

ME sem I / mechanical / choice based / 2nd Nov 2018  
(3 Hours) [Total Marks: 80] 7/12/2018

1. Question one is compulsory
2. Attempt any three from Q.2 to Q.6
3. Assume data wherever necessary
4. Figure to the right indicate full marks.

- Q.1 Attempt any four of the following 20
- a) Write a note on PID and PFD diagram.
  - b) State the procedure for spherical shell subjected to an external pressure.
  - c) State the procedure of design of leg support.
  - d) Classify agitators.
  - e) Estimate the period of vibration for a tall vessel 2.5 m in diameter and 40 m in height. The thickness of vessel is 12 mm. the column has no attachment. weight of the vessel per unit length is 1250 kg/m.
- Q.2 a) A tall vertical vessel 1.5 m in diameter and 13 m height is to be provided skirt support. 12  
Weight of the vessel with all its attachment is 80000kg. Diameter of skirt is equal to the diameter of the vessel. Height of skirt is 2.2 m. Wind pressure acting over the vessel is 100 kg/m<sup>2</sup>.  
K<sub>1</sub> = 0.7 for cylindrical vessel.  
C = 0.08 seismic coefficient.  
Permissible tensile stress of skirt material = 960 kg/cm<sup>2</sup>  
Permissible compressive stress is 1/3 of yield stress of material.  
Yield stress of material = 2400 kg/cm<sup>2</sup>  
Estimate thickness of skirt support.
- b) State complete design of API tank. 8
- Q.3 a) State various types of roof for storage vessels. 10  
b) Explain the design of flanged joint. 10
- Q.4 a) A propeller operating at 350 rpm speed in a vessel of 1200 mm diameter with following 12  
data: Design shaft based on equivalent bending and critical speed.
- |                                      |                       |
|--------------------------------------|-----------------------|
| Internal pressure in a vessel        | 0.3 N/mm <sup>2</sup> |
| Specific gravity of liquid in vessel | 1.1                   |
| 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 <sup>2</sup>
Elastic limit in tension	250 N/mm <sup>2</sup>
Modulus of elasticity	$2 \times 10^5$ N/mm <sup>2</sup>

b) Write a note on importance of design code and standards 8

Q.5 a) A cylindrical storage tank with open top has following data. 10

Tank diameter	20 m
Tank height	12 m
Density of liquid	1000 kg/m <sup>3</sup>
Permissible stress	165 N/mm <sup>2</sup>
Modulus of elasticity	$2 \times 10^5$ N/mm <sup>2</sup>
Corrosion allowance	2 mm
Material of construction	Carbon steel
Density of MOC	7850 kg/m <sup>3</sup>

Design

- i. Shell plate thickness at various height.
  - ii. Wind girder
- b) State different types of pressure vessels and draw sketch of each type and explain design procedure of cylindrical pressure vessel. 10

Q.6 Attempt any four 20

- a) Design consideration in process equipment design
- b) Base plate and skirt bearing plate
- c) Classification of heat exchanger as per TEMA.
- d) Describe procedure of rectangular tank.
- e) Effect of wind load and seismic load on tall vessels