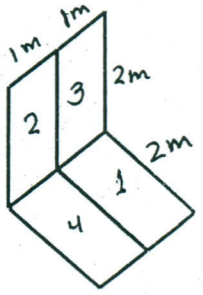
Mansoura University Faculty of Engineering Dept. of Power Mech. Eng. Course Title: Heat &mass transfer Course Code:		3ed year Dec. 2013 Exam Type: Final Time: 3 Hours Full Mark: 110 Examiner: Prof. A.A. Sultan

***Answer all the following questions. *Heat transfer tables are allowed**

Question 1 (25 marks)

A-determine F1-2 for the geometry shown in figure . (5 marks)



B-Two large parallel plates have emissivities of 0.2 and .8 and are maintained at 100°C and 1000°C respectively. If a radiation shield having an emissivity of 0.05 is placed between the plates, determine:

(a)The heat flow without shield (b) the heat flow with the shield when covering all the area of the plates

(c) The heat flow with the shield when covering half the area of the plates (d) The temperatures of the shield in cases (b) and (c).

Question 2 (15 marks)

A cross flow heat exchanger with cold fluid unmixed is used to cool air from 100 °C by using an air at 20 °C. The hot air flows at a rate of 3000 kg/hr, while the cold air rate is 7000 kg/hr. The hot air leaves the exchanger at 55 °C. Assuming the U value to be equal to 70 W/m^2K, calculate the exit temperature of the cold fluid and the area of heat exchanger.

Question 3 (15 marks)

A cross flow heat exchanger is used to cool air that initially at 40 °C and flowing at a rate of 4000kg/hr. Water is used as the coolant at 5 °C with a flow rate of 4600kg/hr. Assuming the U value to be 150 W/m^2K and the surface area of the exchanger is 25 m^2, calculate the exit temperatures of the air and water.

Question 4 (15 marks)

Using dimensional analysis find the relation between condensation heat transfer (h) over vertical flat plate of height (L), and mass flow rate (m), steam density (ρ_s), condensate density (ρ_l), acceleration of gravity (g), steam velocity (V), thermal conductivity of condensate (k) and saturation temperature (T).

Question 5 (25 marks)

A shell and tube heat exchanger consists of 60 four meter lengths of standard copper condenser tubing (I.D=23 mm; O.D =25 mm). Steam at 100°C is to be condensed using water at a rate of 200000kg/hr flowing inside the tubes. The water inlet temperature is 8°C. The unit surface conductance I W/meK, passed on actual area, are (a) scale on steam side , 14000; and (b) scale on water side, 12200. Estimate the rate of condensation of steam if h_{fg} = 2257 kJ/kg.

Question 6 (15 marks)

A-Draw the boiling curve and explain the process of boiling indicating the important points and regimes.

B-Describe an experiment for the determination of the coefficient of heat transfer for natural convection.

Best wishes for you