GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VII • EXAMINATION – SUMMER • 2015

Subject Code: 170403 Date: 12/05/2015 Subject Name: Bioprocess Plant Design Time:02.30pm-05.00pm **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. (a) Enlist different techniques used for the fabrication of equipment. Explain any Q.1 07 one in detail. (b) Explain in brief about weld joint efficiency factor. 07 (a) Give the stepwise design procedure for designing of distillation column. 0.2 07 (b) Explain in brief: different types of nozzles used in industry. 07 OR (b) Discuss about Process Flow Diagrams. 07 **Q.3** (a) Explain in detail different types of supports used in industries. 07 **(b)** Write a short note on methods of feeding for multiple effect evaporators. 07 OR **Q.3** (a) Write the design equations for designing of following heads. 07 a) Flat head b) Torispherical head c) Elliptical head d) Conical head e) Hemispherical head (b) Data for pressure vessel are given below: 07 Capacity:16000 L (cylindrical portion) • Rc = 10% excess of I.D., $R_1 = 10\%$ of R_C • Operating pressure = 10 kgf/cm^2 • • J = 0.85, $f = 980 \text{ kg} / \text{cm}^2$ Torispherical heads are provided at both sides. • Specific gravity of material = 7.7Taking L/D = 5• Calculate and suggest the plate thickness of shell. Also calculate the thickness of torispherical head and total weight of shell with heads. Define the terms: Corrosion allowance, Stress, Malleability, Creep, Resilience, **Q.4 (a)** 07 Elasticity. (b) Explain the term: Capacity and Economy of an evaporator. 07 OR Narrate the factors on which $(NPSH)_R$ depends. Q.4 07 (a) (b) Give a classification of reciprocating pump with a brief about the designing 07 aspects of these pumps. Q.5 Summarize the tubing and piping size and its material of construction. 07 **(a)** (b) Describe, advantages and applications of 07 • Diaphragm valve • Plug cock OR 07

Q.5 (a) Comment on the following statements:

- 1) Gear pumps are used in the transportation of sterile liquids.
- 2) Reciprocating pumps can handle sterile liquids.

- (b) Solve the following:
 - Estimate safe working pressure for a 4 inch diameter, Schedule 40 pipe, carbon steel, but welded working temperature 20°C. The safe working stress for but welded steel pipe up to 20° is 41.4 N/mm².
 - 2) Estimate the optimum pipe diameter for a water flow rate of 10kg/s at 20° C, carbon steel pipe will be used. Density of water 1000 kg/m3. Viscosity of water at 20° C=1.1 x 10^{-3} NS/m².
