1071 機械系博士班資格考試題目

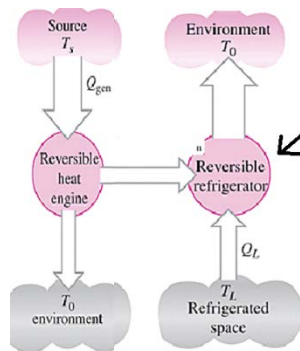| 考試科目	方式	
Thermodynamics & Heat Transfer	**Closed Book, Calculator is permitted.**	**Part I**

1. A heat engine that rejects waste heat (移除廢熱) to a sink at 350 K has a thermal efficiency of 36% and a second law efficiency of 60%. Determine the temperature of the source (T_H) that supplies heat to the engine. (10%)
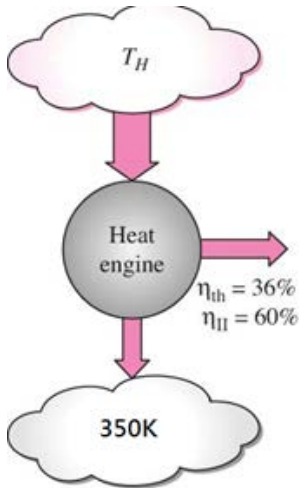
2. (a) Please define coefficient of performance of refrigerator (COP_R) and heat pump (COP_{HP}) (5%)

   (b) Prove that $COP_{HP} = COP_R + 1$ (10%)

3. Determining the **maximum COP** of an absorption (reversible) refrigerator term in terms of T_0, Ts, T_L (15%)

4. Starting with the first Tds relation $ds = \dfrac{du}{T} + \dfrac{P\,dv}{T}$, prove (證明) that isentropic process (s = constant) will also lead to(導致) isothermal process (T= constant) for incompressible substances. (10%)

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Thermodynamics & Heat Transfer	**Closed Book, Calculator is permitted.**	**Part II**

1. (10%) (a). Please describe the physical mechanisms of conduction, convection and radiation, and then also write their rate equations.

(b). What is heat transfer defined ?

(c) What is a contact resistance ?,

2. (20%) Passage of an electric current through a long conducting rod of radius ri and thermal conductivity kr results in uniform volumetric heating at a rate of q. The conducting rod is wrapped in an electrically nonconducting cladding material of outer radius ro and thermal conductivity kc, and convection cooling is provided by an adjoining fluid.
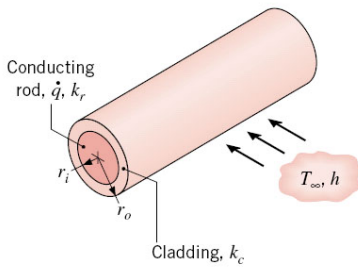
For steady state conditions, write appropriate forms of the heat equations for the rod and cladding. Express appropriate boundary conditions for the solution of these equations.

3. (20%) A closed container filled with hot coffee is in a room whose air and walls are at a fixed temperature. Identify all heat transfer processes that contribute to cooling of the coffee. Comments on features that would contribute to a superior container design.