114VE04

國立臺北科技大學 114 學年度碩士班招生考試

系所組別：1303 車輛工程系碩士班

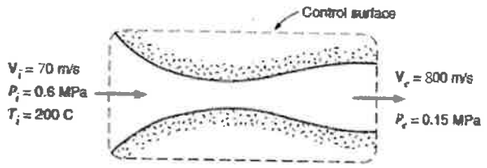
第二節　熱力學　試題（選考）

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. Steam at 0.6 MPa and 200°C enters an insulated nozzle with a velocity of 70 m/s. It leaves at a pressure of 0.15 MPa and a velocity of 800 m/s. Determine the final temperature if the steam is superheated in the final state and the quality if it is saturated.(20%)

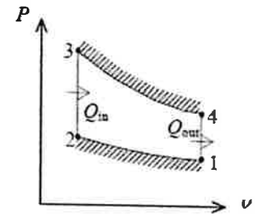
- Control volume：Nozzle
- Inlet state：fixed (see fig)
- Exit state：P_e known
- Process：steady-state
- Model：steam tables



2. A heat pump is used to heat a house during the winter. The house is to be maintained at 25°C at all times. The house is estimated to be losing heat at a rate of 145,000 kJ/h when the outside temperature drops to -10°C. Determine the minimum power required to drive this heat pump.(20%)

3. 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 (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%)



4. A compressor receives air at 100 kPa, with a velocity of 10 m/s. At the compressor discharge, the air exits at 1000 kPa, 500 K, with a velocity of 30 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 (10%)
b. the entropy change of the lake water (10%)