

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII EXAMINATION – WINTER 2015

Subject Code: 170403**Date: 09/12/2015****Subject Name: Bioprocess Plant Design****Time: 10:30am to 1:00pm****Total Marks: 70****Instructions:**

1. Attempt **all** questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Give the stepwise design procedure for distillation column. **07**
 (b) Explain in detail about plug and check valve. Also draw neat sketch of each. **07**
- Q.2** (a) Define: Stress, Strain, Ductility, Fatigue, Suction head, Total dynamic head, Schedule Number. **07**
 (b) Describe different methods of feeding in multiple effect evaporation system. **07**
- OR**
- (b) Write a note on: different types of nozzles. **07**
- Q.3** (a) Give the mechanical design procedure for pressure vessel having internal pressure and external pressure. **07**
 (b) A reactor (ID = 800 mm) with hemispherical head at the bottom. Inside working pressure is 75 kgf / cm² gauge & working temperature is 70 °C. reactor is covered with plain jacket such that 75% length of shell & bottom hemispherical head are covered with jacket. Cooling water is circulated inside the jacket by pumping with a centrifugal pump having a shut – off discharge pressure 6 kgf/cm² gauge. The hemispherical head is fabricated from SA 516 Grade 70. The maximum allowable stress at design temperature is 610 kgf/cm². Modulus of elasticity (E) for material is 193×10^3 N/mm², Poisson's ratio (μ) = 0.3, $\rho = 7.83$ gm / cm³, weld joint efficiency factor (j) = 0.85. Find (a) Thickness of hemispherical head and (b) weight of fabricated hemispherical head. Take $R_0 = 440$ mm and $R_i = 400$ mm. **07**
- OR**
- Q.3** (a) Discuss: 1) Design stress & factor of safety, 2) Weld joint efficiency factor. **07**
 (b) Write a short note on: Process Flow Diagrams. **07**
- Q.4** (a) Discuss various types of fabrication technique used for pressure vessel. **07**
 (b) Explain boiling point elevation and Durand's rule in brief. **07**
- OR**
- Q.4** (a) Write a short note on stepwise design for shell and tube heat exchanger. **07**
 (b) Describe the criteria for the selection of the pump in detail. **07**
- Q.5** (a) Discuss various stresses to be considered during designing of equipment. **07**
 (b) Describe in detail the types of jackets & coils used in reactors with neat sketch. **07**
- OR**
- Q.5** (a) Write in detail: Types of supports used in industries. Also draw its sketch. **07**
 (b) Define NPSH. Write suitable equations for (NPSH)_a and (NPSH)_R. Mention its correlation. **07**
