Duration: 3 Hours **Total Marks: 80**

N. B. (i) Question number **one is compulsory.**
(ii) Answer any **three** questions from the rest.
(ii) Assume suitable data wherever necessary.

Q. 1 Write short note on any **four** **20**

a) Design Pressure and Design Temperature
b) Various types of heads
c) Power Requirement for Agitation
d) Calendria Evaporator
e) Stresses in Column Shell

Q.2(a) Design storage tank for following data: (Shell plates and bottom plates) **10**
Tank diameter = 3 m
Tank ht = 6 m
Density of liquid = 980 kg/m^3
Superimposed load = 1200 N/m^2
MoC = CS
Permissible stress = 95 N/mm^2
Density of MoC = 7800 kg/m^3
Corrossion allowance = 2 mm
E = 2*10^5 N/mm^2
Weld joint efficiency = 0.85
Shell plate and bottom plate size = 5000 x 2000 mm (L x W)

Q.2(b) Write design procedure for determination of shell thickness at different heights for distillation column. **10**

Q3 (a) Design a propeller operating at 350 rpm speed in a vessel of 1200 mm diameter with following data **10**

Internal pressure in vessel	= 0.3 N/mm^2
Specific gravity of liquid in vessel	= 1.1
Diameter of agitator	= 300 rpm
Power Number	= 0.9
Overhang of shaft from bearing support	= 1500 mm
Shaft material	= steel
Permissible shear stress	= 50 N/mm^2
Elastic limit in tensions	= 250 N/mm^2
Modulus of elasticity	= 2x10^5 N/mm^2

Q 3(b) Explain types of supports with neat diagram. **10**

Q 4(a) Design a U-tube heat exchanger for the following data- **12**

Shell Side:

Design Pressure	= 0.8 N/mm^2
Permissible stress of shell material	= 100 N/mm^2
Standard torispherical head with knuckle radius	= 6% crown radius
25 % cut segmental baffles	
Gasket on shell side	= flat metal jacketed asbestos filled
Gasket factor	= 3.75
Gasket seating stress	= 53 N/mm^2

Tube side :

No of Tubes	= 40
Tube outside diameter	= 20 mm
Design pressure of tube side fluid	= 2 N/mm^2
Permissible stress for tube material	= 120 N/mm^2
Tube pitch	= square 35 mm

Channel and channel cover MOC same as shell, Joint with tubesheet ring facing with 18 mm width

Gasket factor	= 5.5
Gasket Seating stress	=126 N/mm^2

Design i) Shell diameter and thickness ii) Flanged joint between shell and tube sheet iii) Tube sheet thickness

Q 4(b) Explain Internal Parts of Packed column **08**

Q 5(a) Write the design procedure for a Standard Vertical Short Tube Evaporator for the following data- **12**

Design should include-
(a) Diameter of tube sheet,
(b) Calendria sheet thickness,
(c) Tube sheet thickness,
(d) Drum diameter and thickness

Q 5(b) Explain Various types of jackets with neat diagram and write design of plain jacket **08**

Q 6(a) Design a pressure vessel subjected to internal pressure for the following data: **10**

Shell and head data: Operating pressure = 0.5 N/mm^2,
ID of the shell = 900 mm
Permissible stress for head and shell material = 95 N/mm^2,
Corrosion allowance = 1.5 mm
Weld joint efficiency = 0.85
Crown radius = Shell ID
Knuckle radius = 10 % of shell ID
Flanged joint: Gasket factor = 3.75,
Min gasket seating stress = 52.5 N/mm^2
Flange material same as shell material.
Permissible stress for bolt material = 138 N/mm^2

Design should include Shell, tori spherical Head, flanged joint.

Q.6(b) Short Note on **10**

i) Explain types of losses in storage of volatile liquids.

ii) What are standard and codes? List out different standards.