

ME495: DESIGN OF PRESSURE VESSELS
CREDITS = 3 (L=3, T=0, P=0)

Course Objective: To design pressure vessels and piping system.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	0	3	70	30	0	0	100

Course Content:

Unit No.	Topics	Teaching Hrs.
1	<p><u>Stresses in Pressure Vessels:</u> 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.</p>	10
2	<p><u>Design of Vessels using Codes:</u> Introduction to ASME codes 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.</p>	12
3	<p><u>Supports for vertical & horizontal vessels:</u> Design of base plate and support lugs. Types of anchor bolt, its material and allowable stresses. Design of saddle supports.</p>	04
4	<p><u>Other Design Considerations:</u> 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, and Buckling under combined External pressure and Axial loading.</p>	08

Fatigue, shock, high pressure, high temperature, irradiation, corrosion, and other hostile environments; High strength, lightweight pressure vessels,

Vessels resistant to external high pressures found in undersea exploration, offshore drilling, and mineral mining.

5 **Piping Design:** 08

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.

TOTAL 42

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. Stanley M Wales, Chemical Process Equipment, Selection and Design, Butterworths, series in Chemical Engineering, 1988
7. J. Phillip Ellenberger Pressure Vessels: ASME Code Simplified
8. Smith P, Fundamentals of Piping Design, Elsevier.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Determine stresses in pressure vessels
2. Design pressure vessels using codes
3. Design support members of pressure vessels
4. Apply various design considerations for pressure vessels
5. Design of pressurized fluid piping.