K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech
Branch Code:MEC	Pattern:2023
Name of Course:Design of Pressure Vessel and Piping	Course Code:2305306C
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

		Marks	CO
Question No. 1			
1a)	Explain any three non destructive examination (NDE) methods specified in ASME Section V.	(6)	CO1
Question No. 2			
2a)	The cylindrical pressure vessel, made of steel (Syt = 200 N/mm2), is subjected to operating pressure of 3MPa. The thicknesses of shell and torispherical heads of vessel are 14 mm and 16 mm respectively. If the weld joint efficiency is 85% and corrosion allowance is 1.5 mm, Calculate 1) the inside diameter of shell and 2) the crown radius of torispherical head	(6)	CO2
Question No. 3			
3a)	Describe the different welding processes used in pressure vessel fabrication and their importance in ensuring vessel integrity, at United Heat Transfer Industry	(8)	CO3
	OR		
3b)	Discuss the role of non-destructive testing (NDT) in quality assurance of pressure vessels, citing examples from the United Heat Transfer industry visit	(8)	CO3
3c)	What are the challenges in regulatory compliance and safety standards mentioned in relation to emerging pressure vessel technologies	(8)	CO3
	OR		
3d)	What are some of the lightweight, high-strength materials being explored for pressure vessel construction, and why are they considered advantageous	(8)	CO3
Question No. 4			
4a)	How do different piping codes in ASME, address specific safety and design requirements	(8)	CO1
	OR		

4b)	Explain the basic components of a piping system, including the functions of each component. How do these components work together to ensure efficient fluid transportation in industrial applications	(8)	CO1
4c)	What is a piping system? Briefly explain the primary functions of a piping system in industrial applications.	(8)	CO1

OR

4d)	How does the design of a piping layout impact the efficiency and safety of a pressure vessel system? What key considerations must engineers account for when planning the arrangement of piping components	(8)	CO1

Question No. 5

5a)	A horizontal steel pipe with an outer diameter of 350 mm , Wall thickness (t) = 9 mm is subjected to an internal pressure of 5 MPa. The pipe is exposed to corrosion, so a corrosion allowance of 2 mm is considered. Additionally, the pipe is welded along its length, and the weld joint efficiency is 85%. The pipe is also restrained at both ends, preventing expansion during heating, and the temperature rises by 70°C. Coefficient of thermal expansion for steel (α) = 12×10^{-6} /°C, Young's modulus for steel (E) = 210 GPa Calculate: 1.The hoop stress 2. The axial thermal stress due to the temperature rise.	(8)	CO4

OR

5b)	Water flows through a horizontal pipe with an internal diameter of 300 mm and a length of 300 meters. The flow rate is 0.12 m^3/s, and the Darcy-Weisbach friction factor is f=0.02. In addition to major losses due to pipe friction, the system experiences the following minor losses: 1. Loss of head due to sudden enlargement with a diameter change from 200 mm to 250 mm (Kenlargement = 0.2), 2. Loss of head at the entrance of the pipe (Kentrance=0.5), 3. Loss of head at the exit of the pipe (Kexit=1), 4. Loss of head due to various fittings (Kfittings=2), The density of water is 1000 kg/m3. Calculate the total pressure drop considering both major friction loss and all minor losses.	(8)	CO4
5c)	A horizontal steel pipe of length 25 meters and an external diameter of 260 mm carries water at 35°C. The density of water is ρ=1000 kg/m3, and the pipe itself has a weight of 80 kg per meter. The system needs to be supported using pipe supports placed at equal intervals along the length of the pipe. The pipe is to be supported to prevent sagging and excessive deflection. Design the pipe support system, ensuring that the maximum bending stress in the pipe does not exceed σmax=170 MPa. Assume the pipe is made of steel with a Young's modulus E=200 GPa, and the supports are modeled as simple supports	(8)	CO4

OR

5d)	A 25 m long steel pipe carrying steam is subjected to a temperature increase from 25°C to 250°C. The coefficient of thermal expansion for steel is α=12×10−6 °C and Young's modulus of steel is E=200 GPa, Calculate: 1. The axial thermal stress due to the temperature rise. 2. What are the critical inspection techniques used for piping systems to ensure they meet safety and regulatory standards?	(8)	CO4

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