國立中山大學107學年度碩士暨碩士專班招生考試試題

科目名稱：基礎熱傳學【機電系碩士班甲組】　　題號：438003

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

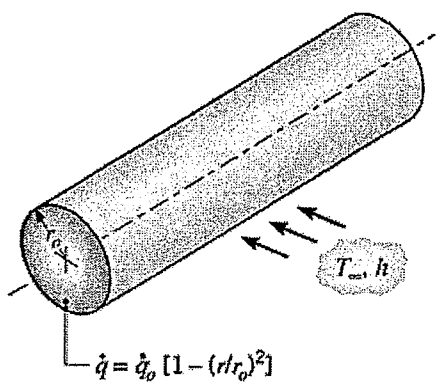
1.(5%) What is the major difference between thermodynamics and heat transfer?

2.(15%) Please illustrate the physical principles of the three modes of heat transfer conduction, convection, and radiation, respectively. Please also write down the rate equations of the three modes, respectively.

3.(20%) A glass window of width W =1 m and height H = 2 m is 5 mm thick and has a thermal conductivity of k_g = 1.4 W/m·K. If the inner and outer surface temperatures of the glass are 15°C and -20° C, respectively, on a cold winter day, what is the rate of heat loss through the glass? To reduce heat loss through windows, it is customary to use a double pane construction in which adjoining panes are separated by an air space. If the spacing is 10 mm and the inner and outer surface temperatures of the double pane window remain the same as single pane window, what is the rate of heat loss from this double pane window? The thermal conductivity of air is k_a = 0.024 W/m·K.

4.(20%) The free convection heat transfer coefficient on a thin hot vertical plate suspended in still air can be determined from observations of the change in plate temperature with time as it cools. Assuming the plate is isothermal and radiation exchange with its surroundings is negligible, evaluate the convection coefficient at the instant of time when the plate temperature is 250°C and the change in plate temperature with time (dT/dt) is -0.028 K/s. The ambient air temperature is 25°C and the plate measures 0.4 * 0.4 m with a mass of 4.5 kg and a specific heat of 2770 J/kg·K.

5.(20%) Radioactive wastes are packed in a long, thin-walled cylindrical container. The wastes generate thermal energy nonuniformly according to the relation $\dot{q} = \dot{q}_o[1 - (r/r_o)^2]$, where $\dot{q}$ is the local rate of energy generation per unit volume, $\dot{q}_o$ is a constant, and r_o is the radius of the container. Steady-state conditions are maintained by submerging the container in a liquid that is at T_∞, and provides a uniform convection coefficient h. Obtain an expression for the total rate at which energy is generated in a unit length of the container. Use this result to obtain an expression for the temperature T_s of the container wall.



試題隨卷繳回

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6.(20%) an annular aluminum fin of rectangular profile is attached to a circular tube having an outside diameter of 25 mm and a surface temperature of 250°C. The fin is 1 mm thick and 10 mm long, and the temperature and the convection coefficient associated with the adjoining fluid are 25°C and 25 W/m^2·K, respectively. (Assume that the fin effectiveness is 97%.)

(a) What is the heat loss per fin?(10%)

(b) If 200 such fins are spaced at 5-mm increments along the tube length, what is the heat loss per meter of tube length? (10%)