

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- VII (New) EXAMINATION – WINTER 2019

Subject Code: 2170403

Date: 26/11/2019

Subject Name: Bioprocess Plant Design

Time: 10:30 AM TO 01:00 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 the function of coil in reactor with its importance. **03**
 (b) Discuss the factors affecting the fluid allocation in Shell and Tube heat exchanger brief. **04**
 (c) Describe Mc Cabe Thiele method for Distillation. **07**
- Q.2** (a) Discuss the term: Design stress & Poisson's ratio **03**
 (b) Give classification of Nozzle stating the importance of each. **04**
 (c) Explain the various types of flanges used in industry with neat sketch. **07**
- OR**
- (c) Explain different types of heads used in the industry with neat sketch. **07**
- Q.3** (a) Write the full form of HTRI, HTFS & HEL. **03**
 (b) Explain the types of jacket in brief. **04**
 (c) Write a short note on selection of equipment for distillation. **07**
- OR**
- Q.3** (a) Explain in brief: Design Temperature & Design Pressure **03**
 (b) Define the term relative volatility and its importance. **04**
 (c) Discuss different types of heads used in the industry with neat sketch.. **07**
- Q.4** (a) Discuss the advantages and disadvantages of vacuum distillation in detail. **03**
 (b) Write a short note on: Process Flow Diagram. **04**
 (c) Write a note on corrosion allowance & weld joint efficiency factor (j). **07**
- OR**
- Q.4** (a) Define: Stress, Strain, Modulus of Elasticity.. **03**
 (b) State the various types of agitators used in the reactor. **04**
 (c) Draw the neat sketch of various types of flanges used in industries. **07**
- Q.5** A single effect evaporator is to be designed to concentrate 9000 kg/hr of a solution from 12% to 20% solids. Feed enters at 25 °C. Saturated steam at 110 °C (latent heat = 540 kcal/kg) is available. The condensate leaves at the condensing temperature. Saturation temperature of vapor to the condenser is 400C ($\lambda = 580$ kcal/kg). Specific heat of all solutions may be taken as 1 kcal/kg°C. Boiling point rise is 5°C. The evaporator has an overall heat transfer coefficient of 1900 kcal/hr.m².°C. Calculate: i) evaporator capacity, ii) evaporator economy, iii) The area of heating surface required. Use 1 kcal = 4186 J. **14**
- OR**
- Q.5** Calculate the thickness of shell of the reactor and thickness of jacket for the following available options (i) Reactor with plain jacket and (ii) Reactor with channel jacket. Following data are available. **14**
- Inside diameter of shell = 1500 mm, Inside diameter of jacket = 1600 mm
 - Shell length=1500 mm, Half coil diameter = 75 mm, Width of channel jacket = 75 mm,
 - Internal design pressure for Shell & Jacket= 4 kgf/cm² & 3 kgf/cm²
 - Design temperature for both shell and jacket 150 °C
 - Max. Allowable stress = 980 kgf/cm², Modulus of elasticity, E = 19×10^5 kgf/cm²
 - Poisson's ratio, $\mu = 0.3$, Joint Efficiency J = 0.85
