Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech Mid Semester Exam

Semester:6 | **Date: (31/01/2024)**
Subject Code: (203103355) | **Time: (1hr: 30min)**
Subject Name: (Process Equipment Design) | **Total Marks: 40**

Instruction:

1. Q.1. is compulsory.
2. Figure to the right side indicates maximum marks.
3. If required assume necessary data.

Q.1 **(A)** **05**

1. Flow rate of fluid created by pump is known as_____.
   a) NPSH b) Vapor Pressure c) Capacity of Pump d) None

2. NPSH available can be calculated by_____.
   a) Process Engineer b) Project engineer c) Production engineer d) supplier

3. Design of Heat Exchange is Belongs to Mechanical Aspect design.
   a) True b) False

4. Wall thickness of schedule number 40 pipe as compared to that of schedule 80 pipe is _____.
   a) More b) Less c) same d) depends on I.D.

5. What is the Density of carbon monoxide gas at the discharge pressure of pipe is atmosphere, Temperature of gas is 50^0 C?
   a) 1.0558 kg/m^3 b) 8.535 kg/m^3 c) 2.535 kg/m^3 d) 1.99 kg/m^3

(B) **05**

Estimate the optimum pipe diameter for a flow of dry chlorine gas of 10000 kg/h at 4 atm and at 20°C through carbon steel pipe.

Q.2 **Attempt any four (Short Questions)** **12**

(1) Define: Critical Pressure, Critical Temperature, Equivalent Length
(2) Distinguish between (NPSH)A and (NPSH)R.
(3) Explain NPSH and give its importance for pump design.
(4) Give the difference between CODE and standards in process equipment design.
(5) What is difference between tube and pipe.

Q.3 **Attempt any two questions** **08**

(1) Justify the effects of larger diameter pipe operating cost and fixed cost.

(2)
Calculate the pipe size required based on Following data :
Flow rate CO =1000 ton/day
Total length= 800 m
Available pressure at inlet of pipe = 24 kpa g
Discharge pressure of CO from pipe required = Atmospheric
No. of 90^0 Elbows in pipe line = 9 , Value of K=0.75
No. of Butterfly valve = 1, Value of K=0.24
No. of flow nozzle =5
Temperature of gas =60^0
Viscosity of CO gas =0.016 Centipoise.
Velocity=20 m/s

(3) Hexane at 37.80C is pumped through the system at a rate of 9.09 m^3/hr. The tank is at atmospheric pressure. Pressure at the end of discharge line is 345 kPa g. The discharge head is 3.05 m, and the suction lift is 1.22 m above the level of liquid in the tank. The friction loss in suction line is 3.45 kPa and that in the discharge line is 37.9 kPa. The mechanical efficiency of the pump is 0.6. The density of hexane is 659 kg/m3 and its vapour pressure at 37.80C is 33.71 kPa.

Calculate (a) $(NPSH)_A$

Q.4 **(A)** Find out the power required for a turbo blower for the following duty. **05**

Fluid = Atmospheric air
Capacity = 1000 Nm^3/h
Discharge pressure = 2 atm a
Also find the discharge temperature of air.
Data: For air, k = 1.395, Temprature 50^0

$$P_a = 2.78\times10^{-4}\frac{k}{k-1}q_{v1}p_1\left[\left(\frac{p_2}{p_1}\right)^{\frac{k-1}{k}}-1\right]$$

Discharge temperature of Air

$$T_2 = T_1\left(\frac{p_2}{p_1}\right)^{\left(\frac{k-1}{k}\right)}$$

(B) List out with schematic diagram the flow meters and Explain the Principle and working of Venturi meter. **05**

OR

(B) Design an orifice meter based on the following data : **05**
Name of fluid= Water
Flow rate =150000 kg/h
Inside Diameter of pipe =154 mm (SCH-40 pipe)
Operating temperature=320C
Density of water =995 kg/m3
Viscosity of water=0.765 mPa
Manometer fluid=Mercury
Density of mercury=13516 kg/m3
Dia of Orifice =do =77 mm
Take C0 = 0.6055, g=9.81,gc =1