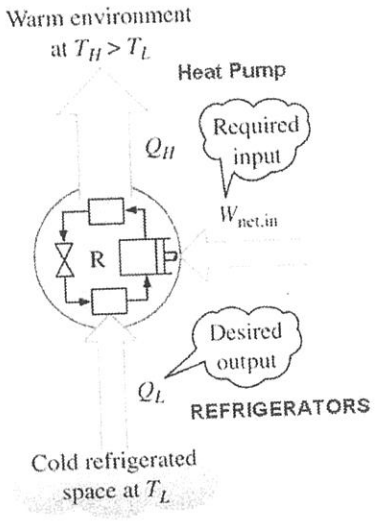
992 機械系博士班資格考試題目

考試科目	方式	
熱力熱傳學	Closed Book,可使用計算機	Part I

1. Refrigerator and Heat Pump are shown as below

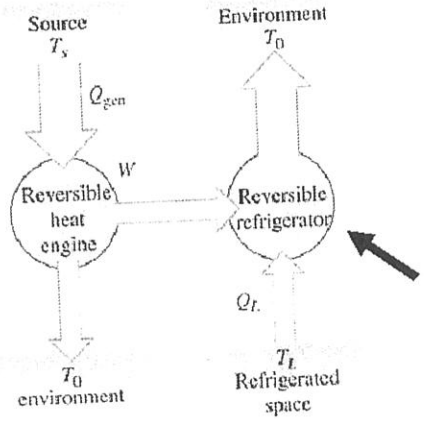
(a) Refrigerator 與 Heat Pump 之效率定義 COP_R and COP_{HP}。(5%)

(b) Prove $COP_{HP} = COP_R + 1$ (10%)



2. 證明如下吸收式（absorption）冷凍器（refrigerator）之 $COP_{rev,\ absorption}$ 最大值為

$$COP_{rev,\ absorption} = \left(1 - \frac{T_0}{T_s}\right)\left(\frac{T_L}{T_0 - T_L}\right) \quad (10\ \%)$$



3. 證明系統內物質爲液體時，常 (火商)過程($\Delta s = 0$)將導致常溫結果(10%)
Provided 1st TdS = dU+PdV (since $c_p = c_v = c$ and $du = c\,dT$)

4. For a reversible steady-flow process, prove $W_{rev} = -\int_1^2 \forall\, dP$

Provided $TdS = dH + VdP$ $\delta q_{rev} - \delta w_{rev} = dh + dke + dpe$ $dS = \left(\frac{\delta Q}{T}\right)_{int\,rev}$
(15%)

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考試科目	方式	
熱力熱傳學	**Closed Book,可使用計算機**	**Part II**

Closed books (50%)

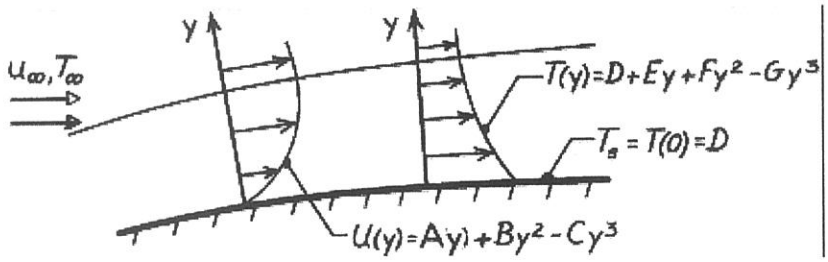
1. (15%). Define the following no-dimensional parameters and their physical interpretation, Re, Pr, Gr, Nu. For forced convection over a flat plate, what is the **critical parameter and value** to characterize the laminar or turbulent convection over a flat plate ?

2. (15%) IN flow over a surface, velocity and temperature profiles are of the forms

$u(y)= Ay +By^2-Cy^3$ and

$T(y)=D+Ey+Fy^2 -Gy^3$

Where the coefficients A through G are constant.



3. 3. (20%) Consider flow in a circular tube. Within the test section length (between 1 and 2) a constant heat flux q''_S is maintained.

(a). For the following two cases, sketch the surface temperature $T_S(x)$ and the fluid mean temperature $T_m(x)$ as a function of distance along the test section x In case A flow is hydrodynamically and thermally fully developed. In case B flow is not developed.

(b). Assuming that the surface flux q''_S and the inlet mean temperature $T_{m,1}$ are identical for both cases, will the exit mean temperature $T_{m,2}$ for case A be greater than, equal to or less than $T_{m,2}$ for case B ? Briefly explain why