(4 hours) Maximum marks: 80

N.B.

1. **Question No.1** is compulsory.
2. Attempt any **three** out of remaining **four** questions.
3. Assume any suitable data if necessary and indicate it clearly.
4. Figures to the right indicate marks.
5. Illustrate answers with sketches wherever required.

1. Write short notes on any **four.** 20
   a) Gaskets and their selection.
   b) Various theories of failure.
   c) Design of stuffing box.
   d) Equipment classification.
   e) Various metal forming techniques.

2. a) Describe design procedure of a flanged joint. 10

   b) Design the thickness of a cylindrical shell subjected to an internal pressure of 0.5 N/mm^2. Also check the resultant stress in the shell for safety with the following data. 10
   Permissible stress of the material used = 140 N/mm^2
   Internal diameter of the vessel = 1500 mm
   Spot radiographically tested double welded butt joint (J = 0.85)
   Total weight of the vessel and its content = 40 kN
   Torque due to offset piping in the shell = 1500 Nm

3. a) A cylindrical storage vessel has the following dimensions: 14
   Diameter of tank = 12 m
   Height of tank = 15m
   Specific gravity of liquid to be stored = 1.2
   Permissible stress of material of construction of tank = 98 N/mm^2
   Joint efficiency factor = 0.85
   Corrosion allowance = 1.5 mm
   Modulus of elasticity = 2×10^5 N/mm^2
   Assume superimposed load of 1225 N/m^2
   Density of steel = 7800 Kg/m^3
   Design:
   (a) i. Shell ii. Bottom iii Roof

   b) Draw to a recommended scale the front view of the shell and show the fabrication details. 6

4 a) Write a design procedure for agitator vessel which includes: 15

i) Agitator shaft, ii) Blade assembly, iii) Stuffing box.

b) Draw a proportionate drawing of stuffing box. 5

5 a) Design a reaction vessel with following data. 16

Inside diameter of shell = 1200 mm;
Jacket shell inside diameter = 1325 mm
Jacketed on straight side only with jacket length = 1000 mm
Design pressure shell = 0.4 N/mm^2
Design pressure Jacket= 0.45 N/mm^2;
Design temperature (shell and jacket) = 150°C
Standard torisperical heads are provided on top and bottom.
Allowable stress for shell and head material = 120 N/mm^2
Modulus of elasticity = 1.7×10^5 N/mm^2
Poisson's ratio = 0.3
Allowable stress for jacket material = 95 N/mm^2
Corrosion allowance for shell = 1.5 mm
Corrosion allowance for jacket = 2 mm
Internal diameter of half jacket coil = 100 mm
Weld joint efficiency factor for shell and jacket = 0.85
Weld joint efficiency factor for heads = 1
Factor B for (L/D_o with 0.825 and D_o/t = 202 considering thickness of shell as 6 mm) = 9000
If two stiffening rings are provided , Factor B for (L/D_o with 0.275 and D_o/t = 202 considering thickness of shell as 6 mm) = 13000
Use stiffener of 40 mm x 40 mm (width x thickness)

b) Draw front view of reaction vessel. 4

6. Write short notes on any **four.** 20

a) Classification of reaction vessels.
b) Saddle supports.
c) Skirt supports.
d) Wind girders.
e) Explain in detail metal joining arc welding method with neat sketch.
