

BS in Chemical Engineering

Course Description

CHEN 201 Principles of Chemical Engineering (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEM 211

This course introduces the students to chemical engineering profession and basic calculations in mass and energy balance; phase equilibrium; and process flow sheeting. It includes applications on reactive and non-reactive chemical processes. Computer programs are used to implement these topics.

CHEN 302 Computer Applications in Chemical Engineering (0:3:0)

1 Semester Credit Hour

Pre-requisite(s): CHEN 201 and CIEN 251

This course will focus on computer applications in chemical engineering including available software packages. Students will be introduced to the applications of software packages such as E-Z solve, Polymath, MATLAB, COMSOL, MATHCAD, Hysys, Aspen Plus for solving systems of algebraic and differential equations related to chemical engineering processes.

CHEN 312 Chemical Engineering Thermodynamics (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEM 315, CHEM 316, MENG 211

This course presents: fundamentals of thermodynamics, such as thermodynamic properties (energy, entropy, enthalpy, heat capacity, etc.), the first and second law of thermodynamics (energy and entropy balance), heat of reactions, etc., thermodynamics of ideal and non-ideal gases and liquids, vapor-liquid equilibrium and thermodynamics of chemical processes.

CHEN 321 Chemical Engineering Laboratory I (0:6:0)

2 Semester Credit Hours

Pre-requisite(s): MENG 211, CIEN 251, and MENG 361

In this laboratory course, students conduct selected experiments to illustrate and use material covered in transport phenomena courses: fluid, heat and mass transfer. Students are evaluated on submitted reports covering experimental design, theory tested, and analyses of experimental data.

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CHEN 351 Chemical Reaction Engineering (3:0:0)

2 Semester Credit Hours

Pre-requisite(s): CHEN 201 and CHEM 315

This course provides a detailed analysis to the principles of chemical kinetics, and reactor analysis and design. The course covers kinetics of homogeneous and heterogeneous reactions, design of isothermal reactors such as Batch, Continuous Stirred Tank Reactor (CSTR) and Plug Flow Reactor (PFR). Other topics include data collection and handling, non-isothermal reactor design and multiple reactions. The last part of the course considers homogeneous and heterogeneous catalytic reactions. Further, the course introduces the link between the theoretical part and the laboratory scale chemical reactors through physical tour of the Chemical Engineering Laboratory facility.

CHEN 371 Mass Transfer (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CIEN 251

This course covers molecular and convective steady- and unsteady- state mass transfer, interfacial mass transfer and continuous and stage-wise contact operations, with applications in absorption, stripping, and humidification. Further, the course introduces the link between the theoretical part and experimental design of mass transfer equipment through physical tour of the Chemical Engineering unit operation facility.

CHEN 403 Fundamentals of Biochemical Engineering (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): BIOL 112 and CHEN 351 / Co-requisite(s): CHEN 371

This course aims to apply the principles of Chemical Engineering in bioprocess, in which biocatalysts, i.e. cells and enzymes, play key roles in producing new bioproducts and chemicals. The purpose of this course is to introduce the fundamental principles of biochemical engineering and present a wide spectrum of potential technological applications. This course includes introduction to biochemical and microbiological applications to commercial and engineering processes, including industrial fermentation, ultrafiltration and resulting waste treatment. In addition to introduction to enzyme kinetics, cell growth, energetics and mass transfer.

CHEN 404 Safety and Environmental Impact (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): Senior Standing

Sources of hazard in chemical and petroleum industry, management of safety and loss prevention, safety programs and safety rules, typical and sources of pollutant in chemical and petroleum operations, environmental protection, rules and regulation.

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CHEN 422 Chemical Engineering Laboratory II (0:6:0)

2 Semester Credit Hours

Pre-requisite(s): CHEN 371 and CHEN 351 / Co-requisite: CHEN 472

In this course the students conduct selected experiments to apply material presented in kinetics and reactor design, and separation processes. Students are evaluated based on their participation and submitted reports. **(Writing Intensive Course)**

CHEN 462 Petroleum Refining Engineering (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEN 351 and CHEN 371

This course aims at introducing different techniques for petroleum refining. Topics include refinery feed stocks and products, field processes, crude distillation, coking and thermal processes, catalytic reforming and cracking, hydro- processing, and solvent treating processes. Solve petroleum-refining problems including material balances and process economics. Conduct lab experiments to characterize crude oils and final petroleum products. Students will do a case study of a typical refinery.

CHEN 463 Natural Gas Processing (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEN 371

This is an elective and a senior level course on process engineering. The course deals with natural gas properties including real gas mixtures behavior. Natural gas water systems, natural gas condensate systems, hydrate formation and inhibition. Separation processes. Field treatment of natural gas, absorption and adsorption processes. Natural gas dehydration, sweetening and sulfur recovery. Design and sizing of the main equipment.

CHEN 472 Separation Processes (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEN 371

This course aims to introduce the fundamental principles of Separation Processes through examining both equilibrium-controlled separation processes as well as separation processes that involve both mass transport

and equilibrium considerations. In order to probe the key concepts in depth, the course will focus primarily on binary and multicomponent distillation, leaching, absorption, membranes and liquid-liquid extraction. Furthermore, Computer instruction will be employed throughout the course to illustrate important characteristics of these separation systems.

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CHEN 473 Water Desalination (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEN 371

This course covers water resources, chemistry of saline water, modeling and analysis of single effect desalination combined with mechanical vapor compression and thermal vapor compression, modeling of multiple effect desalination (MED), modeling of single and multistage desalination processes, reverse osmosis. Also, cogeneration, scale formation, pre and post treatment operations will be discussed.

CHEN 474 Industrial and Wastewater Treatment(3:0:0)

3 Semester Credit Hours

Pre-requisite(s): Senior Standing

This course covers characteristics of industrial wastewater; physical, chemical and biological unit operations/processes in industrial wastewater treatment; non-conventional (advanced) wastewater treatment technologies; case study of industrial wastewater treatment processes.

CHEN 481 Process and Plant Design (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): IENG 231 and IENG 321 / Co-requisite: CHEN 472

Application of chemical engineering principles to the development of process flow diagrams including flow and process conditions. Estimation of capital and manufacturing cost and application of heuristic methods to the design of process equipment. Design of heat and separation sequences of chemical processes. Utilization of process simulators to develop process flow diagram and size equipment.

CHEN 482 Chemical Process Dynamics and Control (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): CHEN 302 and CHEN 351

This course aims to introduce process dynamics and principles of control for chemical processes. Topics covered include block diagrams, Laplace transforms, development of dynamic equations for elements of control loops, transient response of feed-back systems, stability characteristics of dynamic systems, gain and phase margins. In addition to development of process characterization using mathematical models, controller design, and implementation.

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Course Description

CHEN 491 Senior Design Project I (0:9:0)

3 Semester Credit Hours

Pre-requisite(s): Senior Standing

The Senior Design Project entails team work involving development of a two-semester long workflow that includes preparing and presenting a proposal for a major design work. The design work may involve physico-chemical process design and testing, or simulation workflow design related to one or more chemical engineering activities, such as, reaction, separation, mass or heat transfer and dynamic and control– with due consideration of economic, environmental and societal impacts. The SDP-I entails finalizing the proposal by interacting with the Faculty Supervisor. A progress report is due that includes the following: objective, review of literature, statement of the problem, scope of work, description of tasks to be executed and task plan. The recognition of the ethical and legal principles are also aspects of the course. Most of the tasks are planned to be pursued and finalized in Senior Design Project-II for the following semester.

CHEN 492 Senior Design Project II (0:9:0)

3 Semester Credit Hours

Pre-requisite(s): CHEN 491

The Senior Design Project entails team work involving development of a two-semester long workflow that includes designing, implementing and evaluate the propose solution to a certain engineering problem. The design work may involve process design and testing, or simulation workflow design related to one or more chemical engineering activities, such as, reaction, separation, mass or heat transfer and dynamic and control with due consideration of economic, environmental and societal impacts. The SDP- II entails finalizing the tasks planed in SDP- I. Students must present their work in a detailed technical report and defend their project in oral presentation.

CHEN 493 Special Topics in Petroleum Engineering (3:0:0)

3 Semester Credit Hours

Pre-requisite(s): Department Consent

A specific topic in Chemical Engineering that is not covered in other program courses is presented in a course format.