

**10166 : Process Equipment Design and Drawing : 6 CH 04**

P. Pages : 2

Time : Three Hours

**AW - 3249**

Max. Marks : 80

- Notes :
1. Answer **three** question from Section A and **three** question from Section B.
  2. Assume suitable data wherever necessary.
  3. Diagrams and chemical equations should be given wherever necessary.
  4. Illustrate your answer necessary with the help of neat sketches.
  5. Use of pen Blue/Black ink/refill only for writing the answer book.

**SECTION - A**

1. a) Discuss various simple stresses induced in machine components in detail. 7  
b) Discuss the various materials used for linings in process vessels. 6

**OR**

2. a) Discuss the various factors required to be considered in determining the 'factor of safety' in process equipment design. 7  
b) Explain the various types of cyclic stresses. 6
3. a) The load of bolt consist of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to  
i) maximum principal stress theory.  
ii) maximum shear stress theory.  
permissible tensile stress at elastic limit is  $100 \text{ N/mm}^2$  and Poisson's ratio is 0.3. 7  
b) Explain the failure of thin cylindrical shell subjected to internal pressure. 6

**OR**

4. a) Derive an expression to find out optimum vessel size of pressure vessel. 7  
b) What are different methods used for fabrication of vessel? Explain it. 6
5. a) Discuss the design of multilayer vessel with shrink fitted shell applied for high pressure operation. 7  
b) Explain the causes of shaft failure in mixing and agitation system. 7

**OR**

6. A thick walled vessel has an inside diameter of 30 cm and outside diameter of 60 cm the yield stress of material is  $5000 \text{ kg/cm}^2$ . Calculate the variation of tangential and radial stress if it is operated at  $4500 \text{ kg/cm}^2$ . Also find out maximum pressure at which yielding of material starts. 14

7. a) Discuss the design of saddle support in details. 7
- b) Discuss the use of nozzles in process equipments and different types of nozzles. 7

**OR**

8. a) Explain in detail the classification of flanges with the help of neat sketches. 8
- b) How to estimate the stresses due to Seismic load. Discuss. 6
9. a) A centrifugal pump is driven by motor through a single set of 5 : 1 reduction gears power of motor is 12 H.P. while rpm is 1900. Load can be considered to be applied with minor shocks. Calculate the diameter of shaft on the motor and pump, when design stress of shaft material is  $490 \text{ kg/cm}^2$ . 7
- b) Explain the various parameters to be considered while designing a good agitation system. 6

**OR**

10. a) What is stress concentration. Discuss methods of its reduction. 7
- b) Discuss the various materials of construction for process equipments. 6
11. a) Water flows through a pipeline 20 mm in internal diameter. Distance of pipeline is 3 km. The impressed head of water is 15 m of water. Estimate volumetric and mass flow rate of water. 9
- Viscosity of water is  $1 \times 10^{-3} \text{ N-s/m}^2$   
density of water  $1 \text{ kg/lit}$ .
- b) Explain the condensate piping with the help of velocity equation. 4

**OR**

12. a) What are the criteria for material of selection for pipe line system. Discuss in detail. 7
- b) What are the various types of supports for piping system in process industry. Explain with neat sketches. 6

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