

Minor in Pharmaceutical Engineering

Curriculum – Minor in Pharmaceutical Engineering

REQUIREMENTS

A total of 15 AUs shall constitute a Minor in Pharmaceutical Engineering and may be obtained over the duration of the student's respective degree program. Students can take the following courses of our CBE curriculum to fulfill this requirement:

1. Chemical Reaction Engineering (CH3002) – 4 AUs
2. Materials and Energy Balance (CH 1004) – 3 AUs
3. Chemical Engineering Unit Operations II (CH 3041) – 3 AUs
4. Chemistry of heterocyclic compounds (CH 4103) – 3 AUs
5. Formulation of Active Pharmaceutical Ingredients dosage forms (CH 4106) – 3 AUs
6. Bioseparations (CH4303) – 3 AUs

Students can also take an optional laboratory offered together with this minor:

7. Pharmaceutical Engineering Laboratory (CH 4171) – 1 AU

DESCRIPTION OF COURSES

CH 3002 Chemical Reaction Engineering

Reaction rates and batch reactor. Continuous isothermal reactors - Single reaction. Continuous isothermal reactors - Multiple reactions. Nonisothermal reactors. Multiple steady states and transients. Mass transfer and catalytic reactor. Examples in chemical and biological processing. Nonideal reactors, bioreactors, environmental modeling. Reactions of solids. Chain reactions, combustion reactors and safety. Polymerization reactions and reactors. Multiphase reactors.

CH 1004 Materials and Energy Balance

This subject focuses on the material and energy balances in chemical processes and lays foundation in thermodynamics, unit operations, kinetics, etc.. It introduces the engineering approach to problem solving: breaking a process down into its components, establishing the relations between known and unknown process variables, assembling the information needed to solve for the unknowns, and finally obtaining the solution using appropriate computational methods.

CH 3041 Chemical Engineering Unit Operations II

General principles of separation, particle technology and their applications. Crystallization, membrane processes, filtration and particle/colloid technologies. Recovery of products from pharma- & bio-processes.

CH 4103 Chemistry of Heterocyclic Compounds

The objective of the course is to give an insight into heterocyclic chemistry and the use of different classes of these compounds in active pharmaceutical ingredients. Heterocyclic compounds are of prime importance in the chemical industry, and heterocyclic chemistry is therefore a fundamental topic in the undergraduate courses. The emphasis of this course is on synthetic aspects, and it covers the essential details and basic principles with reference to all the important classes of heterocyclic compounds. It is the study of Heterocyclic organic compounds including their, methods of synthesis, reactions and their mechanisms. Three- four- five- and six- membered heterocyclic compounds with one heteroatom as well as five- and six- membered with two or three heteroatoms, particularly those containing nitrogen will be taught. The course includes synthesis of some naturally occurring heterocyclic compounds.

CH 4106 Formulation of Active Pharmaceutical Ingredients dosage forms

The objective of the course is to give an insight in drug formulation and the setting of quality specifications. Thus, the course is devoted to the objectives involved in bringing an active pharmaceutical ingredient into an effective and safe dosage form.

CH 4303 Bioseparations

Bioseparation techniques that have been developed over the past couple decades to separate biological mechanistic analysis of key phenomena at the microscopic scale in bioseparation, will be emphasized, purification of biomolecules ranging from recombinant proteins to gene therapy products, with footnotes detailing economics of the products. Among the topics to be discussed are sedimentation, centrifugation, filtration, membrane separations, precipitation, crystallization, extraction, and the principles and scale-up of liquid chromatography.

CH4171 Pharmaceutical Engineering Laboratory

This subject focuses on teaching and imparting to the students hands-on techniques in pharmaceutical engineering.

Upon successful completion of this course, students will be able to:

- a) Acquire hands-on techniques in synthesis of organic compounds
- b) Acquire hands-on techniques in various characterization methods
- c) Acquire hands-on techniques in separation and purification methods

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