**Near East University, Lefkoşa,** **Department of Mechanical Engineering**

**ME-313, Heat Transfer I, FALL 2015**

**Assignment 3,** *due Tuesday, December 15, 2015*

**NOTICE!!**

**Submit homework on time, late submissions will not be graded!, first write down the problem, then sketch the problem in the solution section, state your assumptions show your work in getting the result and carry through all units to receive full credit! Try to be neat in your figures!.**

**1.** (20points)A hot surface at 150oC is to be cooled by attaching 3-cm-long, 0.25-cm-diameter aluminum pin fins () to it, with a center-to-center distance of 0.6 cm. The temperature of the surrounding medium is 25oC, and the heat transfer coefficient on the surfaces is . Determine the rate of heat transfer from the surface for a  section of the plate. Also determine the overall effectiveness of the fins.

**2.**(10points) To warm up some milk for a baby, a mother pours milk into a thin-walled glass whose diameter is 5 cm. The height of the milk in the glass is 8 cm. She then places the glass into a large pan filled with hot water at 60oC. The milk is stirred constantly, so that its temperature is uniform at all times. If the heat transfer coefficient between the water and the glass is , determine how long it will take for the milk to warm up from 3oC to 35oC. Take the properties of the milk to be the same as those of water.

**3.**(20points) Long cylindrical AISI stainless steel rods ( ) of 10cm diameter are heat treated by drawing them at a velocity of  through a 8-m -long oven maintained at . The heat transfer coefficient in the oven is . If the rods enter the oven at , determine their centerline temperature when they leave.

2m/min

900oC

8m

**4.**(20points)White potatoes (m2/s) that are initially at a uniform temperature of 25oC and have an average diameter of 8 cm are to be cooled by refrigerated air at 2oC flowing at a velocity of 4 m/s. The average heat transfer coefficient between the potatoes and the air is experimentally determined to be 23W/m2oC. Determine how long it will take for the center temperature of the potatoes to drop to 6oC.

**5**. Oil flow in a journal bearing can be treated as parallel flow between two large isothermal plates with one plate moving at a constant velocity of 12m/s and the other stationary. Consider such a flow with a uniform spacing of 0.5mm between the plates. The temperatures of the upper and lower plates are 50°C and 20°C, respectively. By simplifying and solving the continuity, momentum, and energy equations, determine

(*a*) (10points) the velocity and temperature distributions in the oil,

(*b*) (10points) the maximum temperature and where it occurs, and

(*c*) (10points) the heat flux from the oil to each plate.

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