國立臺北科技大學 102 學年度碩士班招生考試

系所組別：1203 製造科技研究所

第二節　熱力學　試題（選考）

注意事項：

1. 本試題共 4 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。

Problem 1 (25%)

Please find the two equal mass (m is mass) of the same liquid (c is the specific heat) initially at temperatures T_1 and T_2 are mixed adiabatically.

a) (15%) the change of entropy $\Delta S = f(T_1 + T_2, \sqrt{T_1 T_2})$, please find the f form.

b) (10%) prove the change of entropy is positive.

Problem 2. (25%)

One mixture is mixed by 1.0 kg Carbon Monoxide (gas constant $297.0 J/kgK$, constant volume specific heat $745.0 J/kgK$) and 3.0 kg Nitrogen (gas constant $296.92 J/kgK$, constant volume specific heat $742.3 J/kgK$). The mixture is compressed from initially pressure $2.0 bar$, temperature 300 K to pressure $5.0 bar$, which followed the polytropic process pv^n =constant, n=1.3 where p is pressure, v is specific volume, Please find the following results

a) (10%) the final mixture temperature (K)=?

b) (10%) the process compressed work=(kJ)?

c) (5%) the process heat transfer (kJ)?

Problem 3. (25%)

A gas turbine power plant operating on an Brayton cycle has pressure ratio 10. The gas temperature is 350 K at the compressor inlet and 1400 K at the turbine inlet. Utilizing the cold air standard assumption, compressor efficiency 0.8, turbine efficiency 0.9, determine the following results

a)(5%) gas temperature at the exits of the compressor.

b)(5%) gas temperature at the exits of the turbine.

c)(5%) back work ratio.

d)(5%) temperature-entropy diagram for the cycle.

e)(5%) thermal cycle efficiency.

Problem 4. (25%)

The unknown gas state equation can be interpolated by experiment of $(p + a/v^2)v = RT$ where a constant, p pressure, v specific volume, R gas constant, K absolute temperature.

Please find the following results by p, v, T

a) (5%) specific internal energy change $\Delta u = ?$

b) (5%) specific entropy change $\Delta s = ?$

c) (5%) expansion coefficient of constant pressure β_p =?

d) (5%) specific heat change of constant pressure and the constant volume $C_p - C_v = ?$

e) (5%) Joule-Thomson coefficient μ_J