國立臺北科技大學 101 學年度碩士班招生考試

系所組別:1330 車輛工程系碩士班丙組

第一節 熱力學 試題

第一頁 共一頁

注意事項:

- 1. 本試題共5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。
- 1. A cylinder fitted with piston has an initial volume of $0.2\,m^3$ and contains nitrogen at 250 kPa, 25^0C . The piston is moved, compressing the nitrogen until the pressure is 1.25MPa and temperature 150^0C . During this compression process heat is transferred from the nitrogen, and the work done on the nitrogen is 20 kJ. Determine the amount of this heat transfer. (20%) (nitrogen $C_v = 0.745kJ/kg K$, R = 0.2968kJ/kg K)
- 2. Two steady flows of air enter a control volume. One is 0.03 kg/s of flow at 300 kPa, $250^{\circ}C$, and the other enters at 450 kPa, $10^{\circ}C$. A single flow exits at 100 kPa, $-35^{\circ}C$. The control volume rejects 1.2 kW of heat to the surroundings and produces 4 kW of power output. Neglect kinetic energies and determine the mass flow rate of the enter at 450

$$kPa, 10^{0}C. (20\%) (air C_{p} = 1.004kJ/kg - K)$$

- 3. We propose to heat a house in the winter with a heat pump. The house is to be maintained at $25^{\circ}C$ at all times. When the ambient temperature outside is $-15^{\circ}C$, the rate at which heat is lost from the house is estimated to be 30kW. What is the minimum electrical power required to drive the heat pump? (20%)
- 4. A mass of 1 kg of air contained in a cylinder at 2 MPa and 1000 K expands in a reversible isothermal process to a volume 12 times larger. Calculate the change of entropy of the air (20%)
- 5. Two flows of air are both at 200 kPa; one has 1kg/s at 350 K, and the other has 2 kg/s at 280 K. The two flows are mixed together in an insulated box to produce a single exit flow at 200 kPa. Find the total rate of entropy generation (20%)

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