**BBBDNITM, LKO**

**MECHANICAL AND AERONAUTICAL DEPARTMENT**

**SUBJECT-HEAT AND MASS TRANSFER**

**UNIT-5**

**ASSIGNMENT-5**

**SECTION-A**

**Short Questions :(2 Marks)**

1).What do you mean by fouling in Heat Exchanger?

2).Sketch temperature distribution graph for condensers & evaporators.

3).What is overall heat transfer coefficient in a heat exchanger?

4).What is LMTD?

5).What is effectiveness of a heat exchanger?

**SECTION-B**

**Questions upto 200 words :(10 Marks)**

6). Oil (cp= 3.6 KJ/KgºC ) at 100 C flows at the rate of 30000 Kg/hr. and enters into a parallel flow heat exchanger. Cooling water( cp= 4.2 KJ/KgºC) enters the heat exchanger at 10ºC at the rate of 50000 Kg/hr. .Heat transfer area is 10 m2 and U=1000 W/m2ºC. Calculate the following-(i) the outlet temperatures of oil and water(ii) the maximum possible outlet temperature of water.

7).The following data relate to a parallel flow heat exchanger in which air is heated by hot exhaust gases: Heat transferred per second=46.52 kJ; Inside heat transfer coefficient=116 W/$m^{2}$˚C; Outside heat transfer coefficient =186 W/$m^{2}$˚C. Inlet and outlet temperatures of hot fluid =400˚C and 150˚C respectively. Inlet and outlet temperatures of cold fluid=50˚C and 100˚C respectively. Inside and outside diameters of tubes=50 mm and 60 mm, respectively.Calculate the length of the tube required for necessary heat transfer to occur. Assume the tube resistance to be negligible.

8).Explain the pool boiling curve for water.

9).What do you mean by equimolar counter diffusion? Derive the general mass transfer equation in Cartesian coordinates.

10). Derive an expression for effectiveness by NTU method for counter flow heat exchanger.

11). A chemical having specific heat of 3.3 kJ/kg K at a rate of 20000 kg/hr. enters a parallel flow heat exchanger at 120⁰ C. The flow rate of cooling water is 50000 kg/hr. with an inlet temperature of 20⁰ C. The heat transfer area is 10 m2 and overall heat transfer coefficient is 1050 W/m2K. Find – (a) effectivenss of heat exchanger (b) outlet temperature of water and chemical .Cp= 4.186 kJ/kg K

12).What are the limitations of LMTD method? How is ε-NTU method superior to LMTD method?Derive an expression for effectiveness by NTU method for parallel flow heat exchanger.

**SECTION-C**

**Very Long Questions :(15 Marks)**

13). (a) Derive an expression for LMTD in case of counter flow heat exchanger.

(b) In a counter flow double pipe heat exchanger, water is heated from 25 C to 65 C by an oil with a specific heat of 1.45 KJ/Kg K and mass flow rate of 0.9 Kg/sec. The oil is cooled from 230 ºC to 160 ºC. If the overall heat transfer coefficient is 420 W/m2 C, Calculate-(i)The rate of heat transfer (ii)Mass flow rate of water (iii)The surface area of heat exchanger

14).(a) Give the classification of heat exchangers.

(b) It is desired to use a double pipe counter flow heat exchanger to cool 3 kg/s ofoil (Cp = 2.1 kJ/kgK) from 120°C. Cooling water at 20°C enters the heat exchanger at a rate of 10 kg/s. The overall heat transfer coefficient of the heat exchanger is600 W/m2 Kand the heat transfer area is 6 m2.Calculate the exit temperatures of oiland water.

15). (a) Discuss the general arrangement of parallel flow, counter flow and cross flow heat exchangers.

(b) In a Double pipe counter flow heat exchanger 10000 kg/h of an oil having a specificheat of 2095 J/kgK is cooled from 80°C to 50°C by 8000 kg/h of water entering at 25°C.Determine the heat exchanger area for an overall heat transfer coefficient of 300 W/m2K.Take Cp for water as 4180 J/kgK.