本試題是否可以使用計算機： ☑可使用 ， □不可使用 （請命題老師勾選）

I. Answer the following questions: (35%)

1. 請簡述能源危機與熱傳有何關係。

2. 請寫出三種熱傳導之應用實例。

3. 若有衣服可以冬暖夏涼，請簡述如何可以達到此目的。

4. Which one has the higher thermal conductivity, wood or copper? How do you prove that?

5. What's the difference between Bi and Nu?

6. 如何製作一保溫杯？

7. 請簡述桌上型電腦之散熱系統。

II. The temperature distribution of a 1-D steady-state problem (as shown in the following figure) is $T = a + b \cdot \exp(-cx)$, where a, b, and c are constants. At $x = 0$, there is a convective boundary condition. Derive the expression of h, which is the convective heat transfer coefficient. T_∞ is the ambient temperature, and k is the thermal conductivity. Hint: Do not need to find a, b and c, since they are assumed to be known in this problem. (10%)
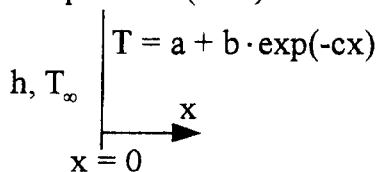

III. The temperatures on the faces of a plane wall 15 cm thick are 375 and 85°C. The wall is constructed of a special glass with the following properties: k = 0.78 W/(m·°C), ρ = 2700 kg/m³ and Cp = 0.84 kJ/kg. What is the heat flow through the wall at steady-state conditions? (10%)

IV. Consider a 0.8-m-hight, 1.5-m-wide double-pane window consisting of two 4-mm-thick layers of glass (k = 0.78 W/m·°C) separated by a 10-mm-wide stagnant air space (k = 0.0.026 W/m·°C). Determine the steady rate of heat transfer through this double-pane window and the temperature of its inner surface for a day during which the room is maintained at 20°C while the temperature of the outdoors is -10 °C. Take the heat transfer coefficients on the inner and outer surfaces to be $h_1 = 10$ W/m²·°C and $h_2 = 40$ W/m²·°C, which include the effects of radiation. (15%)
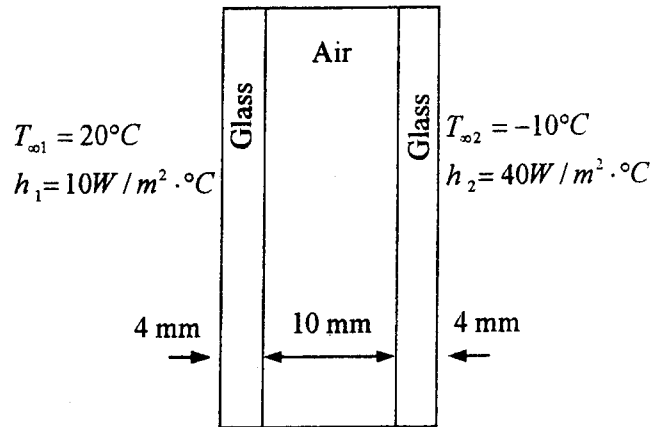
V. A thin flat plate of length L, thickness t, and width W >> L is thermally joined to two large heat sinks that are maintained at a temperature T_0. The bottom of the plate is well insulated, while the net heat flux to the top surface of the plate is known to have a uniform value of q_0''.
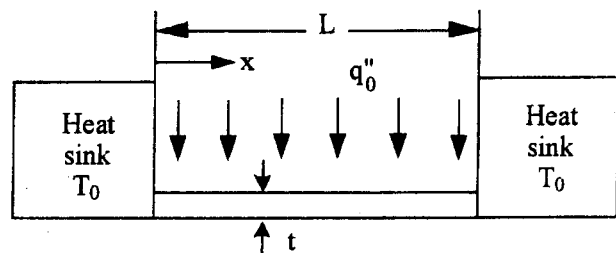
(a) Derive the differential equation that determines the steady-state temperature distribution T(x) in the plate. (8%)

(b) Solve the foregoing equation for the temperature distribution for the temperature distribution , and obtain an expression for the rate of heat transfer from the plate to the sink. (7%)

VI. Explain the following terms: (15%)

(1) Convection

(2) The first law of thermodynamics

(3) Thermal diffusivity