THEORY QUESTION A

Describe the flow regimes for adiabatic flow in vertical and horizontal tubes.

Heterogeneous nucleation, bubble equilibrium, growth and dynamics.

Draw the pool boiling curve and identify the different boiling regimes. Also, explain the characteristics of each regime. In absence of the boiling curve, but all necessary correlations available, how you can identify the boiling regime?

Describe the wall temperature profile, the flow regimes and the heat transfer regimes along a uniformly heated vertical tube in flow boiling (both for low-medium and high heat fluxes). Draw the flow boiling map (q" - x)

Describe how the thermal crisis can be reached in flow boiling. Why it can occur at different qualities? Draw and discuss the heat transfer coefficient map (h-x) in flow boiling for different heat fluxes.

CHF in flow boiling: parametric dependencies and major trends. Main arguments on Post-CHF in flow boiling

Subcooled and saturated flow boiling.

Choked flow (definition and main aspects on single and two phase flow)

THEORY QUESTION B

Describe the flooding and flow reversal phenomena. The Wallis criterion.

Classify heat exchangers according to flow type and explain the characteristics of each type. The overall heat transfer coefficient. Fouling.

The LMTD method: performance and design calculations. Calculation of the LMTD for multiple passes shell and tube and cross flow heat exchangers. Limitations of the LMTD method.

The ε-NTU method: definition of effectiveness. Performance and design calculations. How the effectiveness changes increasing U or A or the heat capacitance ratio?

Pressure drops in two-phase flows: the HEM model.

Classification of different condensation regimes. The interfacial heat transfer coefficient for a planar interface.

The Nusselt's theory for film condensation. List the assumptions, and discuss the improvements.

Condensation inside and outside tubes. Main aspects about condensation in the presence of noncondensable gases