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NATIONAL INSTITUTE OF TECHNOLOGY HAMIRPUR

B. Tech (Chemical Engineering) – Vth Semester

END-SEMESTER EXAMINATION (Nov.-Dec., 2023)

CH-313 PROCESS EQUIPMENT DESIGN -I

Duration: 3 Hrs. **Max. Marks: 50**

Note:

- *Attempt all questions*
- *Wherever necessary, draw neat diagram, assume data if required*
- *Assign proper and correct number for each answer in the answer sheet.*

Sr. No.	Questions	Marks	COs
1.	Calculate the thickness of skirt support from following given data. Diameter of vessel : 3000mm Height of vessel : 37.5m Weight of vessel, attachment = 200000kg. Diameter of skirt : 3000mm Height of skirt : 4.8m Wind pressure : 128.5kg/m^2 K1 (Shape factor for Cylindrical vessel = 0.7 K2 (Period of vibration is less than 0.5 sec) = 1. Cs (Seismic coefficient) = 0.8. Calculate thickness of skirt support.	**10**	CO1 CO2 CO3
2.	Explain in detail the different theories of failure for thick vessel design.	**5**	CO1
3.	A pipe 200 mm internal diameter and 50mm thickness carries a fluid at a pressure 10 MPa. Calculate the maximum and minimum intensities of circumferential stress across the section. Also sketch the radial and circumferential stress distribution.	**5**	CO1 CO3
3.	Write a short note on flange, and Explain in detail the design of the non-standard flange.	**10**	CO2 CO3
[illegible]	Prove that the strength of transverse fillet weld is 1.17 times of parallel fillet weld.	**10**	CO1 CO3
5.A.	A cylindrical vessel of 2 meter outer diameter and 3 meter height is to operate at a design pressure of 1 MN/m^2 and design temperature of 310 ^{O}C. The allowable stress of material is 100MN/m^2 at the given temperature. Weld joint efficiency is 0.9. Assume that the thickness of vessel is very small in comparison to diameter of vessel. What will be the thickness of this column assuming it to be a small column.	**5**	CO2 CO3
5.B.	Under similar operating conditions to above tall column of 20 meter is to be designed with the following details: Total axial stress due to shell weight, weight of liquid, weight of attachments (including tray weight) and the weight of insulation collectively is given as, $\sigma_{zw} = 0.23X - 0.25$ MN/m^2. Axial stress due to the wind moment is $\sigma_{zwm} = 0.02X^2$ MN/m^2, Where, X is total height of the column. Carry out a check, if the thickness obtained for the small column will be sufficient for the tall column (both tensile and compressive checks). Modulus of elasticity of shell material is 10^5.	**5**	CO2 CO3