國立臺北科技大學九十九學年度碩士班招生考試

系所組別：1431 能源與冷凍空調工程系碩士班丙組

第二節　熱力學　試題 選考

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、Answer the following problems(20%)

1. What is thermodynamic properties、state、 process、cycle. (5%)
2. Define "enthalpy"and "entropy". (5%)
3. Please describe the first law of thermodynamics , second law of thermodynamics and third law of thermodynamics. (5%)
4. Consider the Carnot cycle(5%)

   (1) Using P-v and T-s diagrams to describe the Carnot cycle(2%)

   (2) Please derive its thermodynamic cycle efficiency(3%)

二、Answer the following problems(20%)

1. Describe ideal Rankine cycle, Plot the P-V and T-s diagram for this Cycle. (10%)
2. What is the difference between a refrigerator and a heat pump. (10%)

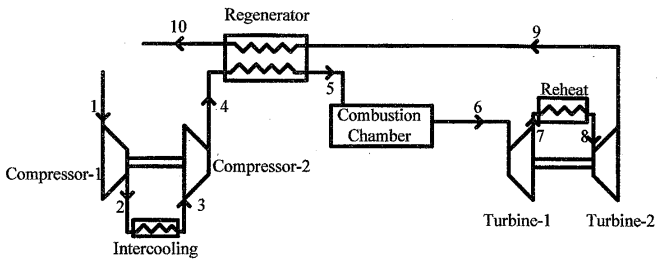
三、Answer the following problems(20%)

1. Consider the polytropic process (PV^n = constant) by closed system (10%)

   (1)Plot the P-V diagram for this process (3%)

   (2)Derive the work done during a polytropic process in terms of P_1,V_1,P_2,V_2 and n, where 1 and 2 are initial and final state. (7%)

2. Plot the T-s diagram for this cycle.(10%)



四、Calculate the power required by the two compressors in an ammonia system which serves a 450kW evaporator at -25°C.The system uses two-stage compression with intercooling and removal of flash gas.The condensing temperature is 35°C. (10%)

(h_1=1430kJ/kg , h_2=1573kJ/kg , h_3=1463kJ/kg , h_4=1620kJ/kg , h_5=366kJ/kg , h7=202kJ/kg)

(1) What is the rate of refrigerant compressed by the high-stage compressor?(5%)

(2) Plot the P-h diagram for this cycle.(5%)

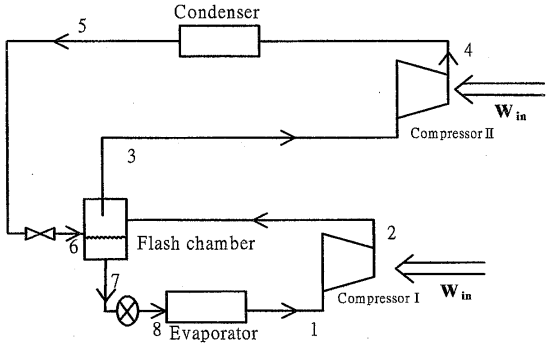


Fig.1 Two compressor and one evaporator

五、Please prove

1. $du = C_v dT + \left\{ -P + T\left(\frac{\partial P}{\partial T}\right)_v \right\} dv$ (10%)

2. $\mu = -\frac{1}{C_p}\left[v - T\left(\frac{\partial v}{\partial T}\right)_p \right]$ (10%)