一、

(a). 穩態、穩流過程之機械功 w 可表示為(設此過程為可逆絕熱)

$$w = -\int_i^e V\,dp + \frac{v_i^2 - v_e^2}{2} + g(z_i - z_e)$$

試由熱力學第一定律

$$q + h_i + \frac{v_i^2}{2} + gz_i = w + h_e + \frac{v_e^2}{2} + gz_e$$

與特性關係式

$Tds = dh - Vdp$ 加以求證 (10%)

(b). 試繪 P-V 圖(設 $\Delta K.E.=0$ 、$\Delta P.E.=0$)說明上述之機械功與 Closed system 之功有何差異? (10%)

$V$：體積　$v_i$：進口速度　$v_e$：出口速度　T：流體溫度

$h_i$：進口焓　$h_e$：出口焓　$z_i$：進口高度　$z_e$：出口高度

q：熱傳量　s：流體熵　p：流體壓力　K.E.：動能　P.E.：位能

二、0.5 公斤空氣由壓力 $P_1 = 10^6\ N/m^2$，體積 $V_1 = 0.1m^3$ 以可逆多變過程膨脹至壓力 $P_2 = 5\times10^5\ N/m^2$，體積 $V_2 = 0.17m^3$. 試求：

(a). 膨脹過程之功 (Joules) (8%)

(b). 溫度變化(℃)，$T_2 - T_1$. (8%)

(c). 熱傳量(Joules). (9%)

Note：$C_p = 1.005\ KJ/Kg^oC$

$C_v = 0.716\ KJ/Kg^oC$

$R = 0.289\ KJ/Kg^oC$

三、有一冷凍壓縮循環在蒸發器(Evaporator)內之冷媒溫度為-20 ℃，在凝結器(condenser)內溫度為 40 ℃

(a). 試繪 T-S 圖 (5%)

(b). 試繪 P-h 圖 (5%)

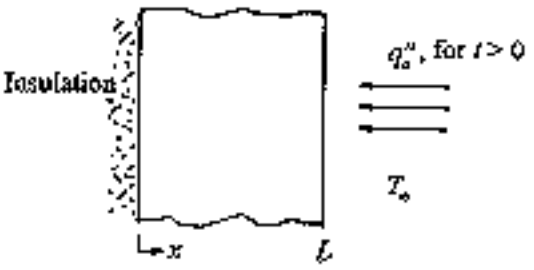
(c). 若壓縮機為不可逆絕熱過程，試繪 T-S 圖 (5%)

(d). 設壓縮機之機械效率為 0.7，試求壓縮機出口冷媒之溫度為若干.(說明計算過程即可不必算出數值) (5%)

(e). 簡述氨氣吸收冷凍循環與壓縮循環有何差異 (5%)

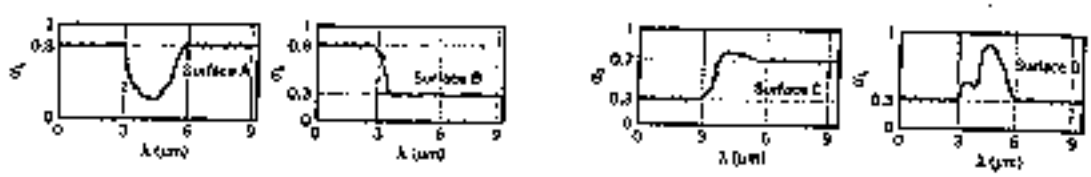
(背面仍有題目,請繼續作答)

四、 The inner surface of a plane wall is insulated while the outer surface is exposed to an airstream at $T_\infty$. The wall is at a uniform temperature corresponding to that of the airstream. Suddenly, a radiation heat source is switched on applying a uniform flux $q_o''$ to the outer surface.




(a) Sketch and label, on $T$-$x$ coordinates, the temperature distributions: initial, steady-state, and at two intermediate times.
(b) Sketch the heat flux at the outer surface $q_x''(L, t)$ as a function of time. (15%)

五、 Four diffuse surfaces having the spectral characteristics shown are at 300 $K$ and are exposed to solar radiation. Here, $\alpha_\lambda$ denotes spectral absorptivity and $\lambda$ denotes wavelength.




Which of the surfaces may be approximated as being gray? (7%)

六、 Consider the conical cavity of radius $r_o$ and depth $L$ formed in the opaque, diffuse, gray, isothermal material of emissivity $\varepsilon$ maintained at temperature $T$. Derive an expression for the radiant power leaving the opening of the cavity in terms of $T$, $r_o$, $\varepsilon$, and $L$. (8%)