

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Thermodynamics

Master Program Entrance Examination

1. (a) Air contained in a piston-cylinder assembly performs an expansion process from V_1 to V_2 . Please compare the works done by the system if the process is performed in the isothermal, isentropic, and polytropic processes, respectively. Please explain your idea to design a device with the maximum work output.
(b) Air enters an insulated diffuser operating at steady state with a pressure of 2 bar, a temperature of 350 K, and a velocity of 250 m/s. At the exit, the pressure is 2.5 bar and the velocity is 150 m/s. Please determine the ratio of the exit flow area to the inlet area. What is the exit temperature of the flow? (25%)
2. A thermodynamic power cycle receives energy by heat transfer from an incompressible body of mass m and specific heat c initially at temperature T_H . The cycle discharges energy by heat transfer to another incompressible body of mass m and specific heat c initially at a lower temperature T_C . Work is developed by the cycle until the temperature of each of the two bodies is the same. Develop an expression for the maximum theoretical amount of work can be developed, in terms of m , c , T_H and T_C . (25%)
3. Considering human body a power system, please complete its energy and entropy analyses, and discuss its thermal efficiency in comparison to common thermodynamic power cycles. (25%)
4. Please sketch the T-s (temperature vs. entropy) diagrams of Rankine cycle and Brayton cycle, and discuss the advantages and dis-advantages between them in practice. (25%)