Part II   Heat Transfer

1. (20%) What are the definitions and physical meanings of the following dimensionless parameters: Bi (Biot number), Pr (Prandtl number), Nu (Nusselt number), and Gr (Grashof number).

2. (10%) A rectangular plate is L_1 by L_2. It is initially uniform in temperature at T_1 and then suddenly exposed to a convection environment at T_2 while maintaining the bottom face at T_1 and the top face well-insulated. How do you formulate the problem?

3. (10%) A fine wire having a diameter D is placed in a 1-atm airstream at T_1 having a flow velocity V perpendicular to the wire. An electric current is passed through the wire, raising its surface temperature to T_2. How would you calculate the heat loss per unit length.

4. (10%) Explain what thermal boundary layer is. How would you estimate the thickness of thermal boundary layer with a uniform flow at T_1 passing over a flat plate at T_2.