

國立中央大學 105 學年度碩士班考試入學試題

所別： 機械工程學系 碩士班 熱流組(一般生)
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科目： 熱力學

本科考試可使用計算器，廠牌、功能不拘

*請在答案卷(卡)內作答

1. Define the isothermal, isobaric and adiabatic processes. (6%)
2. A computer is to be examined from a thermodynamic viewpoint. Find the direction of the work and heat transfers (in, out or not exist) when (a) keyboard, (b) monitor and (c) central processor unit (CPU). (6%)
3. Fill in the relation for the following states: a) superheated vapor: p p_{sat} , T T_{sat} , v v_{sat} , (b) compressed liquid: p p_{sat} , T T_{sat} , v v_f , where p =pressure, T =temperature, v =specific volume, sat =saturated state, f =saturated liquid. (6%)
4. A piston in a cylinder contains air and it obtain the ideal gas relation ($pv=RT$) where the air is undergoing two continuous cooling processes. During the cooling process, the heat is rejecting out from the cylinder to the surroundings. The first process is set as pressure is constant until $T_2=3T_1/4$. The second process is fixed the piston position until $T_2=T_1/2$. Find the following values: (a) the ratio of final volume to the initial volume, (b) the work for the piston done on the air, (c) the total heat transfer amount from the air. (12%)
5. Define the second thermodynamic law efficiency. How does it differ from the first thermodynamic law efficiency? (8%)
6. A heat engine receive heat rate of 150,000 kJ/hour from a thermal energy reservoir at 1227°C and deliver a net power of 20 kW. The ambient temperature is 27°C. Find the thermal efficiency and the Carnot efficiency of this engine. What the maximum output power of the engine? Explain why there is difference between the net power and the maximum power. Note that kJ=kilo Joule, kW=kilo Watt. (12%)
7. 市面上最近開始看到「熱泵熱水器」，相較於傳統瓦斯或天然氣熱水器，熱泵熱水器具有何優點？為什麼？(8%)
8. Toyota 自 2015 年起，開始銷售燃料電池汽車，相較於傳統內燃機引擎汽車，燃料電池汽車有何優缺點？為何？(8%)
9. 「再生 Brayton cycle」相對於「簡單 Brayton cycle」有何優點？為什麼？甚麼條件下不適合將「再生」應用至 Brayton cycle？(10%)
10. 何謂「cogeneration plant」？簡單畫出一個 cogeneration plant 的系統示意圖，並說明其運轉原理。(12%)
11. 真實氣體的行為較理想氣體複雜許多，尤其是多組成的氣體混合物。請說明 3 種可以用來處理真實氣體混合物 P - v - T 關係的方法。(12%)