

Total No. of Questions : 12]

SEAT No. :

P1201

[4659] - 298

[Total No. of Pages : 3

B.E. (Chemical Engineering)
d - PIPING DESIGN AND ENGINEERING
(2008 Course) (Elective - II) (Semester - I)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answer three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Answers to the two sections should be written in separate Answer book.*

SECTION - I

- Q1) a)** Discuss the procedure in determining pipe diameter for specified height of pipe wall roughness and the discharge? **[8]**
- b) A concrete pipe 2m inside diameter is used to transport water from a pumping facility to a storage tank 5km away. Neglecting any difference in elevations, calculate the friction factor and pressure loss in kPa/km due to friction at a flow rate of 34,000 m³/h. Assume a pipe roughness of 0.05mm. If a delivery pressure of 4kPa must be maintained at the delivery point and the storage tank is at an elevation of 200m above that of the pumping facility, calculate the pressure required at the pumping facility at the given flow rate.

Data: Darcy friction factor (f) = 0.01 **[10]**

OR

- Q2) a)** Derive the following, $\Delta Q = \frac{-\sum r \cdot Q_o^n}{\sum r \cdot n \cdot Q_o^{n-1}}$. **[8]**
- b) Explain the different types of major and minor losses occurring in piping system? **[10]**

- Q3) a)** Discuss the different sections of ASME B31 Code for Pressure Piping? **[8]**

P.T.O.

- b) State and explain the different material standards for metallic piping components? [8]

OR

Q4) a) Explain the various types of pipe fittings in detail? [8]

- b) Discuss the various types of gasket according to ASME B 16.5 and B16.47 for flanges? [8]

Q5) a) Write down the different types of butterfly valve along with neat sketch? Also state the merits and demerits along with the applications. [8]

- b) Explain the steps used for sizing of pressure relief valves as per API RP 520? [8]

OR

Q6) a) Discuss the working principle and applications of Rupture Disks? [8]

- b) Write down the general guidelines used for positioning safety valve along with the example of pressure-reducing station? [8]

SECTION - II

Q7) a) Discuss the significance of Churchill and Swamee-Jain equation for calculation of friction factor in Compressed-Air Piping Systems? A pipe is to be designed to carry 150 CFM free air at 100 psig and 80 °F. If the pressure loss must be limited to 5 psi per 100 ft of pipe, what is the minimum pipe diameter required? [10]

- b) Discuss the concept of Deposition Velocity? Calculate the deposition velocity of a heterogeneous slurry with a solid specific gravity of 3.0 in water, for a pipeline with an 8-in internal diameter. The particle size = 1mm, and volume concentration = 15 percent.

Data: Froude number $F_L = 1.45$ [8]

OR

Q8) a) A steam piping system transports 20,000 lb/h of dry saturated steam at 150 psia. If the velocity is limited to 3000 ft/min, what size pipe is required? Calculate the pressure loss due to friction in 500 ft of pipe using the Unwin and Darcy equations, and compare the answers obtained.

Data: $v_s = 3.015 \text{ ft}^3/\text{lb}$. [10]

- b) Calculate the friction factor and transmission factor using the Colebrook-White equation for a 16-in (0.250-in wall thickness) gas pipeline at a flow rate of 100 MMSCFD. Flowing temperature = 80 °F, gas gravity = 0.6, viscosity = 0.000008 lb/(ft.s), base pressure = 14.73 Psia, and base temperature = 60 °F. Assume a pipe internal roughness of 600 microinches. [8]

- Q9)** a) Which are the factors considered while locating the equipment in the plot plan? [8]
- b) Discuss the different types & approval, engineering and construction issues involved in the development of P& IDs? [8]

OR

- Q10)**a) Which data is required for establishing the pipe rack width, number of levels, elevations and bent spacing? [8]
- b) Develop the typical layout considerations for reactor and pump? [8]

- Q11)**a) Determine the minimum insulation thickness required for a pipe carrying steam at 180 °C. The pipe size is 8" and the maximum allowable temperature of outer wall of insulation is 50 °C. Thermal conductivity of the insulation material for the temperature range of the pipe can be taken as 0.04 W/m. K. The heat loss from steam per meter of pipe length has to be limited to 80W/m.? [8]
- b) Write down the different insulation material classifications mostly used in the industrial and commercial piping industry? [8]

OR

Q12) Write short notes on [16]

- a) Responsibilities of piping engineer.
- b) Two design criteria's for insulation system design in piping.
- c) Critical and Optimum thickness of insulation.
- d) List of documents for preparation of layout for a process plant.

