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Total No. of Pages : 03

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B.Tech.(ME) (E-I 2011 Onwards) (Sem.–6)

HEAT EXCHANGER DESIGN

Subject Code : DE/ME-1.7

M.Code : 71249

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write short notes on :

a. Differentiate between recuperative and regenerative type of heat exchanger.

b. What is the purpose of using baffles in a heat exchanger?

c. Differentiate between LMTD and NTU approach for design of heat exchanger.

d. Draw the schematic of a two shell and four tube pass heat exchanger.

e. What is fouling factor and how do the temperature and velocity affect it?

f. Write a short note on multiple effect evaporators.

g. What do you mean by liquid chillers?

h. Write down the names of various methods for enhancement of heat transfer.

i. Differentiate between thermosyphen and forced circulation reboilers.

j. Why fouling fluids are not used in compact heat exchanger?

SECTION-B

2. Derive an expression for logarithmic mean temperature difference (LMTD) in counter flow heat exchanger.

3. Exhaust gases (Cp =1.12 KJ/Kg-deg) flowing through a tubular heat exchanger at the rate of 1200 Kg/hr are cooled from 400°C to 120°C. The cooling is affected by water (Cp = 4.18 KJ/Kg K) that enters the system at 10°C at the rate of 1500Kg/hr. If the overall heat transfer coefficient is 500 KJ/m^2-hr-deg. What heat exchanger area is required to handle the load for :

   (a) Parallel flow arrangement

   (b) Counter flow arrangement.

4. When one of the two fluids undergoes phase change, show that effectiveness values for both parallel flow and counter flow heat exchanger are equal and given by ε = 1- exp (-NTU).

5. A chemical having a specific heat of 3.3 KJ/Kg K flowing at the rate of 20,000Kg/h enters a parallel flow heat exchanger at 120°C. The flow rate of cooling water is 50,000 Kg/h with an inlet temperature of 20°C. The transfer area is 10m^2 and overall heat transfer coefficient is 1200 W/m^2 °C. Taking specifications heat of water as 4.186KJ/Kg K, find

   a) Effectiveness of the heat exchanger

   b) Outlet temperature of water and chemical.

6. Explain the methods for performance evaluation of heat transfer enhancement techniques.

SECTION-C

7. n a counter flow double pipe heat exchanger, water is heated from 25°C to 65°C by an oil with a specific heat of 1.45KJ/Kg K and mass flow rate of 0.9Kg/s. The oil is cooled from 230°C to 160°C. If the overall heat transfer coefficient is 420W/m^2 °C, calculate the following :

   (a) The rate of heat transfer

   (b) The mass flow rate of water

   (c) The surface area of heat exchanger

8. In a double pipe parallel flow heat exchanger, the hot water is cooled by colder water flowing inside the tube. The results obtained from experiments are as follows :

	Mass flow rate Kg/s	**Inlet Temp.°C**	**Outlet Temp.°C**	**Specific heat J/Kg K**
Hot Water	50	90	60	4180
Cold Water	500	25	-	4180

Overall heat transfer coefficient, U = 2400W/m^2K. Find :

a) Heat transfer area needed

b) Effectiveness of heat exchanger

9. Explain the following :

a) Criteria for selection of material for heat exchanger.

b) Discuss the phenomena of two phase boiling flow.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.