

M.TECH DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2013)

Third Semester

BIOTECHNOLOGY

P13BTE303: Bioprocess Plant Design and Practice

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

1. Differentiate tank and column in reactors.
2. Write short notes on the selection of accessories in design of a bioreactor.
3. Why stainless steel is always preferred for fabrication of a bioreactor?
4. Give an account on welding joint efficiency.
5. When torispherical closure is preferred in process industries?
6. List the requirements for construction of a bioreactor.
7. Write the concept of design factors in bioreactor design.
8. Differentiate shear force diagram and bending moment diagram.
9. Classify supports used in process vessels.
10. Give an outline on seismic load.

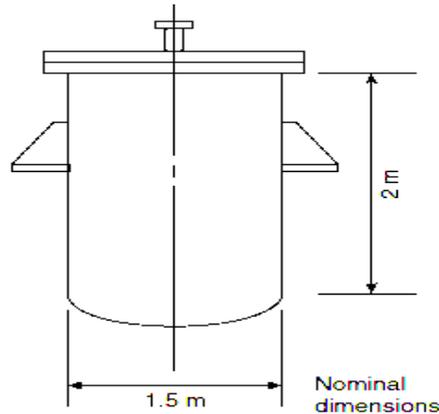
Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

Q.No:11 is Compulsory

11. A fermenter is to operate at 5 psig working pressure during the fermentation. Maximum allowable pressure is rated at 35 psig. Calculate the thickness of the end plate for the fermenter. Material of construction is stainless steel and the reactor capacity is 50 L. Do you prefer similar end plates for the top and bottom ends?
12. Discuss the basic components of a typical biochemical process.
13. Estimate the thickness required for the component parts of the vessel shown in the diagram below. The vessel is to operate at a pressure of 14 bar (absolute) and

temperature of 300°C. The material of construction is plain carbon steel. Welding joint is fully radiographed. A corrosion allowance of 2 mm may be used.



14. A vacuum distillation column is to operate under a top pressure of 50 mmHg. The plates are supported on rings 75 mm wide, 10 mm deep. The column diameter is 1 m and the plate spacing 0.5 m. Check if the support rings 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.
15. Design a reactor for the conversion of cellulose to glucose by the action of endo-1,4-o-glucanohydrolase, cellobiohydrolase and β -glucosidase. The kinetics of cellulose hydrolysis follows Michaelis-Menten equation. Initial concentration of cellulose = 50% (w/v), $V_{\max} = 5.14 \times 10^{-3}$ M/min and $K_m = 9.08 \times 10^{-3}$ M. Assume other data reasonably.
16. Make a preliminary estimate of the plate thickness required for the distillation column specified below:
 Height, between tangent lines 50 m
 Diameter 2 m
 Skirt support, height 3 m
 100 sieve plates, equally spaced
 Insulation, mineral wool 75 mm thick
 Material of construction, stainless steel, design stress 135 N/mm² at design temperature 200°C
 Operating pressure 10 bar (absolute)
 Vessel to be fully radiographed (joint factor 1).
