淡江大學九十三學年度碩士班招生考試試題

系別：航空太空工程學系　　科目：熱　力　學

准帶項目請打「○」否則打「x」
簡單型計算機
○

壹、 簡答題：

(一)爲何水在高山上較平地上易沸騰？爲何用壓力鍋煮食物會較快煮熟？(6 分)

(二)什麼是 flowing work (flowing energy)？ P-V 圖曲線下面積代表什麼？T-s 圖曲線下面積又代表什麼？ (6 分)

(三)什麼是 heat engine？在沒有任何 friction and other irreversibilities 下，一 heat engine 之效率(efficiency)是否可達 100 percent？Why？(8 分)

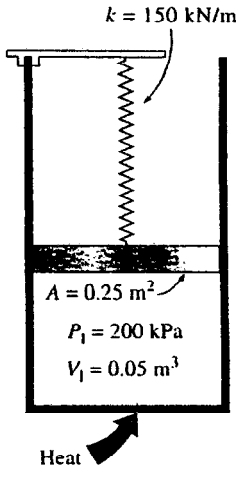
(四)在起始及終了狀態固定下之一過程中，無論過程是否可逆，其 entropy 變化是否相同？Why？(6 分)

(五)寫出造成一 open system (control volume) entropy 變化之機構(mechanisms)。(8 分)

(六)在熱力學 cycle 分析中，爲何 regeneration 可增加熱效率？intercooling 可降低 compressor 所需輸入功？reheating 可增加 turbine 輸出功？ (6 分)

貳、 計算題：

(七) A piston-cylinder device contains 0.05 m^3 of a gas initially at 200 kPa. At this stage, a linear spring that has a spring constant of 150 kN/m is touching the piston but exerting no force on it. Now heat is transferred to the gas, causing the piston to rise and to compress the spring until the volume inside the cylinder doubles. If the cross-sectional area of the piston is 0.25 m^2, determine (a) the final pressure inside the cylinder, (b) the total work done by the gas, and (c) the fraction of this work done against the spring to compress it. (20 分)



◀注意背面尚有試題▶

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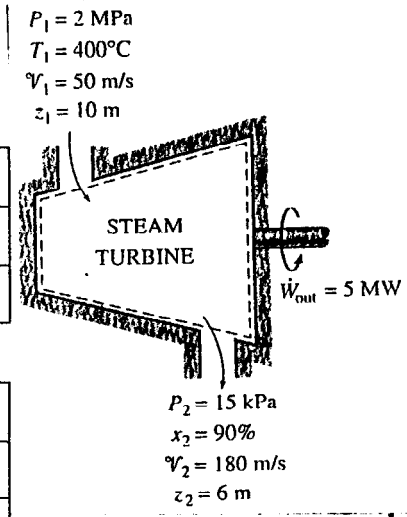
(八) The power output of an adiabatic steam turbine is 5 MW, and the inlet and the exit conditions of the steam are as indicated in figure. (a) calculate the magnitudes of enthalpy change per unit mass (△h), the kinetic energy change per unit mass (△ke) and the potential energy change per unit mass (△pe), (b) determine the work done per unit mass of the steam flowing through the turbine, and (c) calculate the mass flow rate of the steam. (20 分)



附表：

Saturated water table:

Pressure	Enthalpy: Saturated liquid	Enthalpy: Saturated vapor
15 kPa	225.94 kJ/kg	2599.1 kJ/kg
2 MPa	908.79 kJ/kg	2799.5 kJ/kg

Superheated water vapor table:

Pressure	Temperature	Enthalpy (kJ/kg)
0.2 MPa	400 °C	3276.6
2 MPa	400 °C	3247.6

(九) An ideal Otto cycle has a compression ratio of 9.2 and uses air as the working fluid. At the beginning of the compression process, air is at 27 °C and 98 kPa. The pressure is doubled during the constant-volume heat-addition process. Using constant specific heats at room temperature, determine (a) the amount of heat transferred to the air, (b) the net work output, (c) the thermal efficiency for the cycle. (20 分)

Note: C_p=1.005 (KJ/Kg K), C_v=0.718 (KJ/Kg K), k= C_p / C_v =1.4 for air

Isentropic relation: $T_2/T_1 = (v_1/v_2)^{k-1}$