

# CHEMICAL ENGINEERING (CHEG)

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## **CHEG 101. Chemical Engineering Seminar. 0 Credits.**

**Offered Spring Semester Only; Lecture hours:1**

A joint seminar for all chemical engineering students and faculty. Variety of engineering-related topics presented by industrial, academic, alumni, and student speakers. Presentations and discussions on professional development and interpersonal skills in the work place, ethics, and societal issues, professional society activities, and other topics relevant to the profession.

## **CHEG 102. Chemical Engineering Seminar. 0 Credits.**

**Offered Spring Semester Only; Lecture hours:1**

A joint seminar for all chemical engineering students and faculty. Variety of engineering-related topics presented by industrial, academic, alumni, and student speakers. Presentations and discussions on professional development and interpersonal skills in the work place, ethics, and societal issues, professional society activities, and other topics relevant to the profession.

## **CHEG 103. Chemical Engineering Seminar. 0 Credits.**

**Offered Spring Semester Only; Lecture hours:1**

A joint seminar for all chemical engineering students and faculty. Variety of engineering-related topics presented by industrial, academic, alumni, and student speakers. Presentations and discussions on professional development and interpersonal skills in the work place, ethics, and societal issues, professional society activities, and other topics relevant to the profession.

## **CHEG 104. Chemical Engineering Seminar. 0 Credits.**

**Offered Spring Semester Only; Lecture hours:1**

A joint seminar for all chemical engineering students and faculty. Variety of engineering-related topics presented by industrial, academic, alumni, and student speakers. Presentations and discussions on professional development and interpersonal skills in the work place, ethics, and societal issues, professional society activities, and other topics relevant to the profession.

## **CHEG 200. Chemical Engineering Principles. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4,Lab:2**

Introduction to the concepts of material and energy balances and phase equilibria for chemical engineering processes. Introduction to problem solving methodologies and computer simulation. With experimental laboratory. Prerequisite: MATH 201.

## **CHEG 210. Applied Mathematics for Chemical Engineering. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:1**

Mathematical modeling and methods. Topics include ordinary and partial differential equations, Laplace transforms, and matrices with analytical and computer solutions. With computational laboratory. Prerequisite: MATH 211 or equivalent.

## **CHEG 2NT. Chemical Engineering Non-traditional Study. .25-4 Credits.**

**Offered Fall, Spring, Summer; Lecture hours:Varies**

Non-traditional study course in chemical engineering. Prerequisite: permission of the instructor.

## **CHEG 300. Heat and Mass Transfer. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4,Lab:2**

Conductive, convective and radiation heat transfer; analytical and numerical solutions of heat transfer problems, estimation of heat transfer coefficients, and heat exchanger design. Fundamentals of mass transfer (diffusion and convection) with applications to unit operations. With experimental laboratory. Prerequisites: ENGR 233, CHEG 200 and CHEG 210 or MATH 212.

## **CHEG 301. Transport of Heat and Mass. 1 Credit.**

**Offered Occasionally; Lecture hours:4**

Conductive, convective and radiation heat transfer; analytical and numerical solutions of heat transfer problems, estimation of heat transfer coefficients, and heat exchanger design. Fundamentals of mass transfer. Corequisite: CHEG 303. Prerequisites: ENGR 233, CHEG 200, and CHEG 210 or MATH 212.

## **CHEG 302. Equilibrium Stage Processes. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:2,Lab:1**

Analysis of binary and multicomponent separations by analytical, graphical, and computer methods. Topics include gas absorption, distillation, liquid-liquid extraction as well as selected novel separation processes. With computational laboratory. Prerequisite: CHEG 200. Corequisite: CHEG 300.

## **CHEG 303. Separation Processes. .5 Credits.**

**Offered Occasionally; Lecture hours:2**

Analysis of binary and multicomponent separations by analytical, graphical, and computer methods. Topics includes gas absorption, distillation, liquid-liquid extraction as well as selected novel separation processes. Corequisite: CHEG 301. Prerequisites: ENGR 233, CHEG 200 and CHEG 210. Minimum grade of a D.

## **CHEG 310. Chemical Engineering Thermodynamics. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:1**

Laws of thermodynamics, thermodynamic properties of materials, equations of state, refrigeration and engine cycles, physical and chemical reaction equilibrium, and solution thermodynamics. With computational laboratory. Prerequisites: CHEG 302 and CHEM 341 or CHEM 343.

**CHEG 315. Unit Operations Laboratory. .5 Credits.**

**Offered Spring Semester Only; Lecture hours:1,Lab:3**

A laboratory course in pilot-scale processes involving momentum, heat and mass transfer. Project definition, experimental operation, analytical procedures, data analysis, technical reports and oral presentations. Prerequisite: CHEG 302. Corequisite: CHEG 310.

**CHEG 320. Chemical Reaction Engineering. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Rate forms for homogeneous and catalytic reactions; isothermal and nonisothermal reactor design and analysis; interpretation of laboratory data; introduction to nonideal flow and residence-time distributions. With experimental laboratory. Prerequisites: CHEM 341 or CHEM 343, CHEG 210, and CHEG 310.

**CHEG 330. Process Control. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Dynamics of open and closed-loop processes. Design, analysis and tuning of PID feedback control based on transient, Laplace domain, and frequency response methods. Instrumentation and computer-based data acquisition and control for chemical processes. With experimental laboratory. Introduction to feedforward, cascade and advanced control strategies. Prerequisites: CHEG 300 and CHEG 302.

**CHEG 3NT. Chemical Engineering Non-traditional Study. .25-4 Credits.**

**Offered Fall, Spring, Summer; Lecture hours:Varies**

Non-traditional study course in chemical engineering. Prerequisite: permission of the instructor.

**CHEG 400. Process Engineering. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3**

Applications of engineering, economic, environmental, and ethical principles in preliminary process design using computer aids such as process simulators. Problem definition literature survey, flowsheet development, material and energy balances, equipment design, profitability analysis, oral and written communication. With design laboratory. Prerequisites: CHEG 310 and CHEG 315. Crosslisted as CHEG 600.

**CHEG 410. Project Engineering. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3**

Second of two capstone experiences. Students refine a general problem statement in order to plan, execute and assess a project that achieves specific goals. Design, construction, and testing of an apparatus, system, or simulation. Problem-solving, teamwork, communication, professional development, and laboratory work are emphasized. With design laboratory. Prerequisite: CHEG 400. Crosslisted as CHEG 610.

**CHEG 430. Chemical Engineering Project. .5 Credits.**

**Offered Either Fall or Spring; Lecture hours:1,Other:5; Repeatable**

Individual work with a faculty adviser on a development or design project beginning with a written plan and culminating with a deliverable product and a written report. Problem analysis involving information synthesis, experimentation, mathematical modeling or software development. Prerequisite: permission of the instructor. Crosslisted as CHEG 630.

**CHEG 431. Chemical Engineering Project. .5 Credits.**

**Offered Either Fall or Spring; Lecture hours:1,Other:5; Repeatable**

Individual work with a faculty adviser on a development or design project beginning with a written plan and culminating with a deliverable product and a written report. Problem analysis involving information synthesis, experimentation, mathematical modeling, or software development. Prerequisite: permission of the instructor.

**CHEG 440. Chemical Engineering Research. 1 Credit.**

**Offered Both Fall and Spring; Lecture hours:1,Other:9; Repeatable**

Independent study with a faculty adviser on a research project. Submit a project proposal for group review, conduct the work, and culminate with a written report and an oral presentation before a faculty group. Prerequisite: permission of the instructor. Crosslisted as CHEG 441 and CHEG 640 and CHEG 641.

**CHEG 441. Chemical Engineering Research. 1 Credit.**

**Offered Both Fall and Spring; Lecture hours:1,Other:10; Repeatable**

Independent study with a faculty adviser on a research project. Submit a project proposal for group review, conduct the work, and culminate with a written and an oral presentation before a faculty group. Prerequisite: permission of the instructor. Crosslisted as CHEG 440 and CHEG 640 and CHEG 641.

**CHEG 445. Experiments in Polymer Science and Technology. .5 Credits.**

**Offered Occasionally; Lecture hours:1**

Laboratory investigation into problems involving the synthesis, characterization, and processing of polymeric materials. Prerequisite: ENGR 240 or ENGR 242. Not open to students who have taken CHEG 450 prior to Fall 2012.

**CHEG 448. Electrochemical Energy Conversion. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:4**

Principles of electrochemistry including electrochemical thermodynamics, kinetics, and catalysis. Related emerging energy applications such as fuel cells and advanced batteries. Prerequisite: CHEM 201, CHEM 221 or CHEM 222.

**CHEG 450. Polymer Science. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4,Recitation:1**

Structure, characterization and properties of polymeric materials. Chemistry and kinetics of polymerization. Processing and application of polymers. Prerequisite: CHEM 341 or CHEM 343. Crosslisted as CHEG 650.

**CHEG 452. Bioprocess Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Survey course in biochemical engineering. Introduction to microbiology, biochemistry, cell metabolism and genetic control. Enzyme structure and function; enzyme kinetic mechanisms. Emphasis on the design of biochemical reactors and separation processes utilizing fundamental principles of kinetics, thermodynamics and heat, mass and momentum transfer. Prerequisite: CHEG 302. Corequisite: CHEG 320. Crosslisted as CHEG 652.

**CHEG 453. Product and Process Chemistry. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Examination of the internal structure of the chemical industry. The roles of key chemicals and intermediates in chemical synthesis are emphasized to provide an overview of current industrial production methods. Product and process history, design and improvement are covered through discussions, simulations and case studies. Prerequisite: permission of the instructor. Crosslisted as CHEG 653.

**CHEG 454. Pharmaceutical Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Applications of core chemical engineering concepts to pharmaceutical processes. Development of fundamentals used in the pharmaceutical industry. Introduction to the development and approval of pharmaceutical process, along with social, regulatory, historical and ethical issues present in the pharmaceutical industry. Prerequisite: CHEG 300 or BMEG 400 or permission of the instructor. Crosslisted as CHEG 654.

**CHEG 455. Atmospheric Chemistry and Physics. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Addresses the relationships of chemistry, physics, and engineering principles in understanding processes in the Earth's atmosphere. Topics include overview of the Earth's atmospheric history and problems of current environmental concerns including urban ozone, acid rain, particulate pollution, and global change. Prerequisite: permission of the instructor. Crosslisted as CHEG 655.

**CHEG 457. Applied Colloid, Surface, and Nanoscience. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

We will explore the ways in which surfaces are different from bulk substances, and how this impacts processes such as illness, chemical processing, contaminant transport, and enzymatic activity. The topics discussed in class will be shaped by student interest. Prerequisite: permission of the instructor. Corequisite: CHEM 341 or CHEM 343. Crosslisted as CHEG 657.

**CHEG 460. Biomaterials: Materials in Medicine. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4,Recitation:1**

Classes of biomaterials, their applications, and current trends in biomaterials research and technology. Medical/ethical implications of biomaterials development and research. Open to seniors in chemical engineering, others by permission of the instructor. Crosslisted as CHEG 660.

**CHEG 465. Advanced Materials Science and Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4,Recitation:1**

Advanced, in-depth exploration of processing - structure - property - performance relationships of materials through real-world examples and case studies. Prerequisite: ENGR 240, ENGR 242, or equivalent. Crosslisted as CHEG 665.

**CHEG 470. Special Topics in Chemical Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4; Repeatable**

Advanced, in-depth courses developed from areas of chemical engineering science or technology. Prerequisite: permission of the instructor. Crosslisted as CHEG 670.

**CHEG 472. Special Topics in Chemical Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4; Repeatable**

Advanced, in-depth courses developed from areas of chemical engineering science or technology. Prerequisite: permission of the instructor. Crosslisted as CHEG 672.

**CHEG 481. Topics in Reaction Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Reactor design and analysis applied to specific systems. Complex chemical reaction networks with emphasis on nonideal flow and transport effects on heterogenous reactors. Prerequisite: permission of the instructor. Crosslisted as CHEG 681.

**CHEG 482. Topics in Chemical Engineering Applied Mathematics. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Analytical and numerical methods for ordinary and partial differential equations with problems drawn from chemical engineering. Topics include transform methods, matrix methods, weighted-residual methods, and finite differences. Prerequisite: permission of the instructor. Crosslisted as CHEG 682.

**CHEG 483. Topics in Chemical Engineering Thermodynamics. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:4**

Advanced study of thermodynamics applied to fluid flow, heat transfer, gas compression, air conditioning, refrigeration, and chemical equilibria.

Prerequisite: permission of the instructor. Crosslisted as CHEG 683.

**CHEG 485. Topics in Transport Theory. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:4**

Mass, energy, and momentum transfer in continuous media. General equations of transfer developed and used to analyze physical systems.

Development and application of mathematical techniques appropriate to the topic. Prerequisite: permission of the instructor. Crosslisted as CHEG 685.

**CHEG 495. Advanced Topics in Engineering Mathematics. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4**

Linear algebra and analytical/computational techniques for solving ordinary and partial differential equations relevant to engineering applications.

Prerequisite: permission of the instructor. Crosslisted as CEEG 495 and ECEG 495 and ECEG 695 and MECH 495 and ENGR 695.

**CHEG 4NT. Chemical Engineering Non-traditional Study. .5-2 Credits.**

**Offered Fall, Spring, Summer; Lecture hours:Varies**

Non-traditional study in chemical engineering. Prerequisite: permission of the instructor.