

Reactor Thermal-Hydraulics Design and Analysis Test

<b>Student:</b>	<b>Test</b>
<b>Date:</b> <b>22 April 2006</b>	

1. **Design Process**

- Explain how do you understand the iterative nature of the design process..

2. **Design Requirements**

- Explain the requirements for materials for reactor coolant, list the usual materials used, and discuss how they meet the requirements.
- List and explain which design features are mostly influenced by the selection of reactor coolant.

3. **Power Reactor Types**

- List and explain the most important differences between the CANDU-type and PWR-type reactors.

4. **Flow Instabilities**

- Draw the flow instability diagram and explain the criteria of instability.
- Explain the impact of instability on in single channel configuration and parallel channel configuration.

5. **Thermal Efficiency**

- Explain the most important design features that limit the thermal efficiency in NPPs.

6. **Steam Generators**

- Explain the importance and use of the steam generator heat duty diagram.

7. **Fuel-Coolant Heat Transfer**

- Draw a diagram of temperature distribution along the fuel element and coolant in axial direction and explain the change of rate of heat transfer along different components.

8. **Two-phase Flow**

- Identify all boiling heat-transfer modes and transition points in the boiling curve.
- Explain / define the most important two-phase flow parameters: void fraction, volumetric flux, mass flux, thermodynamic quality, mass quality, slip ratio.
- List flow patterns that are possible in horizontal flow in a channel, and explain relevance to heat transfer modeling.

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9. **Film Boiling**

- Identify heat-transfer modes (i.e., conduction, convection, and radiation) between the heated wall and two phases in dispersed-flow film boiling.

10. **Basic Conservation Equations for Two-Fluid Models**

- Explain the difference between the microscopic and macroscopic form of the conservation equations.

11. **CHF and Safety Margins**

- Explain the CHF margins in thermal-hydraulics design using appropriate diagrams.

12. **Heat Transport Pumps**

- Explain what are pump curves by using appropriate diagrams, including pump efficiency and cavitation

13. **Thermodynamics Laws**

- Explain how the three laws are used in reactor thermal-hydraulics

14. **Pressure Drop**

- State the types of pressure drop along a pipe and explain the relative difference between them.
- What is the relationship between pressure drop and CHF in a CANDU fuel channel?
- What is the difference in modelling pressure drop in single-phase and two-phase flow?