

Chemical Processes

Calendar: 3rd semester

Contact Hours: TP – 52,5; OT - 15,0

Scientific Area: Processos em Engenharia Química e Biológica

Learning outcomes of the curricular unit

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 course, 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 non-reactive 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.

Demonstration of the syllabus coherence with the curricular unit's objectives

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 chemical engineering course.

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.

Teaching methodologies:

Lectures with exposition technique to depiction the proposed concepts by stimulating the student to a logic and critical thinking and also propose to the students, in an autonomous manner, the resolution of practical examples to implement the concepts outlined above.

Demonstration of the coherence between the teaching methodologies and the learning outcomes.

The main goal of this curricular unit is to allow the student to acquire material and energy balances knowledge that is essential for a Chemical engineering course, since the contents is expected to be focus in chemical activities, in which an important part is related with chemical industry

For these basic contents to be correctly acquired by the students, it must be teaches in a solid and consistent approach. For that purpose it is necessary that basic concepts, be properly explained. Consequently, it is essential that in theoretical classes' the fundamental concepts are exposed.

The acquired knowledge can be consolidate by solving relevant amount of practical problems, either by the teacher or by the student, which is a very important reason for the presence of significant number of practical classes.