1、請敘述熱力學第一、第二、第三定律的重點各是什麼？請說明並討論!（15%）

2、能量守衡在熱與流的物理問題中是非常重要的條件，許多問題也據此解決。在一個熱力學控制體積（control volume）中，能量平衡（energy balance） 是什麼？請說明討論每一項。（15%）

3、熱動力機中常用水做爲介質，爲什麼？請在 T-S 圖上畫出水的三態區，標出等壓、等溫線等等，討論理想之熱機如何在 T-S 圖上運作。（20%）

Prob. 4 (15%) Please illustrate the physical meanings (basic analogies) of the two equations

$$\begin{bmatrix} exergy\ transfer \\ accompanying\ heat \end{bmatrix} = \int_1^2 \left(1 - \frac{T_0}{T_b}\right) \delta Q$$

and

$$\begin{bmatrix} exergy\ transfer \\ accompanying\ work \end{bmatrix} = [W - p_0(V_2 - V_1]$$

for the exergy analysis, where Q is the amount of energy by heat interaction across the system's boundary and V is the volume of the system.

Prob. 5 (15%) Please use P-V diagram and/or T-S diagram to explain and identify the processes in (1) Ideal Rankine Cycle, (2) Ideal Air Standard Diesel Cycle, and (3) Ideal Air Standard Brayton Cycle.

Prob. 6 (20%) On the basis of a cold air-standard analysis, show that the thermal efficiency of an ideal regenerative gas turbine can be expressed as

$$\eta = 1 - \left(\frac{T_1}{T_3}\right)(\gamma)^{(k-1)/k}$$

where γ is the compressor pressure ratio, and T_1 and T_3 denote the temperatures at the compressor and turbine inlets, respectively.