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18BT62

Sixth Semester B.E. Degree Examination, July/August 2022
Bioprocess Equipment Design and CAED

Time: 4 hrs.

Max. Marks: 100

Note: 1. Answer any ONE full question.
2. Perry Chemical Engineering Hand book and IS2825, IS4503 code books allowed.

- 1 A shell and tube heat exchanger (1-2 type) is required to cool 1×10^5 kg/hr of methanol from 95°C to 40°C using raw water, which flows through the tubes with a temperature rise from 25°C to 40°C . The tube details are as follows: $3/4$ inch OD, 16 BWG, 4.88m long cupronickel arranged in a triangular layout with a pitch of $\frac{15}{16}$ inch. 25% cut segmented baffles are to be spaced at 356mm intervals. A combined fouling factor of $4.5 \times 10^{-4} \text{ m}^2 \cdot \text{K/W}$ is required. An overall heat transfer coefficient of $600 \text{ W/m}^2 \cdot \text{K}$ is required.
- i) Design the 1-2 pass shell and tube heat exchanger. (50 Marks)
 - ii) Check the pressure drop. (20 Marks)
 - iii) Sectional front view of exchanger. (20 Marks)
 - iv) Tube sheet layout. (10 Marks)
- 2 A Mixed Flow Reactor (MFR) is to be designed to carry out liquid phase reaction at a pressure of 5 kgf/cm^2 and a volume of 3500lit. The density of liquid is 1.1 g/cc and viscosity is 500cp. The MFR contains an agitator with 6 flat bladed turbine rotating at 150rpm. Reactor contains 4 baffles. The material of construction are low carbon alloy steel which has maximum allowable stress of 102MPa. Assume L/D ratio of 1.
- i) Design the reactor. (75 Marks)
 - ii) Draw to scale the sectional front view of reactor. (25 Marks)
