Unit operations

1. **Course number and name:** 020OPUCS4 Unit operations

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

3. **Names of instructors:** Jihane Rahbani

4. **Instructional materials:**

- Course handouts
- In class problems
- References:
  - Chemical Process Equipment Selection and Design- Stanley M. Walas-Butterworth-Heinemann Series in Chemical Engineering.
  - Separation Process Principles- Chemical and Biochemical Operations-Seader/Henley/Roper-3rd Edition.

5. **Specific course information**
   a. **Catalog description:**
   Sizing of adsorption columns; Mass transfer zone and breakthrough curve in a fixed bed column; Empirical methods: Length of unused bed; The scale-up approach; Mathematical models (Thomas model, Bohart-Adams model (bed depth service time, BDST), Yoon Nelson model); Drying; Efficiency of the dryer; Mass transfer during drying; Psychrometry; Equilibrium relative humidity; Drying rate; Calculation of drying times; Mass and energy balance of a continuous dryer; The different types of dryers; Crystallization, Fundamentals of crystal growth; Measurement of growth rate; Crystal yield; Crystallization technologies; Equipment for solution crystallization; Crystallization from the molten state; Modeling and design of the crystallizer. Practical work: 1-Crystallization; 2- Polyvalent Reactor; 3-Drying

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

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

6. **Specific goals for the course**
   a. **Specific outcomes of instruction:**
   At the end of this course, students will be able to
   - Understand the concept “Unit operation”
   - Design and scale up an adsorption column.
   - Recognize the fundamental principles of the drying process
   - Determine the thermodynamic properties of Air-Water Mixtures and Moist solids.
   - Apply the laws of conservation of mass and energy to establish material and heat balances in continuous dryer and crystallizer.
   - Select the dryer that is best for each application.
   - Calculate drying rate.
   - Apply the laws of conservation of mass and energy to establish material and heat balances in a crystallizer.
   - Understand the fundamentals of crystal growth and nucleation

- Explain the operation and design of crystallization
- Determine crystal yield in a solution crystallization.

b. PIs addressed by the course:

PI	1.1	1.2	1.3	2.1	2.2	2.3
Covered	x	x	x	x	x	x
Assessed	x	x	x	x	x	x

7. Brief list of topics to be covered

- Chapter I Sizing of adsorption columns
- Chapter II Drying
- Chapter III Crystallization