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

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

**Assignment 2,** *due Tuesday, November 24, 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)** The roof of a house consists of a 20-cm-thick concrete slab () that is 12 m wide and 25 m long. The convection heat transfer coefficients on the inner and outer surfaces of the roof are and , respectively. On a clear winter night, the ambient air is reported to be at 12oC, while the night sky temperature is 100K. The house and the interior surfaces of the wall are maintained at a constant temperature of 22oC. The emissivity of both surfaces of the concrete roof is 0.85. Considering both radiation and convection heat transfers, determine the rate of heat transfer through the roof, and the inner surface temperature of the roof.

22oC

12oC

20cm

25m

12m

**2.** Consider a 5-m-high, 8-m-long, and 0.22-m-thick wall whose representative cross section is as given in the figure. The thermal conductivities of various materials used, in W/mC, are . The left and right surfaces of the wall are maintained at uniform temperatures of 250oC and 100oC, respectively. Assuming heat transfer through the wall to be one-dimensional, determine

250oC

**(*a*) (10 points)**the rate of heat transfer through the wall;

**(*b*) (10 points)**the temperature at the point where the sections *B*, *D*, and *E* meet; and

**(*c*) (10 points)**the temperature drop across the section *F.* Disregard any contact resistances at the interfaces.

**3.**(20points) Consider a 2-m-high electric hot-water heater that has a diameter of 40 cm and maintains the hot water at 65oC. The tank is located in a small room whose average temperature is 25oC, and the heat transfer coefficients on the inner and outer surfaces of the heater are 50 and 12 W/m2C, respectively. The tank is placed in another 50-cm-diameter sheet metal tank of negligible thickness, and the space between the two tanks is filled with foam insulation (). The thermal resistances of the water tank and the outer thin sheet metal shell are very small and can be neglected. The price of electricity is $0.10/kWh, and the home owner pays $380 a year for water heating. Determine the fraction of the hot-water energy cost of this household that is due to the heat loss from the tank.

50cm

25oC

65o

**4.**(20points)A 5-mm-diameter and 15-cm-long aluminum fin () is attached to a surface. If the heat transfer coefficient is 12 W/m2 C, determine the percent error in the rate of heat transfer from the fin when the infinitely long fin assumption is used instead of the adiabatic fin tip assumption

**5**. **(10points)**Consider a stainless steel spoon () partially immersed in boiling water at  in a kitchen at 25oC. The handle of the spoon has a cross section of 0.2cmx1.2cm, and extends 20cm in the air from the free surface of the water. If the heat transfer coefficient at the exposed surfaces of the spoon handle is 15W/m2K, determine the temperature difference across the exposed surface of the spoon handle. State your assumptions.

25oC

20cm

95oC