國立臺北科技大學九十八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

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。

一、A balloon behaves so the pressure is $P = CV^{\frac{1}{2}}$, C=100 $kPa/m^{3/2}$. The balloon is blown up with air from a starting volume of 1 m^3 to a volume of 4 m^3. Find the final mass of the air, assuming it is at 25^0C,(10%) and the work done by the air. (10%)

二、Two air flows are combined to a single flow. Flow one is 1.5 m^3/s at 25^0C and the other is 2.5 m^3/s at 250^0C both at 100 kPa. They mix without any heat transfer to produce an exit flow at 100 kPa. Neglect kinetic energies and find the exit temperature and volume flow rate (20%)

三、Nitrogen at 250^0C, 300 kPa is in a piston cylinder, volume 6 L, with the piston locked with a pin. The forces on the piston require a pressure inside of 250 kPa to balance it without the pin. The pin is removed and the piston quickly comes to its equilibrium position without any heat transfer. Find the final temperature and the entropy generation due to this partly unrestrained expansion.

(N_2 $C_{p0} = 1.042$ kJ/kg-K, $C_{vo} = 0.745$ kJ/kg-K) (20%)

四、A car engine burns 6 kg of fuel at 1200^0C and rejects energy to the radiator and exhaust at an average temperature of 300^0C. Assume the fuel has a heating value of 50000kJ/kg and find the maximum amount of work the engine can provide. (20%)

五、Air enters an automotive supercharger at 101.3 kPa and 300 K and is compressed to 200 kPa. The efficiency is 75%. What is the required work input per kg of air?(10%) What is the exit temperature?(10%)(air $C_{p0} = 1.004$ kJ/kg-K)