

# 國立臺北科技大學 100 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)

第一頁 共二頁

### 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 prove the following thermodynamic relationship

- a) (15%)  $c_p = c_v + T v \beta_p^2 / \kappa_T$  for any working medium
- b) (10%)  $c_p = c_v + R$  for any ideal gas

Where  $c_p$  (specific heat for constant pressure),  $c_v$  (specific heat for constant volume),  
 $T$  (absolute temperature),  $\beta_p$  (expansion coefficient for constant pressure),  
 $\kappa_T$  (compression coefficient for constant temperature),  $R$  (gas constant),  
 $v$  (specific volume)

### Problem 2. (25%)

Helium gas is compressed by an adiabatic compressor from initial state of 100 kPa and  $5^\circ\text{C}$  to a final pressure of 300 kPa and the compressor efficiency is 0.8, Please find

- a) (15%) the exit temperature=?
- b) (10%) the entropy change for the compressor=?

### Problem 3. (25%)

An ideal Otto cycle has a compression ratio of 9. At the beginning for the compression process, air is at 100 kPa and  $17^\circ\text{C}$ , and 900 kJ/kg of heat is transferred to air during the constant volume heat addition process, Please find

- a) (5%) maximum pressure during the process
- b) (5%) maximum temperature during the process
- c) (5%) the thermal efficiency
- d) (5%) the mean effective pressure
- e) (5%) the p-v and T-s diagram

### Problem 4. (25%)

Saturated air leaving the cooling section of an air conditioning system at  $14^\circ\text{C}$  at a rate of  $50\text{ m}^3/\text{min}$  is mixed adiabatically with the outside air at  $32^\circ\text{C}$  and 60 percent relative humidity at a rate of  $20\text{ m}^3/\text{min}$ . Assuming that the mixing process occurs at a pressure of 1 atm according Psychrometric chart, determine the exit condition

- a) (5%) specific humidity
- b) (5%) the relative humidity
- c) (5%) the dry-bulb temperature
- d) (5%) the volume flow rate of the mixture
- e) (5%) the wet bulb temperature

注意：背面尚有參考資料

