Ideal and Non-ideal Reactors

1. **Course number and name:** 020RNICS2 Ideal and Non Ideal Reactors

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

3. **Name of instructor:** Jihane Rahbani

4. **Instructional Materials:**
   - Elements of Chemical Reaction Engineering, Fourth Edition, by H. Scott Fogler.
   - Réactions et réacteurs chimiques; Cours et exercices corrigés; Michel Guisnet, Sébastien Laforge, Dominique Couton

5. **Specific course information**
   a. **Catalog description:**
      Mass balance on ideal reactors: Closed reactor, open stirred reactor, plug flow reactor. Energy balances in ideal reactors. Real flow behaviors of the reactors; Distribution of residence times; DTS measurement: tracer method; Diagnosis of reactor malfunction; Modeling of non-ideal reactors: Tanks in series model; Axial dispersion model; Models with zero adjustable parameters.

   b. **Prerequisites:** 020BRICS1 Mass and energy balance

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

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      - Recognize the different types of ideal reactors.
      - Apply the laws of conservation of mass and energy to establish material and heat balances in ideal reactors.
      - Calculate reaction conversions, reaction rates and yields for ideal reactors.
      - Evaluate the performance of ideal reactors in terms of productivity, efficiency and selectivity.
      - Calculate heat fluxes, temperatures and enthalpies in ideal reactors.
      - Understand the limitations of ideal reactors and differences from real reactors.
      - Describe the cumulative functions F(t) and external age E(t) and residence time distribution.
      - Recognize these functions for PFR and CSTR reactors.
      - Apply these functions to calculate conversion and reactor outlet concentrations using the segregation model and the maximum mixing model.
      - Apply the perfectly stirred series reactor model and the dispersion model to tubular reactors.
      - Suggest ideal reactor combinations to model a real reactor.

b. PIs addressed by the course:

PI	1.1	1.2	1.3
Covered	x	x	x
Assessed	x	x	x

7. Brief list of topics to be covered

- Definitions
- Types of reactors
- Writing of the material balance on a volume of the reactor
- Application to different types of reactors
- Association of reactors (in series and in parallel)
- Heat balance of ideal reactors
- Flow in the reactors
- The distribution of residence times
- DTS measurement: tracer method - Pulse injection
- Step injection
- DTS Moments
- DTS in ideal reactors
- Diagnosis of the malfunction of a reactor
- Model of perfectly agitated tanks
- Axial dispersion model
- Segregation model
- Maximum mix model