淡江大學八十七學年度日間部轉學生入學考試試題

系別：機械工程學系三年級　　科目：熱 力 學

1.Explain the following thermodynamic terms: (20%)

(1) isolated system
(2) intensive property
(3) extensive property
(4) compressibility factor
(5) heat pump
(6) heat engine
(7) back work ratio
(8) Gibbs function
(9) Helmholtz function
(10) humidity ratio

2.Try to describe the following thermodynamic laws: (20%)

(1) the first law of thermodynamics
(2) the second law of thermodynamics
(3) Fourier's law of conduction
(4) Newton's law of cooling
(5) the principles of increase of entropy

3.Try to use temperature-entropy diagram to explain the ideal Rankine cycle. What are effects of boiler and condenser pressures on thermal efficiency of the Rankine cycle. (15%)

4.An inventor claims to have developed a device that executes a power cycle while operating between reservoirs at 500 and 300 K that has a thermal efficiency of 40% . Is it possible? Why? (15%)

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5.A small nuclear reactor is cooled by passing liquid sodium (Na) through it. The liquid sodium leaves the reactor at 0.2 MPa and 400℃. It is cooled to 320℃ by passing through a heat exchanger before returning to the reactor. In the heat exchanger, heat is transferred from the liquid sodium to water, which enters the exchanger at 10 MPa and 49℃(enthalpy is 176.38 kJ/kg) and leaves at the same pressure as a saturated vapor (enthalpy is 2724.7 kJ/kg). The mass flow rate of sodium is 10,000 kg/h, and its specific heat is constant at 1.25J/(g)(℃). Determine the mass flow rate of water evaporated in the heat exchanger, in kg/h, and the heat-transfer rate between the two fluids, in kJ/h. (15%)

6.A gearbox operating at steady state receives 20 horsepower along its input shaft, delivers power along its output shaft, and is cooled on its outer surface according to $\dot{Q} = -hA(T_b - T_o)$, where $T_b = 110°F$ is the temperature of the outer surface and $T_o = 40°F$ is the temperature of the surroundings far from the gearbox. The product of the heat transfer coefficient h and outer surface area A is 35 Btu/h·R. For the gearbox, determine the power delivered along the output shaft, the rate of availability transfer accompanying heat, and the irreversibility rate, each in Btu/h. Express each quantity as a percentage of the input power. (15%)