

Model Question Paper
Seventh Semester B.Tech. Degree Examination, November 2016
(2013 scheme)
CHEMICAL ENGINEERING BRANCH
13.701: CHEMICAL ENGINEERING DESIGN – I (H)

Time: 3 Hours

Max. Marks : 100

Instructions:

1. Answer **any one full** question from **each** module.
2. The certified copies or originals of the following codes are **permitted** in the exam hall.
IS Codes-IS 2825:1969, IS 1730:1989, IS 803:1976, IS 4045
3. Certified copies of relevant data tables, charts and graphs for the design.
4. Assume missing data suitably.

Module 1

1. Suggest a suitable design for a storage tank to store 250000 kg of benzene required in the production of alkyl benzene sulphonate. The storage tank will be filled to 90% of its capacity and maintained at atmospheric condition. Due to space limitations, maximum tank diameter which can be used is 3.6 m. material of construction is mild steel of density 7850kg/m³ and allowable stress 125 N/mm² (50 Marks)

OR

2. An integral flange with a plain face for a heat Exchanger shell is required to be designed to the following specification
Design pressure = 1 MN/m²
Design temperature = 160 °C
Flange material = IS 2004-1962 Class 2
Bolting material is Cr/Mo
Gasket material is asbestos composite
Shell outside diameter = 1 m
Shell inside diameter = 0.98 m
Shell thickness = 0.1 m
Allowable stress for flange material = 100 MN/m²
Allowable stress for bolting material = 138 MN/m² (50 Marks)

Module 2

3. Perform the mechanical design of the tall vertical vessel with following specifications:
Maximum wind speed expected (upto 20 m) – 140 km/h
Shell outside diameter – 2 m
Shell length, tangent to tangent – 16 m
Skirt height – 4 m
Operating temperature – 300 °C

Operating pressure – 0.7 MN/m²
Design temperature – 320 °C
Design pressure – 0.8 MN/m²
Shell material: IS 2002-1962 grade II B
Shell is double welded with Butt joint no stress soldering or radiographing.
Corrosion allowance – 3 mm
Tray spacing – 0.75 m
Top disengaging space – 1 m
Bottom separate space – 2.75 m
Weir height – 75 mm for all trays
Down comer clearance – 25 mm for all trays
Weight of each head – 7.5 KN
Tray loading excluding liquid – 1 KN/m²
Tray support rings – 60 X 60 X 10 mm angle
Insulation – 75 mm asbestos
Accessories: 1 lagged ladder
Design in accordance with IS code for unfired pressure vessel with class II vessel type.
Neglect seismic forces. (50 Marks)

OR

4. Design a bracket support for a column of diameter 2m, height 4m with a ground clearance 1.2 m to be erected in the opening air where the maximum wind velocity is expected to be 140 km/h under inclement weather conditions. The maximum weight of the vessel along with the contents can be approximated as 25 tons. The permissible stresses for shell and support material are:
- | | | | |
|-------------|---|--------------------------|------------|
| Tension | = | 14.29kgf/mm ² | |
| Compression | = | 12.48kgf/mm ² | |
| Bending | = | 15.75kgf/mm ² | (50 Marks) |