112VE04

國立臺北科技大學 112 學年度碩士班招生考試

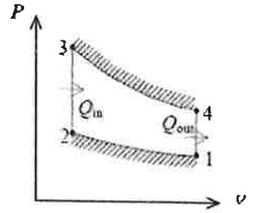
系所組別：1303 車輛工程系碩士班

第二節　熱力學　試題（選考）

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The compression ratio of an air-standard Otto cycle is 9.5. Prior to the isentropic compression process, the air is 100 kPa, 35°C, and $600cm^3$. The temperature at the end of the isentropic expansion process is 800K. Using the specific heat values at room temperature 25°C, determine (20%)
   a. The highest temperature and pressure in the cycle. (5%)
   b. The amount of heat transferred (kJ). (5%)
   c. The thermal efficiency. (5%)
   d. The mean effective pressure (MEP). (5%)



(Assume constant specific heats for air at room temperature 25°C.
C_p=1.005kJ/kgK, C_v=0.718kJ/kgK, R=0.287 kJ/kgK and k=1.4)

2. Apiston cylinder has the water volume separated into V_A = 0.1 m3 and V_B = 0.2 m3 by a stiff membrane. The initial state in A is 1000 kPa quality x = 0.65 and in B it is 1600 kPa and 250°C. Now the membrane ruptures and the water comes to a uniform state with 200°C. (20%)
   a. Find the final pressure. (5%)
   b. Find the work in the process. (5%)
   c. Find the final volume. (5%)
   d. Find the heat transfer in the process. (5%)

3. Air in a piston cylinder is at 120 kPa, 27 °C with a volume of 0.001 m^3. It is now compressed to a volume 10 times smaller in a polytropic process with n = 1.3 with no heat transfer. (20%)
   a. How much mass of air is there? (4%)
   b. What is the final pressure? (4%)
   c. Find the process specific work. (4%)
   d. Find the final temperature. (4%)
   e. Show the P-V diagram for the process. (4%)

4. A compressor receives air at 100 kPa, with a velocity of 5 m/s. At the compressor discharge, the air exits at 1000 kPa, 500 K, with a velocity of 25 m/s, and then flows into a constant-pressure aftercooler, where it is cooled down to 360 K. The power input to the compressor is 50 kW. Determine the heat transfer in the aftercooler. (20%)
   (Air C_v = 0.7176 KJ/kg-K, C_p = 1.004 KJ/kg-K, R = 0.287 kN-m/kg-K)

5. A 50 kg block of iron casting at 500 K is thrown into a large lake that is at a temperature of 285 K. The iron block eventually reaches thermal equilibrium with the lake water. Determine (An average specific heat of 0.45 *kJ / kg-K* for the iron) (20%)
   a. the entropy change of the iron block (5%)
   b. the entropy change of the lake water (5%)
   c. the entropy generated during this process. (10%)