Paper Code: CH-603	**Roll No.**									

B.Tech.

(SEM VI) EVEN SEMESTER EXAMINATION, 2015-16

PROCESS EQUIPMENT DESIGN

[Time: 3 hrs.] **[Max. Marks: 100]**

Note: - Attempt all questions. All questions carry equal marks. Assume suitable data if missing/required. Standard data books are allowed.

Q 1. Attempt any four parts of the following: **[5x4=20]**

(a) Explain the design parameters involved in mechanical and device.
(b) Discuss various types of pressure seals used in high pressure vessels on rotating shafts.
(c) Describe different types of flanges and operating conditions when these are used.
(d) Discuss the phenomenon "Entrainment Flooding" briefly.
(e) Write about the design and selection of piping systems.
(f) How galvanic corrosion occurs? Discuss the measures by which it is minimized.

Q 2. Attempt any four parts of the following: **[5x4=20]**

(a) How to identify the schedule number of pipe by direct measurement?
(b) How to find pipe weight from outside diameter and wall thickness?
(c) Explain the term Transportation of slurries.
(d) Explain the utility and purpose of Horton sphere.
(e) What is the maximum allowable length of unsupported line pipe?
(f) Write a note on optimum tank proportions for the tanks having shell thickness independent of D (diameter of the vessel) and H (height of the vessel).

Q 3. Attempt any two parts of the following: **[10x2=20]**

(a) A 1-1, fixed tube sheet shell and tube heat exchanger has the following data.
Shell side design pressure = 2×10^3 kPa
Tube side design pressure = 1×10^3 kPa
If allowable stress of material used is 1.4×10^5 kPa, and shell inside diameter is 0.5 m with corrosion allowable of 2mm and weld joint efficiency of 0.9, find the shell thickness and the header shell thickness.

(b) Discuss the factors to be considered in addition to basic process design variables when a design engineer selects double pipe heat exchangers.

(c) A vaccum distillation column is to operate under a top pressure of 50 mm Hg. The plates are supported on rings of 75 mm wide, 10 mm deep. The column diameter is lm and the plate spacing of 0.5m. Check if the support ring will act as effective stiffening rings. The material of construction is carbon steel and the maximum operating temperature 50°C. If the vessel thickness is 10 mm, check if this is sufficient. Data: Take the design pressure as 1 bar. Young's Modulus (E) for steel at 50°C = 2×10^{11} N/m^2. Factor of safety = 6.

Q4. Attempt any two parts of the following: **[10x2=20]**

(a) Write notes on:
(i) Design of multi effect evaporator
(ii) Dryers and crystallizers.

(b) Discuss the type of packing and general pressure drop correlation in packed tower in detail.

(c) A sieve tray distillation column is to be designed to process liquid and vapours at a rate of 5000 kg/hr and 5300 kg/hr respectively. If it is operated at 1 atm pressure and 90^0C temperature (assumed constant throughout the column), find the column diameter. Take liquid density as 900 kg/m^3, molecular wt. of 120 and the constant K_v =0.3, in the design equation of Brown.

Q5. Attempt any two parts of the following: **[10x2=20]**

(a) A cylinder subjected to a internal pressure of 500 kg/cm^2, has it's inner radius as 17.5 cm. if the allowable stress is 6000 kg/cm^2, find the vessel thickness by using the thin cylinder and also the thick cylinder equations and find the error in thickness calculation by thin cylinder theory.

(b) A gas cylinder , hold's N_2 gas at $120x10^5$ Pa. if internal diameter is 20 cm, permissible tensile stress is $1000x10^5$ N/m^2 and the cylinder is seamless, find the thickness of the cylinder.

(c) Write notes on the following:
(i) Distillation column design
(ii) Design of crystallizers.