國立中央大學 108 學年度碩士班考試入學試題

所別： 機械工程學系 碩士班 熱流組(一般生)　　共 1 頁　第 1 頁

科目： 熱力學

本科考試可使用計算器，廠牌、功能不拘　　申論題及計算題　　計算題需計算過程

請按題號順序作答，避免被漏改。若您要先做後面題目，請先在答案本預留空間。

1. (10 %) After a long walk in the 8°C outdoors, a person wearing glasses enters a room at 25°C and 40 percent relative humidity. Determine whether the glasses will become fogged. Be sure to show the procedure how you get this conclusion.

Temperature(°C)	5	10	15	20	25
Saturated pressure (kPa)	0.8725	1.2281	1.7057	2.3392	3.1698

2. (10 %) At pressure of 1 atm, liquid water has a state of maximum density at about 4°C.

   Will the $\left(\frac{\partial s}{\partial p}\right)_T$ be positive or negative at 3°C? Be sure to write down the verification, not only the answer.

3. (10 %) A gas enters a compressor operating at steady state and is compressed isentropically. Does the specific enthalpy increase or decrease as the gas passes from the inlet to the exit?

4. (20 %) In an air-standard cycle, air at T_1=70 °F and p_1= 14.7 psia is initially heated at constant volume till the pressure is p_2=30 psia, and then heated at constant pressure till the temperature is T_3=1600 °F. The cycle is completed by first expanding isentropically to p_4=14.7 psia and then cooling at constant pressure. (a) draw the p-v diagram of the cycle, and determine (b) T_2, (c)T_4, (d) heat added per unit of mass, (e) heat rejected per unit of mass as well as thermal efficiency. (For air, c_v=0.171, c_p=0.24 Btu/(lbm• °F)) (4% each)

5. (a) What is the physical meaning of "entropy"? (5%)
   (b) What is the physical meaning of "exergy"? (5%)
   (c) For a process to occur, the entropy of an isolated system should increase or decrease? (5%)

6. (15 %) A heat engine receives 200 kJ from a heat source at 1000 K and ejects waste heat to a heat sink at 400 K, while producing a work output of 80 kJ. What are the first law efficiency and second law efficiency of the engine?

7. (20 %) Helium is to be compressed from 120 kPa and 310 K to 700 kPa and 430 K. A heat loss of 20 kJ/kg occurs during the compression process. Neglecting kinetic energy changes, determine the power input required for a mass flow rate of 90 kg/min. (c_p = 5.1926 kJ/kg•K)