編號： 102　系所：機械工程學系在職專班甲組　　科目：熱力學(專班)

本試題是否可以使用計算機： ☑可使用 ， ☐不可使用 （請命題老師勾選）

1. (25 分) 解釋及說明下列名詞:

(a) Dew point and relative humidity (5 分)
(b) Mollier chart (5 分)
(c) Open and closed type feed water heaters (5 分)
(d) Ideal and Van Der Waals equation of states (5 分)
(e) Heat pump (5 分)

2. (25 分) Air enters a steady-flow adiabatic compressor at 17 °C and is compressed through a pressure ratio of 8.6:1. If the process is assumed to be internally reversible, determine the work input required in KJ/kg.

註: air 定壓比熱 $C_p = 1.004$ kJ/kg K，
定容比熱 $C_v = 0.717$ kJ/kg K，氣體常數 R= 0.287 kJ/kg K

3. (25 分) A piston-cylinder device initially contains 0.5 m^3 of nitrogen gas at 400 Kpa and 27 °C. An electric heater within the device is turned on and is allowed to pass a current of 2A for 5 minutes from a 120V source. Nitrogen expands at constant pressure, and a heat loss of 2800 J occurs during the process.
Determine the final temperature of nitrogen.

註: nitrogen 定壓比熱 $C_p = 1.039$ kJ/kg K，
氣體常數 R= 0.297 kJ/kg K

4. (25 分) 有一空氣在一長 10 m 之不銹鋼管(熱傳導係數 k = 20 W/m °C)內流動，管內徑為 25mm，管壁厚度為 0.4 mm。管內空氣溫度為 120 °C，管內熱對流係數為 65 W/m^2 °C。管外之大氣溫度為 15 °C，熱對流係數為 8 W/m^2 °C
(a) 求此不銹鋼管之熱損失 (W) (15 分)
(b) 若欲使(a)之熱損失減少八成(80%)，則不銹鋼管外應包覆多少厚度(mm)之絕熱材料(假設 k = 0.01 W/m °C)？(10 分)