McMaster University Graduate Study Dr Nik Popov
Engineering Physics Course EP716
Reactor Thermal-Hydraulics Design

Student:	Test #2
Date: 15 Nov 2002	Heat Transport System Thermal-hydraulics Reactor thermodynamics
Scope:	1. For the BWR reactor shown in the attached sheet, calculate the following: ❑ Cycle thermal efficiency ❑ Recalculate thermal efficiency of the cycle assuming that the pumps, and turbine have isentropic efficiency of 100%, and ❑ Calculate the lost heat due to the irreversibility of each component in the cycle and show numerically that the available work equals the sum of the lost work and the net work. **[30 points]** 2. Explain how do you understand the application of 1st and 2nd Law of Thermodynamic in the thermal-hydraulics design of reactor heat transport systems. **[20 points]** 3. Assuming a certain geometry of the reactor fuel core (and fuel elements), show the relationship between the volumetric heat generation rate q''' [kW/m3], surface heat flux q'' [kW/m2], linear heat-generation rate q' [kW/m], rate of generated energy per fuel element q [kW], and core power Q [kW]. **[10 points]** 4. Explain pump operation in the primary heat transport system: • Pump curves • Pump operating quadrants • HTS system curve and pump curve • Cavitation issues **[20 points]** 5. For the case of steam generator with a preheater, derive the equations for inlet and outlet temperatures, and the preheater fraction (gamma), and explain the impact of most important parameters. **[20 points]**