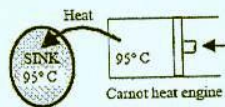


元智大學 102 學年度研究所 碩士班 招生試題卷

系(所)別： 機械工程學系碩士班 組別： 甲組 科目： 熱力熱傳學 用紙第 1 頁共 2 頁

●不可使用電子計算機

1. In the absence of any friction, can a heat engine have an efficiency of 100%? Explain. (5%)
2. Which of the object could not be modeled as thermal energy reservoirs (a) ocean, (b) lake, (c) kitchen, (d) river? Explain. (5%)
3. Difference between Immediate surroundings and Environment. (5%)
4. (a) Definition of COP_R and COP_{HP} for Refrigerator and Heat Pump, respectively? (5%) ($COP = \text{coefficient of performance}$)
(b) Prove $COP_{HP} = COP_R + 1$ (10%)
5. During the isothermal heat rejection process of a Carnot heat engine, the working fluid experiences an entropy change (ΔS) of -0.8 kJ/K . If the heat sink is 95°C , determine (a) the amount of heat transfer (5%), (b) entropy change of the sink (5%), (c) the total entropy change for this process(5%).



6. Determine the power required to raise a 500-kg elevator car from initial position of 20 m to 100 m in 20 s ($g = 9.8 \text{ m/s}^2$). (5%)



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系(所)別： 機械工程學系碩 組別： 甲組 科目： 熱力熱傳學 用紙第 2 頁共 2 頁
士班

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7. (a). Please describe the **physical mechanisms** of conduction, convection and radiation, and then also **write their rate equations**. 5%
(b) What is a thermal contact resistance? 5%
(c) Please **write heat equation** in Cartesian coordinates, with three dimensions, heat generation and unsteady. 5%
8. (20%) For flow of a liquid metal through a circular tube, the velocity and temperature profile at a particular axial location may be approximated as being uniform and parabolic, respectively. That is, $u(r) = C_1$ and $T(r) - T_s = C_2 [1 - (r/r_0)^2]$, where C_1 and C_2 are constants. What is the values of the Nusselt number Nu_D at this location?
9. (a). Define the following no-dimensional parameters and their physical interpretation, Re, Gr, Ja, Nu, Sh. 5%
(b). For forced convection over a flat plate, what is the **critical parameter and value** to characterize the laminar or turbulent convection? 10%

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