GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Fabrication Technology

Subject Code: DI04055031

Subject Name: Process Piping Fabrication

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	PCC

Prerequisite:	-
Rationale:	This course mainly focuses on reading piping & instrumentation diagrams (P&ID), isometric drawings, welding, bending, cutting, and joining of pipes. Skilled piping engineers and fabricators are in high demand in refineries, thermal power plants, shipbuilding, fertilizer plants, water distribution systems, etc. This course opens career options as Piping Engineer, Fabrication Engineer, QA/QC Engineer, Welding Inspector, and Project Engineer.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe importance of process plant piping& piping codes/standards used in fabrication field.	U
02	Describe the functions and features of various piping components/elements.	U
03	Interpret piping isometric/spool drawing in a given situation.	A
04	Describe concept of fluid mechanics applicable in process piping.	U
05	Fabricate process piping by appropriate tools, equipments & piping elements.	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
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Basics of piping** 1.1 Introduction of piping 1.2 Duties & responsibilities of piping field engineer 1.3 Piping classification 1.4 Pipe (types, material, method of joining pipe) 1.5 Pipe vs tube 1.6 General definitions related to piping 1.7 Length areas, surfaces& volumes related to piping 1.8 Acronyms and abbreviation used in piping 1.9 Vent & drain in piping 1.10 Volume calculation of liquid storage tank 1.11 Industrial process piping 1.12 Pipe colour code& labelling 1.13 Pipe sizes & specification 1.14 Introduction of ASME, ASTM, AWS, API ASME B31.1, ASME B31.2 1.15 Basic information about ASME B31.3 (process piping)	07	16%
2.	**Piping components** 2.1 Components for butt welded piping system 2.2 Components for socket welded piping system 2.3 Components for screwed piping systems 2.4 Flanges, gaskets, valves 2.5 Fasteners 2.6 Expansion joint & flexible piping 2.7 Separator, strainer, screens, driplegs, traps, gaskets 2.8 Procedure for application of bolt torque on flanged joints 2.9 Pipe supports.	10	22%
3.	**Piping Drawing** 3.1 Introduction of piping drawing 3.2 Types of piping drawing 3.3 Piping drawing symbols and abbreviations 3.4 Introduction of G.A drawing, Process Flow Diagram (PFD), Piping &Instrumentation Diagram(P&ID), plot plan 3.5 Piping Isometric drawing / spool drawing 3.6 Calculate dimension of pipe fittings from piping isometric	08	18%

	drawing 3.7 Pipe to pipe joint development (L-joint, T-joint etc.)		
4.	**Fluid Mechanics and pipe Sizing** 4.1 Introduction to Fluid mechanics 4.2 Definition of hydraulics, fluid mechanics 4.3 Definition of total pressure and center of pressure 4.4 Properties of fluid 4.4.1 Liquid & their properties 4.4.2 Density, specific gravity, viscosity, Surface tension &capillarity action, Compressibility 4.4.3 Vapor Pressure 4.4.4 Fluid characteristics 4.5 Pressure measurement : 4.5.1 Pressure of fluid 4.5.2 Pressure head of a line 4.5.3 Pascals Law 4.5.4 Relation between positive & negative gauge pressure (Vacuum) and absolute pressure 4.6 Fluid kinematics : 4.6.1 Type of fluid flow 4.7 Fluid dynamics 4.7.1 Introduction 4.7.2 Different types of head 4.7.3 Bernoulli's equation 4.8 Laminar & Turbulent 4.9 Flow through pipes 4.9.1 Loss of energy / head in pipes (Loss of head) due to friction, 4.9.2 Minor energy losses 4.10 Water hammer in pipes	10	22%
5.	**Piping fabrication & Coating (Including green hydrogen transportation pipeline fabrication)** 5.1 Orbital pipe welding 5.2 Up-hill / down-hill welding 5.3 Spiral pipe welding 5.4 Various pipe joints and pipe welding positions 5.5 General fabrication procedure for piping spool 5.6 Shop weld plan for piping 5.7 Fit-up & set-up for welding of pipe	10	22%

	5.8 Purging/trailing gas concept in pipe fabrication 5.9 Equipment/tools / accessories used in piping fabrication 5.10 Hot tapping process 5.11 Pipe Shaping/bending/forming 5.12 Coating: definition, introduction, function & types/classification 5.13 Insulation: Introduction, function/objective & classification 5.14 Surface preparation for coating & painting 5.15 Painting: Introduction, function, ingredients, application 5.16 Green hydrogen transportation piping fabrication 5.16.1 Introduction to Green Hydrogen 5.16.2 Hydrogen Piping Systems Overview 5.16.3 Materials for Hydrogen Piping 5.16.4 Fabrication and Welding 5.16.5 Testing and Inspection 5.16.6 Safety, Risk, and Regulatory Compliance		
	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**
27 %	**57%**	**16%**	**-**	**-**	**-**

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

References/Suggested Learning Resources:

(a) Books:

Sr No	Title of Book	Author	Publication with place, year and ISBN
1	Piping Handbook	Mohinder L. Nayyar Peter H. O. Fischer	McGraw Hill, 1999-2000 Ed. ISBN 0-07-047106-1
2	The piping guide	David R. Sherwood Dennis J. Whistance	Construction Trades Press, 2019 Ed. ISBN-13 :978-0962419775
3	A Textbook of Fluid Mechanics and Hydraulic	Dr. R. K. Bansal	Laxmi Publications, 2020 Ed. ISBN-13 : 978-8131802946

	Machines		
4	A Textbook of Fluid Mechanics	R. K. Rajput	S. Chand & Co. Ltd., 2019 Ed. ISBN-13 :978-9352837205
5	Textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines	R. S. Khurmi	S. Chand & Co. Ltd., 1987 Ed. ISBN-13 :978-8121901628
6	Welding Engineering & Technology	Dr. R. S. Parmar	Khanna Publishers, New Delhi, 2010 Ed. ISBN13 : 978-8174090287
7	Maintenance Engineering: Principles, Practices & Management	Sushil KumarSrivastava	S. Chand & Co. Ltd., 2011 Ed. ISBN-13 : 978-8121926447
8	Modern Arc Welding Technology	S. V. Nadkarni	Oxford & IBH Publishing, 2014 Ed. ISBN-13: 9788120416765
9	Handbook of Piping Design	G. K. Sahu	New Age Int. Pvt Ltd. Publishers; 2008 Ed. ISBN-13 : 978-8122424560
10	Industrial Pipe work	D. N. W. Kentish	McGraw-Hill (UK/US), 1982 Ed. ISBN-13 : 978-0070845572
11	Piping Design for Process Plants	Howard F. Rase	John Wiley & Sons, 1963 Ed. ISBN-13: 978-0471709206
12	ASME Piping Codes	-	ASME
13	API Codes	-	API
14	ASTM Codes	-	ASTM

(b) Open source software and website:

1. https://www.processconstruction.com/services/piping-fabrication/
2. https://www.allaboutpiping.com/
3. https://whatispiping.com/
4. https://www.dtwd.wa.gov.au/sites/default/files/teachingproducts/ENG2068_CCBY.PDF
5. https://www.youtube.com/watch?v=tv6SMLH1A4Q&list=PLduofSZeZdCWtvM-jZEUZPi6R1j317STP
6. https://www.theprocesspiping.com/introduction-to-piping-system/
7. https://www.youtube.com/watch?v=xcB2fyMOJyw
8. https://www.youtube.com/watch?v=WtjLaGgBRcs

Suggested Course Practical List:

Sr.No.	List of Practical	No. of hours
1	Draw different pipe fittings with its function.	02
2	Demonstrate pipe sizing (ID, OD, schedule number, etc.)	02
3	Draw simple Process Flow Diagram (PFD) and P&ID (Process & Instrumentation Diagram).	02
4	Draw and interpret given simple spool/Isometric piping drawings.	02
5	Calculate/Interpret 1) end point co-ordinates 2) No of joints 3) List all given piping fitting/elements with size 4) inch-meter erection & inch dia. Welding from the given piping isometric drawing.	04
6	Prepare typical piping spool from the given piping isometric drawing with the help of mild steel wire/PVC pipe & fittings.	02
7	Prepare a job of T type piping joint.	06
8	Prepare a job of L or Angle type piping joint.	06
9	Demonstrate use of Reynolds's number.	02
10	Demonstrate purging operation for given piping joint.	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:

- Drawing instruments
- Mild steel pipes, Bench vice, Hacksaw blade, marking & measuring instruments, white chalks, various types of files, welding equipments, various piping components (e.g., bend, reducer, valves, cap etc.,)
- Reynolds's apparatus
- Pipe to pipe joints, tapes, hose pipe, nipples, purging gas, regulator, pressure gauges, etc.

Suggested Project List:

1. Prepare charts of different commercial forms of metal as per standards.
2. Prepare solutions of different assignments given by subject faculty.
3. Prepare a list of specifications for various tools/equipment/machines used for piping.
4. Visit the local metal trader/ fabricator and collect all relevant information regarding piping fittings/instruments.
5. Download videos showing correct practices for piping.
6. Student will visit the respective discipline industry / site and will prepare different procedures for piping.
7. Prepare a chart on different piping fittings &
8. Collect piping drawings from internet & prepare report on it.
9. Collect videos, animation showing piping fabrication.
10. Prepare power point presentation on any piping codes/standards.
11. Prepare report piping coatings/paintings.

Suggested Activities for Students:

1. Prepare solutions of different assignments given by subject faculty.
2. Prepare a list of specifications for various tools/equipment/machines used in the industrial piping work
3. Visit the local metal trader/fabricator and collect all relevant information and prepare the detailed report.
4. Undertake a market survey of local dealers for procurement of commercial forms of pipes.
5. Download videos showing correct practices for fit up-set up for process industry with piping related work.
6. Student will visit the respective discipline industry/site and will prepare the list of relevant equipment/machineries used in that industry/site.
7. Collect some industrial piping components; identify type of commercial form used in it.
8. Collect videos, animation showing structural fabrication.
9. Prepare power point presentation on process piping.

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ANNEXURE-1: SAMPLE SAFETY 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.

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Safety Contract

Date: _____

Name of Institute: _____

Name of Course with Code: Process Piping Fabrication (_____)

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/Instructor.
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.
7. Cut or Tie back long hair, remove jewellery, secure loosed clothing, and wear boiler suit & safety shoes in the laboratory.
8. Clean all work areas and put equipment away before leaving the laboratory.

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

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Particulars:

Programme : _____

Batch No. : _____

Enrolment No.: _____

Student Signature

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