Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2170403 **Date:21/11/2016**

Subject Name:Bioprocess Plant Design

Time:10.30 AM to 1.00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable diagrams wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Notations used, have conventional meaning.**
5. **Assume suitable data wherever necessary.**

Q.1 (a) Write a note on: Process Flow Diagrams. **07**

(b) Discuss about the various types of fabrication technique used for the fabrication of pressure vessel. **07**

Q.2 (a) Discuss different types of heads used in the industry with neat sketch. **07**

(b) Different types of jackets and their selection criteria. **07**

OR

(b) Explain: Design pressure, Design temperature & Design Stress **07**

Q.3 A tower having 4.5 m inside diameter & 8 m length from tangent line to tangent line of the end closers. Tower is operated under vacuum. Tower shell is constructed from SA-283 grade-B carbon steel plate, which has yield strength of 1898.4 kgf / cm^2. Determine the required thickness of shell without stiffeners. Assume 8, 12.7, 19.05 & 25.4 mm thick plate. **14**

Values of **A** & **B** from graph are as under:

Thickness (mm)	**8**	**12.7**	**19.05**	**25.4**
A	0.00045	0.0001	0.000118	0.00031
B (psi)	500	1100	2100	3600

OR

Q.3 (a) Discuss various types of feed arrangement used in multiple effect evaporators. **07**

(b) Define: Stress, Strain, Modulus of Elasticity, Rigidity, Elasticity, Creep, Resilience **07**

Q.4 (a) Describe: Weld joint efficiency factor and Corrosion Allowance. **07**

(b) State various types of fabrication technique used in industries. Explain any one in detail. **07**

OR

Q.4 (a) State the various types of agitators. Discuss the design aspects of any two in details. **07**

(b) Explain the various types of flanges used in industry. **07**

Q.5 (a) Discuss various types of evaporators and explain any one with neat sketch. **07**

(b) Give classification of Nozzle stating the importance of each. **07**

OR

Q.5 A Reactor (ID = 800 mm) with hemispherical head at the bottom. Inside working pressure is 75 kgf/cm^2 gauge & working temperature is 70 °C. Reactor is covered with plain jacket such that 75% length of shell & bottom hemispherical head is covered with jacket. Cooling water is circulated inside the jacket by pumping with a centrifugal pump having a shut off discharge pressure 6 kgf/cm^2 (g). The hemispherical head is fabricated from SA-516 Grade 70. The maximum allowable stress at design temperature is 610 kgf/cm^2. Modulus of Elasticity of plate material (E) = 193 × 10^3 N/mm^2. Poisson's ratio (μ) = 0.3, ρ= 7.83 g/cm^3, Joint efficiency (j) = 0.85. Find: (i) Thickness of the head and (ii) weight of the fabricated hemispherical head. **14**

$$t_h' = \left(\frac{PD_i}{(4fJ - P)}\right) + CA \;,\; t_h' = 4.4r\sqrt{\frac{P}{2E}}\left(3\left(1-\mu^2\right)\right)^{\frac{1}{2}} + CA$$

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