Kinetics of Chemical Reactions

1. **Course number and name:** 020CIHNI4 Kinetics of Chemical Reactions

2. **Credits and contact hours:** 2 ECTS credits, 1x1:15 contact hours

3. **Name(s) of instructor(s) or course coordinator(s):** Marie-José Zacca, Samar Kaddah, Fadel Chamsseddine, Alexandre Monnier

4. **Instructional materials:** course handouts; slides; in-class problems

5. **Specific course information**
   a. **Catalog description:**
   This course allows students to determine the rate of a chemical reaction and to understand the impact of different kinetic factors (temperature, concentration of reactants, catalysis) on the rate of a reaction. Through examples of simple chemical reactions, students will be able to express the rate law of a chemical reaction and the evolution of the concentration of a reactant over time. The notions of global order of a chemical reaction and partial order of the reactants will be discussed, as well as the methods for determining the value of these orders. In addition, in the case of more complex reactions occurring in several steps, students will be able to apply the steady state theory in order to express the rate of a complex reaction, the rate of disappearance of a reactant or the rate of formation of a product.

   b. **Prerequisites:** None

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

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
   - Express the molar concentration of species in solution and its molar fraction.
   - Distinguish the total pressure of a system in the gaseous state from the partial pressure of the different species present in the system.
   - Express the speed of disappearance of a reactant and the speed of formation of a product, as well as the volume rate of a reaction.
   - Evaluate the impact of kinetic factors on reaction speed (concentration of reactants, temperature, catalysts).
   - Determine the half life of a reaction.
   - Express the rate law of a reaction and determine the partial orders of the reactants by several methods.
   - Apply the method of order degeneracy.
   - Use Arrhenius law in order to calculate the rate constant at another temperature.
   - Distinguish homogeneous catalysis, heterogeneous catalysis and enzymic catalysis.

- Apply the steady state theory on several types of reactions.

b. PI addressed by the course:

PI	1.3	6.3	7.1
Covered	x	x	x
Assessed	x	x	

7. Brief list of topics to be covered

- Asymptotic analysis: Comparison of real functions near a given point, Taylor series and their applications (4 Lectures)
- Riemann Integral of step and piecewise continuous functions: fundamental theorem of calculus, Taylor- Lagrange theorem, approximation of integral the Riemann's sums (4 Lectures)
- Numerical Series: convergence, absolute convergence, comparison of series and operations on series (4 Lectures)
- Combinatorics: finite sets, cardinal of a set, number of bijective maps, of combinations (4 Lectures)
- Probability on finite spaces: general properties, Bayes formula, independent events (4 Lectures)
- Finite random variables: definition, mean, variance, standard deviation, Bernoulli and binomial variables, Bienaymé-Tchebychev inequality (4 Lectures)