

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-II Remedial Examination December 2010****Subject code: 722101****Subject Name: Design of Heat Exchange Equipments****Date: 18 /12 /2010****Time: 02.30 pm – 05.00 pm****Total Marks: 60****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of steam tables is permitted

- Q.1** (a) A reaction vessel contains 3000Kg of reaction mixture. It is to be heated from 25 °C to 85 °C. Heating is done with help of wet steam available at 117 °C. The area of reaction material is 3 m² and external area of vessel is 8 m². Heat transfer coefficient on the outer surface of vessel is 10W/m²K and overall heat transfer coefficient from reaction material is 600 W/m²K. Taking C_p=2700J/Kg K for reaction material and ambient temperature of 20 °C, determine the time required to heat the reaction mixture at 85°C. **06**
- (b) With usual nomenclature derive log mean temperature for counter flow heat exchanger. **06**

- Q.2** (a) With neat sketch explain forward feed system for multiple effect evaporators and discuss its design considerations. **06**
- (b) An oil cooler for lubricating system has to cool 1000Kg/hr of oil C_p=2.09 KJ/Kg K from 80°C to 40 °C using cooling water. Flow of water is 1000KJ/Kg K and available at 30 °C. Give choice for parallel/counter flow heat exchanger and estimate surface area of heat exchanger if U=24 W/m²K. **06**

OR

- (b) A liquid (C_p=0.8 KJ/Kg K) is entering a counter flow heat exchanger at 25 °C at rate of 2.5 kg/s . It is heated at 750 °C by another (C_p=1.0 KJ/Kg K) with flow rate of 2 kg/sec entering at 1000°C. With these things remaining same, what will be percentage change in the area of heat exchanger if liquid is heated up to 600 °C instead of 750°C.

- Q.3** (a) Obtain an expression for log mean temperature difference of parallel flow heat exchanger, subjected to fouling on its two sides of heat exchanger surface. **06**
- (b) State requirements of good heat exchanger. **06**

OR

- Q.3** (a) For a balanced counter flow heat exchanger where M_hC_{ph}=M_cC_{pc} prove that temperature profiles of two fluids along the heat exchanger are linear and parallel. **06**
- (b) Explain the following design consideration for a heat exchanger **06**
- Pumping power
 - Prediction of heat transfer coefficient
 - Size and weight of heat exchanger

- Q.4** (a) List applications and advantages of plate type heat exchanger. **06**
- (b) Write brief note on compact heat exchanger. **06**

OR

- Q.4** (a) Compare 'welded plate heat exchanger' and 'plate and frame heat exchanger'. **06**
(b) The oil is cooled from 130°C to 60 °C by using water in a parallel flow heat exchanger. The water enters the tube at 15°C and leaves at 50°C , assuming water flows through the tubes and oil flows through annulus calculate using NTU method exit temperature of water and oil if flow is made counter flow and minimum temperature to which oil may be cooled by increasing tube length with parallel flow arrangement. **06**
- Q.5** (a) Explain design procedure of cross flow plate fin compact heat exchanger. **06**
(b) Explain the following: J-factors, fouling factor , Economic analysis of compact heat exchanger **06**
- OR**
- Q.5** (a) Explain with neat sketch design considerations of heavy diesel fired furnace. **06**
(b) Write brief note on 'TEMA-Standard' for the design of shell and tube heat exchangers. **06**
