

1. Question one is compulsory
2. Attempt any three from Q.2 to Q.6
3. Use of ASME, TEMA, API code is permissible.
4. Assume data wherever necessary
5. Figure to the right indicate full marks.

Q.1 Attempt any four of the following

- a) Classify pressure vessels.
- b) Describe non destructive testing of pressure vessels.
- c) Draw the diagram of pressure vessel showing all components.
- d) State brief reasons for loss of fluid in storage tanks.
- e) What are the factors to be considered for selection of agitators.

Q.2

a) A cylindrical storage tank with open top has following data.

Tank diameter	20 m
Tank height	12 m
Density of liquid	1000 kg/m ³
Permissible stress	165 N/mm ²
Modulus of elasticity	2 x 10 ⁵ N/mm ²
Corrosion allowance	2 mm
Material of construction	Carbon steel
Density of MOC	7850 kg/m ³

Design

- i. Shell plate thickness at various height.
 - ii. Wind girder
- b) Write down design procedure cylindrical shell subjected to external pressure.

Q.3

- a) A pressure vessel is constructed of SA 516 – 70 material and has an inside diameter of 2 meter. The internal design pressure is 70 bar. The corrosion allowance is 2 mm and the joint efficiency is 0.85. What is the required thickness of vessel if the allowable stress is 20 MPa and also calculate maximum allowable pressure.
- b) State various types of jackets used in heat exchanger and explain any one.

Q.4

- a) A propeller operating at 350 rpm speed in a vessel of 1200 mm diameter with following data: Design shaft based on equivalent bending and critical speed.

Internal pressure in a vessel	0.3 N/mm ²
Specific gravity of liquid in vessel	1.1

Turnover

Diameter of agitator	300 mm
Power number	0.9
Overhang of shaft from bearing support	1500 mm
Shaft material	Stell
Permissible shear stress	50 N/mm ²
Elastic limit in tension	250 N/mm ²
Modulus of elasticity	2×10^5 N/mm ²

- b) Sketch different types of support used for process equipment. 8
- a) Design shell size, tube size and tube shell thickness of shell and tube heat exchanger. 8

Data refer to shell side

Fluid	liquid
No of shell	1
No of passes	1
Working pressure	5 bar
Inlet and outlet temperature	150 and 60 degree respectively

Data refer to tube side

Fluid	Gas
No of tubes	54
Tube length	8m
Working pressure	3 bar
Pitch	25 mm(square)

- a) State different types of heads(end closures) and draw sketch of each type. 8

6 Attempt any four

- Design consideration in process equipment design
- Enlist Pattern of tubing and draw any one type.
- Application of ASME code as per sections.
- Procedure of rectangular tank.
- Discuss various type of loading used in pressure vessel.