Chemical Thermodynamics

1. **Course number and name:** 020THCCS1 Chemical Thermodynamics

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name of instructor:** Maher ABBOUD

4. **Instructional Materials:**
   - Les nouveaux précis Bréal – BREAL- « Thermodynamiques, Matériaux Inorganiques ; Cours méthodes exercices résolus » J . MESPLEDE
   - « Thermodynamique chimique » J.P. BEYNIER ; J. MESPLEDE- BREAL
   - "Thermochimie" ; Exercices corrigés ; Christian PICARD ; De BOECK Université
   - « Nouveaux Cours de Chimie » ; Jean Claude MALLET, Roger FOURNIER, Chimie Cours 2ème année MP/PT-PSI-PC
   - « Thermodynamique de la réaction chimique, Rappels de Cours Exercices et problèmes corrigés » ; Jean Pierre TROUILHET, ELLIPSES
   - Cours de chimie, thermodynamique chimique, P MORLAES ; VUIBERT
   - Précis de chimie Cours exercices résolus, Thermodynamique- Cinétique chimique ; J. MESPLEDE JL, QUEYREL, BREAL
   - Thermochimie, Diagrammes binaires, Elaboration des métaux ; Puissances, Prépas BREAL
   - H-Prépa Chimie, 2ème année MP-MP* PSI, PSI*, PT, PT* ; Hachette supérieure
   - Thermodynamique chimique, M ; CHABANEL, ELLIPSES

5. **Specific course information**
   a. **Catalog description:**
   Chapter I - Reminders of the concepts; Chapter II - Perfect systems; Chapter III - Principle of the study of balances - The variance; Chapter IV - Binary solutions – Raoult and Henry; Chapter V – Thermodynamics stability- Liquid binary system - stability with respect to diffusion - Liquid-liquid transition or demixing; Chapter VI - The model of MSR regular solutions: Chapter VII Fractional distillation; Chapter VIII - Azeotropic mixtures and their mode of separation; Chapter IX – Completely or partially immiscible solid liquid mixtures Eutectics

   b. **Prerequisites:** 020TH2NI3 Thermodynamics 2

   c. **Required/ Selected Elective/Open Elective:** Required

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**

- Define a unitary and binary system at given T and P, with their different molar and partial molar thermodynamic quantities.
- Establish the equilibrium conditions of unitary and plural systems in phase equilibrium in order to draw up their isothermal and isobaric equilibrium diagram called distillation.
- Identify in mixtures, the behavior of the compound solvent and that of the solute according to the concept of Raoult and Henry.

- Know how to process binary diagrams of perfect and real mixtures by establishing deviations from the perfect using excess quantities.
- To be able to interpret the behavior of the constituents of a binary mixture, perfect or not, during cooling or heating and to evaluate the composition of the phases as well as the distribution of materials in each of the phases in equilibrium (chemical moment theorem).
- Know how to identify Azeotropic behavior, interpret it (Gibbs Konovalov) and establish its coordinates using the TROUTON approximation.
- To be able to analyze the stability and instability of phases with respect to molecular diffusion in mixtures and to establish the demixing domains in binodal and spinodal binary mixtures (strict instability and metastability)
- Establish and interpret Eutectic diagrams of solids or almost completely immiscible liquids.
- Identify in phase diagrams of immiscible solids the existence of defined compounds and deduce their gross chemical formula.

b. PIs addressed by the course:

PI	1,3	2.2	3.1	5,2	7.1	7.2
Covered	x	x	x	x	x	x
Assessed	x	x	x	x	x	x

7. Brief list of topics to be covered

- Thermodynamic of Perfect systems
- Binary solutions – Raoult and Henry
- Thermodynamic stability Liquid binary system - stability with respect to diffusion - Liquid-liquid transition or demixing
- The model of MSR regular solutions
- Null or partial solubility – Eutectic solid/liquid equilibria
- Simple distillation and fractional distillation