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

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

**Assignment 1,** *due Tuesday, November 03, 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.** A 1500-W iron is left on the ironing board with its base exposed to the air. About 80 percent of the heat generated in the iron is dissipated through its base whose surface area is 170 cm2, and the remaining 20 percent through other surfaces. Assuming the heat transfer from the surface to be uniform, determine,

a.(05) the amount of heat the iron dissipates during a 2-hour period, in kWh,

b.(05) the heat flux on the surface of the iron base, in W/m2,

c.(05) the total cost of the electrical energy consumed during this 2-hour period. Take the unit cost of electricity to be $0.07/kWh.

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6500kJ/h

**2.**(20points) A 3mX5mX8m room is heated by the radiator of a steam heating system. The steam radiator transfers heat at a rate of 15,500 kJ/h and a 150-W fan is used to distribute the warm air in the room. The heat losses from the room are estimated to be at a rate of about 6500 kJ/h. If the initial temperature of the room air is 10°C, determine how long it will take for the air temperature to rise to 20°C. Assume constant specific heats at room temperature.

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15,500kJ/h

**3.**(20points) Consider a sealed 20-cm-high electronic box whose base dimensions are 50cmX50cm placed in a vacuum chamber. The emissivity of the outer surface of the box is 0.95. If the electronic components in the box dissipate a total of 100 W of power and the outer surface temperature of the box is not to exceed 55°C, determine the temperature at which the surrounding surfaces must be kept if this box is to be cooled by radiation alone. Assume the heat transfer from the bottom surface of the box to the stand to be negligible.

**4.**(20points)Consider a medium in which the heat conduction equation is given in its simplest form as,



(*a*) Is heat transfer steady or transient?

(*b*) Is heat transfer one-, two-, or three-dimensional?

(*c*) Is there heat generation in the medium?

(*d*) Is the thermal conductivity of the medium constant or variable?



**5**.Consider a large plane wall of thickness m, thermal conductivityW/m°C, and surface area m2. The left side of the wall at  is subjected to a net heat flux of W/m2 while the temperature at that surface is measured to be °C. Assuming constant thermal conductivity and no heat generation in the wall,

a.(05) express the differential equation and the boundary conditions for steady one-dimensional heat conduction through the wall, b.(10) obtain a relation for the variation of temperature in the wall by solving the differential equation,

c.(10) evaluate the temperature of the right surface of the wall at *.*