PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
SCHOOL OF ENGINEERING
DEPARTAMENT OF CHEMICAL ENGINEERING AND BIOPROCESSES
ABET COURSE SYLLABI

# IIQ 2133 CHEMICAL PROCESSES

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| **Credits and contact hours:** | 10 UC credits /10 hours (3 h. Lectures; 1,5 h. Labs; 5,5 h. Independent learning experiences) |
| **Instructor's name:** | María Carolina Moreno |
| **Course coordinator's name** | To be defined |
| **Textbook:** | None |
| **Course Catalog Description:** | This course prepares students to formulate and solve material and energy balances in chemical and bioprocess systems, and sets the foundation for subsequent courses in unit operations, kinetics and process dynamics.<br>Basically, enters the point of view of engineering to solve problems related to processes: the decomposition of a process into its components, the formulation of relations between the known and the unknown process variables, the information gathering necessary to find the unknowns by combining experimental data, empiricism and application of natural laws, and finally, the union of all the required parts for obtaining the solution of the problem. |
| **Prerequisite Courses:** | Admission 2008 and above IIQ1002 o IIQ1003 oFIS1523<br>Admission 2009 and superior IIQ 2043 |
| **Co-requisite Courses:** | None |
| **Status in the Curriculum:** | Required |
| **Course Learning Outcomes:** | 1. Construct flowcharts from the description of any chemical process.<br>2. Analyze the freedom degrees of any chemical process.<br>3. Set and solve the mass balance of a chemical process.<br>4. Set and solve the energy balance of a chemical process.<br>5. Applying the concept of physical-chemical balance and its relationship to any chemical process.<br>6. Effectively work in teams to solve tasks, workshops and other related activities. |
| **Relation of Course to ABET Criteria:** | a. Knowledge of mathematics, science and engineering<br>e. Identify, formulate, and solve engineering problems<br>g. Effective communication<br>k. Techniques, skills, and modern tools for engineering practice. |

**Topics covered:**

1. Matter and Energy Balances in Simple Systems
   - Component balances equations; expressions for flows and concentrations of stream; data and relationships; analysis of freedom degrees; calculation basis.
   - Energy balance equation; energy forms (potential energy, kinetic and chemical, heat, work); thermophysical properties tables; specific heat; phase transition heat; defining reference states; analysis of freedom degrees; coupling of the mass and energy balances.
2. Reacting Systems
   - Reaction stoichiometry; system reactants components balance; excess and reactants conversion. Multi-reactant systems; selectivity reactions. of Energy balance formulation with the reactions net heat; formation, combustion and reaction heats; analysis of freedom degrees.
   - Elementary balances; formulation of the energy balance with the total stream's enthalpy; analysis of freedom degrees; comparison of elemental balances and by components; troubleshoot with partially unknown stoichiometry using component balances.
3. Physicochemical Equilibrium
   - Gases properties, pure liquids and solids and ideal mixtures; sources of information; thermodynamic freedom degrees.
   - Physicochemical equilibrium relations for ideal vapor-liquid systems; enthalpy-composition diagrams construction; material and energy balances graphical representation; flash distillation operations of ideal and real systems.
   - Psychometric chart for air-water balance; wetting and drying operations.
4. Multiple Units Systems
   - Special configurations of multi-unit systems (leakage current and recycle); special units (flow divider, mixer); variables of units and current; analysis of freedom degrees; coupling of the material and energy combined balances; sequencing calculations; global balances; redundant balances equations.
5. Transient Systems
   - Variables stationary position systems; differential expression of the balance equations; resolution methods.
   - Transient systems accumulation term; differential and integral expression of the balance equations.

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