# 國立臺北科技大學 111 學年度碩士班招生考試

## 系所組別：1313、1323 車輛工程系碩士班甲、乙組

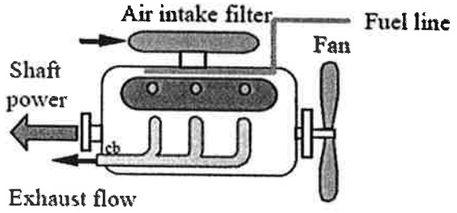
## 第二節　熱力學　試題（選考）



**注意事項：**

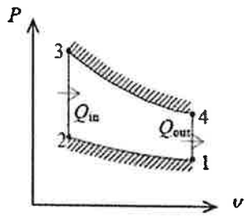
1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. A car engine delivers 25 hp to the drive shaft with a thermal efficiency of 30%. The fuel has a heating value of 40,000 kJ/kg. Find the rate of fuel consumption (10%) and the combines power rejected through the radiator and exhaust. (10%)




2. 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 $kJ/kgK$ for the iron) (20%)
   a. the entropy change of the iron block (6%)
   b. the entropy change of the lake water (7%)
   c. the entropy generated during this process. (7%)

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, 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*)

4. Air in a piston cylinder is at 90 kPa, 17°C with a volume of 0.001m3. It is now compressed to a volume 10 times smaller in a polytropic process with n=1.4 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%)

5. A heat pump is used to heat a house during the winter. The house is to be maintained at 21°C at all times. The house is estimated to be losing heat at a rate of 135,000 kJ/h when the outside temperature drops to -5°C. Determine the minimum power required to drive this heat pump.(20%)