國立臺北科技大學105學年度碩士班招生考試

系所組別：1303 車輛工程系碩士班

第三節　熱力學　試題（選考）

注意事項：

1. 本試題共五題，每題二十分，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。

一、A heat pump is used to heat a house and maintain it at 20^0C. When the outdoor temperature drops to -5^0C, the house loses heat at a rate of 120,000 kJ/hr. If the heat pump under these conditions has a COP of 3, determine (a) the power (kW) consumed by the heat pump (10%) and (b) the rate at which heat (kW) is absorbed from the outdoor. (10%)

二、A fan is claimed that it consumes 25 W of electrical power, when it operates to discharge air from a room at a rate of 1.2 kg/s at a discharge velocity of 8 m/s. Determine if this claim is reasonable. (20%)

三、A piston and cylinder arrangement initially contains air at 100 kPa and 25^0C. At this state, the piston is resting on a stop, and the enclosed volume is $0.4m^3$. The mass of piston is such that a 300 kPa pressure is required to move it. The air is heated until its volume becomes doubled. Determine, (a) the work done by the air, (10%) and (b) the total heat transferred to the air. (10%)(air R=0.287 kPam^3/kgK, $c_v = 0.7176$ kJ/kgK)

四、Air at 100kPa and 25^0C is compressed steadily to 800 kPa and 400 K. The mass flow rate of the air is 0.03 kg/s, and a heat loss of 20 kJ/kg(air) during the process. Determine the necessary power input to compressor, if the changes of kinetic and potential energy are negligible. (20%)(air $c_p = 1.004$ kJ/kgK)

五、Air at 200 kPa and 1000 K enters an adiabatic nozzle at low velocity and is discharged at a pressure of 60 kPa . If the isentropic efficiency of the nozzle is 93%, determine (a) the maximum possible exit velocity (7%), (b) the exit temperature, (6%) and, (c) the actual exit velocity of the air (7%). Assume constant specific heats of air. (air κ=1.4, $c_p = 1.095$ kJ/kgK)