B.E Semester: 7 Mechanical Engineering
Subject Name: Design of Pressure Vessels and Piping (ME704-N-E)
[Dept. Elect.-4]

A. Course Objective:

- 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.

B. Teaching / Examination Scheme:

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
3	0	0	3	3	3	70	30	20	0	120

C. Detailed Syllabus:

Unit No.	Details
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.
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;
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
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 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.

Total hours (Theory):48
Total hours (Practical):00
Total hours:48

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1^{st} ,2^{nd} ,3^{rd}	Unit 1	20%	1
2	4^{th} .5^{th} ,6^{th}	Unit 2	20%	2
3	7^{th} , 8^{th} ,9^{th}	Unit 3	20%	3
4	10^{th} .11^{th} . 12^{th}	Unit 4	20%	4
5	13^{th} , 14^{th} ,$15^{th,}$,16^{th}	Unit 5	20%	5

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted toequivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overallinternal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for theconcept being taught in lectures.

F. List of Practical:

1	Case studies based on membrane theory and its applications.
2	Case studies for the analysis of circular plates with hole.
3	Understand basic design procedure for low pressure vessel, using ASME code.
4	Understand basic design procedure for high pressure vessel, using ASME code.
5	Design of nozzles
6	Design of supports for vessels.
7	Buckling analysis of vessels.
8	Design of pipes for various applications.
9	Design a pressure vessel from the industrial data and compare your design with existing design. Comment over the differences found (if any).

G. Students Learning Outcomes:

1	Analyse thin plates and shells for various types of stresses.
2	Design shells, end closures and nozzles of pressure vessels using ASME codes.
3	Analyse piping systems.

H. Text Books & Reference Books:

1	Machine Design – by P C Sharma, Agarwal
2	Mechanical Engineering Design by Josheph shighly, McGraw Hill Book Co.
3	Design of Machine Elements by V.B. Bhandari, McGraw Hill Publishing Co.
4	Design of Machine Elements by M.F.Spotts, T.E.Shoup, L.E.Hornberger, S.R.Jayaram and C.V. Venkatesh Pearson Education.
5	Design of Machine Elements by C.S.Sharma & Kamlesh Purohit, Prentice Hall of India Pvt. Ltd.
6	Mechanical System Design II & III by Farazdak Haideri Nirali Prakashan.
7	Machine Design by U.C. Jindal Pearson Education.
8	Engineering Design a material and processing approach/ George Dieter/ McGraw Hill international book company 1983