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

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

**Midterm Exam,** *Tuesday, November 24, 2015 at 10:00 Room: 16D21*

**NOTICE!!**

**Open book exam!, You may use clean textbooks you bring with you but no class notes are allowed. Try to sketch the problem carefully, 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 answers!.**

**1.** Consider a 5-m-long, 3.0-m-high, and 0.25-m-thick wall made of concrete (). The design temperatures of the indoor and outdoor air are  and 2oC, respectively, and the heat transfer coefficients on the inner and outer surfaces are 10 and 20 W/m2C. If a polyurethane foam insulation () is to be placed on the inner surface of the wall to increase the inner surface temperature of the wall to 20oC, determine,

(*a*)**.**(20points) the required thickness of the insulation,

(b)**.**(20points) the percent decrease in heat loss due to insulation ()

**2.**(20points) Heat is generated uniformly in a 5-cm-diameter, 20-cm-long solid bar (). The temperatures at the center and at the surface of the bar are measured to be 220°C and 55°C, respectively. Determine the rate of heat generation in Watts.

**3.**(20points) A 50-cm-long, 0.5-cm-diameter electric resistance wire is used to determine the convection heat transfer coefficient in air at 25°C experimentally. The surface temperature of the wire is measured to be 250°C when the electric power consumption is 190 W. If the radiation heat loss from the wire is calculated to be 75 W, determine the convection heat transfer coefficient of the wire.

**4.** A plane wall of thickness has a thermal conductivity of . A chemical reaction takes place inside the wall resulting in a uniform heat generation at a rate of . Sandwiched between the wall and an insulating layer is a film heater of negligible thickness that generates a heat flux . The opposite side of the wall is in contact with water at temperature . A thermocouple mounted on the surface of the wall in contact with the water reads .

*T*1

*T*o, *h*

q”

(*a*)**.**(10points) determine the convection coefficient between the wall and water.

(b)**.**(10points) If the temperature distribution at steady state is  determine the values of 

(c)**.**(10points) Where the maximum temperature is located and what is its value?