(4 hours) **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) Types of heads.

   b) Mechanical Seals.

   c) Heating and cooling systems in reaction vessel.

   d) Theories of failure.

   e) Supporting structures for pipelines.

2. a) Design a pressure vessel for the following specifications: 15

   i) Shell

   Internal Diameter = 1000 mm

   Material = Carbon steel (IS 2002)-(CS)

   Permissible stress for CS at 150^0 C = 140 N/mm^2

   Design pressure = 0.5 N/mm^2

   ii) Head (Standard Torispherical)

   Crown Radius = 1000 mm

   Knuckle radius = 6 % of Crown radius

   Material = Carbon steel (IS 2002)-(CS)

   Permissible stress for CS at 150^0 C = 140 N/mm^2

   iii) Flange, Gasket and bolt data:

   Gasket factor = 3.75

   Minimum design gasket seating stress = 52.5 N/mm^2

   Flange material is same as shell material.

   Permissible stress for bolt material = 138 N/mm^2

   Bolt size M 20 x 2 with root area = 200 mm^2

   Design should consist of the following:

   i) Shell ii) Head and iii) Flanges

b) Draw to recommended scale, the above designed cylindrical pressure vessel. 05

3. 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. 05

4. a) A cylindrical storage tank with open top has the following data : 14

Tank Diameter = 9 m

Tank Height = 7.5 m

Material of construction = Carbon Steel (IS : 2002- Grade 2B)

Density of Liquid = 0.001 kg/cm^3

Permissible stress = 120 N/mm^2

Design: 1 Shell plate thickness at various height

2 Wind girder.

(Use standard plate size as 1500 mm (width) x 5000 (length)

Standard curb angle of 75 x 75 x 6 mm size with sectional modulus 36.3 cm^3)

b) Draw to recommended scale, the above designed storage tank. 06

5. a) Describe the design procedure for reaction vessel with- 15

i) Plain Jacket

ii) Half Coil Jacket

iii) Channel Jacket

b) Draw to recommended scale, the above designed jackets. 05

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

a) Standards, codes and their significance.

b) Losses in storage of volatile liquid.

c) Nozzles.

d) Various metal forming techniques.

e) Types of gaskets.
