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.

Q1 Write short note on any four 20
(a) Types of heads. Explain any one with neat diagram.
(b) Dye Penetration Method
(c) Shell and tube type Heat Exchanger
(d) Power Requirement for Agitation
(e) List out types of roofs. Explain any one in detail.

Q2 a) Write the design procedure for a Standard Vertical Short Tube Evaporator for the following data- Design should include- 12
(a) Diameter of tube sheet,
(b) Calendria sheet thickness,
(c) Tube sheet thickness,
(d) Drum diameter and thickness
b) Explain with neat diagram different types of agitators and their applications. 08

Q3 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 tori spherical 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 tube sheet ring facing with 18 mm width
Gasket factor = 5.5
Design i) Shell diameter and thickness
ii) Flanged joint between shell and tube sheet
iii) Tube sheet thickness
b) List out types of NDT methods. Explain Radiography in detail with neat diagram. 08

Q4 a) Write the detail design procedure of tall column shell thickness calculation. 12
Design procedure should include calculation of column stresses.
b) Explain Various types of jackets with neat diagram and write design of plain jacket 08

Q5 a) Design storage tank for following data: (Shell plates and bottom plates) 12

Tank diameter = 3 m

Tank height = 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

Corrosion 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)

b) Short Note on 08

i) Losses in storage vessel

ii) Design Pressure and Design Temperature

Q6 a) Design the flanged joint for a cylindrical pressure vessel for the following data 12

Design pressure = 0.5 N/mm^2

Shell Outside diameter = 1000 mm

Shell Inside diameter = 988 mm

Shell thickness = 6 mm

Bolt Material = Hot rolled carbon steel

Allowable stress for bolt material

At atmospheric condition = 57 N/mm^2

At operating condition = 53 N/mm^2

Allowable stress for flange (carbon steel) = 95 N/mm^2

Gasket factor = 2

Minimum design seating stress = 11 N/mm^2

b) Write short notes on 08

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

ii) Explain Internal Parts of Packed column

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