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碩士班入學考試

國立成功大學71學年度機械工程研究所考試(第一次 試題) 共二頁 第一頁

1.(20%) Define or describe the following

(a) reversible and irreversible process

(b) principles of the increase of entropy

(c) Mollier and Psychrometric Chart

(d) the first law and second law efficiency.

2. (20%) A heat engine operating on a Carnot cycle has an efficiency of 60 % with 600 KJ/cycle taken from the high temperature reservoirs at 417 °C. Calculate

(a)the sink temperature, in degrees Celsius

(b)the heat rejected to the sink per cycle

(c)the entropy changes of heat source and heat sink in KJ/(°K)(cycle)

3. (20%) A rigid, insulated tank is divided into two compartments by a partition. Initially N_1 moles of gas A fills one compartment at P_1 and T_1. The other compartment contains N_2 moles of gas B at P_2 and T_2. The partition is removed and the gases allowed to mix. Determine the temperature and pressure of the mixture and the entropy change of each gas. Assume the C_P and C_v of each gas are given. The universal gas constant is R.

4. (20%) Find the change of enthalpy and entropy from state T_1 and P_1 to a state of higher value of T_2 and P_2 for a gas whose equation of state is $Pv = RT - (aP/T) + bP$ and whose specific heat at a pressure P_o is given by $C_{P,o} = 1 + cT$; a,b,c are constants, and P_o is less than P_1 and P_2.

5.

A leak occurs in a rigid, well-insulated, evacuated tank which has a volume of $5m^3$, and as a result, atmospheric air at 100 Kpa, and 20°C enters the tank. When the pressure in the tank reaches 100Kpa,

(a) Describe the conservation of mass and the conservation of energy in the thermal system. (5%)

(b) What is the mass of the air in the tank? (5%)

(c) Use the second law to show the process to be irreversible and calculate the irreversibility of this process. (10%)