 1.2 Definition, classification & function of different process equipments. 1.3 Manufacturing terminology of pressure vessel. 1.4 Sequence of process equipments fabrication. 1.5 Fundamental units and its conversion. 1.6 Volume capacity calculation of pressure vessel. 1.7 Introduction & scope of different codes/standards used in process equipment fabrication industries. 1.8 Qualities of shop floor supervisor in process equipment fabrication industries. 1.9 Major process equipment fabrication industries in India.	7	16
2.	Process equipment drawing. 2.1 Introduction of process equipment drawing. 2.2 Types of process equipment drawing. 2.3 Study of title block in process equipment drawing. 2.4 General notes & bill of material in GA drawing. 2.5 Design data table. 2.6 Typical pressure vessel drawing with its terminology. 2.7 Detailing of process equipment drawing. 2.8 Weld joint geometry/nomenclature/ terminology/types & weld symbols. 2.9 Detail drawing. 2.10 Nozzle schedule table. 2.11 Shell & Cone layout developments and related examples.	9	20
3.	Shell, Cone & Dish end fabrication 3.1 Introduction of shell fabrication. 3.2 Plate length calculation & marking for shell fabrication. 3.3 Advanced cutting processes (plasma cutting, water jet cutting, laser cutting) 3.4 Shell forming from plate (Plate rolling) 3.5 Longitudinal seam fit up & set up of shell 3.6 Run in, run out plate & PTC for shell. 3.7 Inspection of plate & shell. 3.8 Definition, introduction & types of cones or reducer.	12	26



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	<p>3.9 Cone fabrication. 3.10 Inspection of cone. 3.11 Definition & Introduction of heads or dish ends. 3.12 Types of dish end. 3.13 Factors affecting selection of dish end. 3.14 Manufacturing processes of dish ends. 3.15 Blank diameter calculation of dish ends. 3.16 Development of hemispherical dish ends. 3.17 Different marking in dish ends. 3.18 Inspection of dish end. 3.19 Shell, cone & dish end forming defects. 3.20 Safe operating procedures for plasma cutting & forming(rolling) operation.</p>		
4.	<p>Process equipment attachments. 4.1 Definition & introduction & function of nozzles. 4.2 Types of nozzles 4.3 Nozzle elevation, height & centerline marking. 4.4 Nozzle orientation calculations. 4.5 Definition, introduction, function & types of flanges. 4.6 Flange marking & calculations. 4.7 Process equipments supports. 4.8 Reinforcement pad & telltale hole. 4.9 Introduction & function of limpet coil 4.10 Limpet coil marking on shell. 4.11 Lifting lug/lifting trunnion 4.12 External & internals of process equipment like insulation cleat, ladder supports, platform cleat, trays and tray support ring 4.13 Tube bundle fabrication for heat exchanger. 4.14 Elements of tube bundle like Tube Sheet, Tube, Baffles, Tie Rod, Spacers, Impingement Plate, etc.,</p>	9	20
5.	<p>Assembly of process equipment. 5.1 Shell to shell fit up & set up. 5.2 Ovality calculation of shell. 5.3 Dish end to shell fit up & set up 5.4 Nozzle to shell fit up & set up 5.5 Nozzle to dish end fit up & set up 5.6 Shell to support fit and set up 5.7 Equipment & tools for process equipment fabrication like tank rotator, spider etc., 5.8 Jigs & fixtures used for process equipment.</p>	8	18



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5.9	Standard tolerances for pressure vessel as per codes/standards.		
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20 %	38%	42%	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks and marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Practical guide to pressure vessel manufacturing.	Sunil pullarcot	Marcel dekker inc. ISBN: 0-8247-0740-0
2	Process Equipment Design	V.V.Mahajani	Macmillan Publishers India Ltd.
3	Chemical equipment design	B.C.Bhattacharya	CBS publishers
4	Production Technology vol-1&2	O.P.Khanna	Dhanpat Rai & Sons Publication. Latest edition
5	Basic Welding & Fabrication	W.Kenyon	-
6	Welder fitter guide	John P. Stewart	D.B.Tarapurwala
7	Design data handbook	PSG	PSG College of Technology
8	Introduction to Chemical Engineering	Salil K Ghosal & Siddhartha Datta	Tata Mc graw Hill
9	Welders guide handbook	Jems E. Brumbaugh	D.B.Tarapurwala
10	ASME Sec - VIII	James R. Farr & Maan H. Jawad	ASME
11	TEMA Standards	TEMA	Tubular Exchanger Manufacturers



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Sr. No.	Title of Book	Author	Publication with place, year and ISBN
			Association, Inc.
12	IS 2825: Code for Unfired Pressure Vessels	BIS	Bureau of Indian Standards

(b) Open source software and website:

1. <https://www.youtube.com/watch?v=vgANh1L9fvU>
2. <https://workshopinsider.com/welding-symbols/>
3. <https://www.youtube.com/watch?v=-t2FYGaH5IQ&t=12s>
4. <https://www.youtube.com/watch?v=vgANh1L9fvU>
5. <https://www.youtube.com/watch?v=-t2FYGaH5IQ&t=12s>
6. <https://www.youtube.com/watch?v=LojEHJ5vuQg&t=10s>
7. <https://www.youtube.com/watch?v=7XMUxbULo1A>
8. https://www.pveng.com/wp-content/uploads/2016/06/Sample2_Drawing.pdf
9. <https://letsfab.in/guidelines-for-fabrication-of-pressure-vessels/>
10. <https://www.thefabricator.com/thefabricator/article/bending/dished-end-manufacturing-for-beginners>

Suggested Course Practical List:

Sr. No.	List of Practical	No. of Hours
1	Calculate required plate dimension & diagonal length of plate as per given data for shell preparation with neat sketch.	02
2	Perform shell plate marking & cutting for shell fabrication as per given data/drawing.	02
3	Prepare template for shell weld edge preparation & perform weld edge preparation on given shell as per drawing.	04
4	Prepare template for shell forming and perform pre-bending of shell as per given data.	02
5	Perform rolling (forming) operation of shell as per given data.	04
6	Perform long seam set up of shell with run in and run out plate as per given data.	02
7	Perform dimensional inspection of shell with ovality calculation.	02
8	Perform circumferential orientation marking on given shell & Prepare shell to shell circular seam set up operation.	02
9	Prepare list of shell forming defects & identify defects from the prepared shell and suggest remedies to correct it.	02



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Sr. No.	List of Practical	No. of Hours
10	Perform nozzle cut out marking on given shell as per given drawing.	02
11	Perform flange marking on given plate with all required calculation.	02
12	Prepare template for inspection of given dish end.	02
13	Draw a typical cone development as per given data.	02
TOTAL		30

Note

- i. More **Practical Exercises** can be designed and offered and can be changed by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- ii. Boiler suit, safety shoes, other safety items & hand tools are compulsory while attending laboratory and has to be brought by students.

List of Laboratory/Learning Resources Required:

No.	Equipment Name
1	PPE'S: Hand gloves, Welding face guard, Safety goggles, Hand sleeve, Leg guard.
2	Mild steel plate/flat
3	Fabrication tools & equipment's anything from the listed below items:
4	Marking & measuring instrument & tools anything from the listed below items:
5	Tri square, Scriber Spirit level, Chalk stick, Scriber, Steel tape, Steel rule, Marking punch, string, transparent plastic tube.
6	Three roller plate bending machine.
7	Welding rectifier, Electrodes and other marking and measuring tools, etc.,

Suggested Project List:

1. Prepare special tools/projects/fixtures/models used for process equipment fabrication e.g., tank rotator, spider etc.,
2. Prepare a typical programme used for different fabrication calculation in Microsoft excel or suitable software e.g., plate length & diagonal calculation from data.
3. Survey/Visit nearby vendor, prepare sample specifications of fabrication tools & equipments.
4. Prepare his/her video on demonstrating different fabrication processes or process equipment part fabrication.



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5. Prepare typical tube sheet for heat exchanger from mild steel plate.
6. Prepare different types of nozzles from card board or suitable material.
7. Prepare different types of flanges from card board or suitable material.
8. Prepare different fit up & set up models from suitable material.

Suggested Activities for Students:

1. Prepare M.C.Q. type questions from given process equipment drawing.
2. Prepare solutions of different assignments given by subject faculty.
3. Prepare a list of specifications for various tools/equipment/machines used for process equipments.
4. Visit the local metal trader/ fabricator and collect all relevant information regarding process equipment tools & equipments.
5. Download videos showing correct practices for pressure vessel fabrication.
6. Student will visit the respective discipline industry / site and will prepare different procedures for process equipment fabrication.
7. Prepare a chart on shell fabrication, types of dish end, types of nozzles or other attachments.
8. Collect process equipment drawings from internet & prepare report on it.
9. Collect videos, animation showing shell, dish end, nozzle preparation for pressure vessel.
10. Prepare power point presentation on any process equipment codes/standards.
11. Prepare report on dish ends.
12. Prepare report on nozzles.



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ANNEXURE-1

❖ SAMPLE SEFTY CONTRACT:

(To be filled by the students and submitted to concerned faculty/staff)

-- Use for reference purposes only --

1. You have to read and sign the safety contract.
2. The safety contract says that you understand that safety is your responsibility.
3. The safety contract to be signed before you carry out any work in the laboratory and if you don't observe and obey the safety rules, you will not be allowed in the laboratory.

.....

Safety Contract

Date: _____

Name of Institute: _____

Name of Course with Code: Fabrication Technology-2 ()

Name of Faculty/Staff with Designation: 1. _____

2. _____

3. _____

I RECOGNIZE THAT:

1. Safety is my responsibility when using a tool.
2. Safety regulations have been provided to me.
3. The possibility of accident and injury increases if I do not follow all the safety guidelines.
4. I must act responsibly to ensure my own safety & the safety of others in the work area.

I AGREE TO:

1. Never work in the shop without my faculty's/instructor's supervision.
2. Read and practice all the safety regulations that have been distributed to me in this course or have been posted in the work areas.
3. Act in a responsible manner at all times in the laboratory.
4. Follow all instructions given by the faculty.
5. Immediately report any unsafe condition or activity to my faculty/instructor.
6. Wear eye protection at all times when working with tools or working anywhere near someone who is using tools.
5. Cut or Tie back long hair, remove jewellery, secure loosed clothing, and wear boiler suit & safety shoes in the laboratory.
6. Clean all work areas and put equipment away before leaving the laboratory.

I, _____, have read and agree with all the safety instructions.

Particulars:

Programme: _____

Batch No.: _____

Enrollment No.: _____

Student Signature
