

Chemical Processes

Calendar: 3rd day semester

Contact Hours: TP 52,5h; OT 15,0h

Scientific Area: Processes in Chemical and Biological Engineering

Intended learning outcomes (knowledge, skills and competences to be developed by the students):

The UC of Chemical Processes aims to develop simple mathematical calculations in order to quantify the transformation of raw materials into finished products, while also giving importance to consumption or production of energy.

Throughout this UC, students should acquire the following competencies:

- Implement mass balances and energy to unit operations and chemical processes with multiple steps.
- Classify and determine sensible heat, latent heats and heats of reaction.
- Implement combined mass balance and energy to any process.
- Solve problems involving mass balances and energy in non-stationary state

Syllabus:

1. Units metric systems and fundamental concepts.
2. Material balances in reactive and non-reactive processes and steady state. Material balance in nonreactive processes: Processes with multiple unit operations; Recycle and bypass. Material balance in reactive processes: Multiple reactions, yield and selectivity, molecular and atomic balances, product separation, recycle and purge, combustion.
3. Energy balances reactive and non-reactive processes and steady state. Energy forms. Energy balances on closed and open systems. Energy balances in non-reactive processes: Changes in pressure at constant temperature, Changes in temperature, sensible heat and heat capacity; processes involving phase change, latent heat. Energy balance reactive processes: heats of reaction,

measurement and calculation of heat of reaction (Hess's law), reactions of formation and heat of formation; combustion reactions; processes with unknown outlet conditions.

4. Combined energy and material balances.

Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

The main goal of this curricular unit is allow the student to develop mathematical skills to quantify the transformation of raw materials into finished products, giving emphasis to energy production or consumption, basic knowledge that is essential for a Petroleum engineering degree.

The curricular unit is structured in such a way that complexity of the theoretical contents is progressively increased throughout the semester. 1st chapter starts with the engineering calculation followed by presentation and analysis of data. In 2nd chapter material balances are presented, being these fundamentals subjects for the 3rd and 4th chapter were energy balances are presented to the students. Throughout the lecture of this curricular unit the reactions involved in the presented processes are increasingly more intricate, either the introduction of variable parameters, either with multiple reactions or with the introduction of kinetic parameters.

References:

1. Felder, Richard M., Rousseau, Ronald W., Elementary Principles of Chemical Process, New York, Jonh Wiley & Sons
2. Perry, Jonh H., Chemical Engineer's Handbook, New York, MacGraw-Hill Book Comp.
3. Geankoplis, Christie J., Transport Processes and Unit Opertions, Englewood Cliffs, N. J. , Prentice-Hall Internationa Inc.