GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730909
Semester – III
Subject Name: Pressure Vessel and Piping system Design

Type of course: Program Elective

Prerequisite: Zeal to learn the Subject

Rationale: The course aims to impart basic knowledge of design of pressure vessels and piping system. It is also aimed to introduce use of various standards used for the pressure vessel design.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Stresses in Vessels:** General theory of membrane stresses in vessel under internal pressure and its application to shells (cylindrical, conical and spherical) and end closures. Bending of circular plates and determination of stresses in simply supported and clamped circular plate; Thermal stresses, Stress concentration in plate having circular hole due to bi-axial loading, excessive elastic deformation, plastic instability, brittle, rupture and creep. Theory of reinforced opening and reinforcement limits.	**13**
2	**Design of Vessels using Codes:** Introduction to ASME cods for pressure vessel design, Pressure vessel and related components' design using ASME codes; Supports for short vertical vessels, stress concentration at a variable thickness transition section in a cylindrical vessel; Design of nozzles, Design of flanges.	**08**
3	**Supports for vertical & horizontal vessels:** Design of base plate and support lugs. Types of anchor bolt, its material and allowable stresses. Design of saddle supports.	**04**
4	**Other Design Considerations:** Buckling phenomenon, Elastic Buckling of circular ring and cylinders under external pressure, collapse of thick walled cylinders or tubes under external pressure, Effect of supports on Elastic Buckling of Cylinders, Design of circumferential stiffeners, Buckling under combined External pressure and axial Loading, Fatigue, shock, high pressure, high temperature, irradiation, corrosion, and other hostile environments, high strength, lightweight pressure vessels, vessels	**09**

	resistant to external high pressures found in undersea exploration, offshore drilling, and mineral mining.	
5	**Piping Analysis:** Flow diagram, Piping layout and piping stress analysis; Flexibility factor and stress intensification factor; Design of piping system as per B31.1 piping code. Piping components: bends, tees, bellows and valves. Types of piping supports and their behaviour; Introduction to piping Codes and Standards.	**09**

* Use of related standards / codes during Exam is permitted.

Reference Books:

1. Harvey J F, Pressure vessel design CBS publication
2. Brownell L. E & Young. E. D , 'Process equipment design', Wiley Eastern Ltd., India
3. ASME Pressure Vessel and Boiler code, Section VIII Div 1, 2, and 3.
4. American standard code for pressure piping, B 31.1
5. Henry H Bednar, Pressure vessel Design Hand book, CBS publishers and distributors
6. J. Phillip Ellenberger Pressure Vessels : ASME Code Simplified
7. Smith P, Fundamentals of Piping Design, Elsevier.

Course Outcome:

After learning the course the:

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to determine stresses induced in thick and thin cylinders.	30%
CO-2	Students will be able to design pressure vessel using ASME codes.	40%
CO-3	Students will be able to analyse piping systems.	30%