

# California State University, Long Beach 2025-2026 Undergraduate and Graduate Catalog

## Courses

[Contract All Courses](#) |

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### Chemical Engineering

#### **CH E 100 - Introduction to Chemical Engineering**

(1 unit)

Chemical engineering as a profession. Nature of profession and career opportunities. Emerging frontiers of chemical engineering.

Letter grade only (A-F). (Lecture 1 hour) Same Course as [CH E 100H](#)

Not open for credit to students with credit in: [CH E 100H](#)

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#### **CH E 100H - Introduction to Chemical Engineering**

(1 unit)

Prerequisite: Engr Honors Program track I or II.

Chemical engineering as a profession. Nature of profession and career opportunities. Emerging frontiers of chemical engineering.

Letter grade only (A-F). (Lecture 1 hour). Same course as [CH E 100](#)

. Open to students in the Engineering Honors Program. Additional assignments/projects adding depth to the course materials required for Engineering Honors students. Not open for credit to students with credit in [CH E 100](#)

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#### **CH E 200 - Chemical Engineering Fundamentals**

(3 units)

Prerequisites: [CHEM 111A](#)

, [MATH 122](#)

, [PHYS 151](#)

all with a grade of "C" or better.

Dimensional analysis of units, steady and transient balances of mass, momentum and energy, the mathematical solution of chemical engineering problems.

Letter grade only (A-F). (Lecture-problems 3 hrs) Same course as [CH E 200H](#)

. Not open for credit to students with credit in [CH E 200H](#)

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## **CH E 200H - Chemical Engineering Fundamentals**

(3 units)

Prerequisites: [CHEM 111A](#)

, [MATH 122](#)

, [PHYS 151](#)

all with a grade of "C" or better. Engr Honors Program track I or II.

Dimensional analysis of units, steady and transient balances of mass, momentum and energy, the mathematical solution of chemical engineering problems

Letter grade only (A-F). (Lecture-problems 3 hours) CHE 200H is open only to students in the Engineering Honors Program. Additional assignments/projects adding depth to the course materials required for Engineering Honors students. Not open for credit to students with credit in [CH E 200](#)

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## **CH E 210 - Computer Methods in Chemical Engineering**

(3 units)

Prerequisite/corequisite: [MATH 123](#)

Beginning programming and techniques of numerical analysis applied to typical problems in chemical engineering.

Letter grade only (A-F). (Lecture-problems 2 hours, lab 3 hours)

## **CH E 220 - Chemical Engineering Thermodynamics I**

(3 units)

Prerequisite(s)/Corequisite(s): [CHEM 111B](#)

or [CHEM 112B](#)

and [CH E 200](#)

Applications of the first and second laws of thermodynamics to chemical processes. Concepts of heat, work, and energy. Energy balances in batch and flow processes, with and without chemical reaction. Gas behavior, phase change, vapor pressure, humidity.

Letter grade only (A-F). (Lecture-problems 3 hours)

## **CH E 310 - Chemical Engineering Thermodynamics II**

(3 units)

Prerequisites: [CH E 210](#)  
, [CH E 220](#)

all with a grade of "C" or better.

Analysis and design of process equipment and systems using thermodynamics. Turbines, compressors, power plants, refrigeration cycles. Phase equilibria and nonideal solution behavior. Chemical reaction equilibria and heat effects.

Letter grade only (A-F). (Lecture-problems 3 hours) Not open for credit to students with credit in CHE 410.

## **CH E 320 - Fluids**

(3 units)

Prerequisites: [CH E 200](#)  
, [C E 205](#)

all with a grade of "C" or better.

Study of the deformation and flow of fluids, both liquids and gases, with applications to chemical engineering.

Letter grade only (A-F). (Lecture-problems 3 hours)

## **CH E 330 - Separation Processes**

(3 units)

Prerequisite/Corequisite: [CH E 310](#)

Material and energy balances around multi-stage mass transfer unit operations. Calculation and graphical estimation of ideal number of stages. Binary and multicomponent liquid-liquid extraction, distillation and gas absorption. Model equilibrium staged separation processes with chemical process simulation software.

Letter grade only (A-F). (Lecture-problems 2 hours, lab 3 hrs) Same course as [CH E 330H](#).  
. Not open for credit to students with credit in [CH E 330H](#).

## **CH E 330H - Separation Processes**

(3 units)

Prerequisite/Corequisite: [CH E 310](#)

. Engr Honors Program track I or II. Exclude freshmen.

Material and energy balances around multi-stage mass transfer unit operations. Calculation and graphical estimation of ideal number of stages. Binary and multicomponent liquid-liquid extraction, distillation and gas absorption. Model equilibrium staged separation processes with chemical process simulation software.

Letter grade only (A-F). Additional assignments/projects adding depth to the course materials required for Engineering Honors students. (Lecture-problems 2 hours, laboratory 3 hours) Not open for credit to students with credit in [CHE 330](#)

## **CHE 340 - Environmental Sensors and Measurements**

(2 units)

Prerequisites: [PHYS 152](#)

or [EE 210](#)

and [EE 210L](#)

) and [CHE 200](#)

all with a grade of "C" or better.

Introduction to environmental instruments, such as sensors for measuring CO<sub>2</sub>, NO<sub>x</sub>, PH and other harmful compounds in air, water, and soil. Laboratory applications of sensors with data collection and analysis.

Letter grade only (A-F). (Lecture 1 hour, Laboratory 3 hours) Not repeatable for credit.

## **CHE 365 - Statistics for Chemical Engineers**

(3 units)

Prerequisites: [CHE 210](#)

and [MATH 224](#)

all with a grade of "C" or better.

Principles of statistics applied to chemical engineering research and industry. Probability distributions, parameter estimations, confidence intervals and hypothesis testing. Design of experiments. Statistical process control in manufacturing for quality and safety. Computational tools for analyzing case studies.

Letter grade only (A-F). (Lecture 2 hours, Laboratory 3 hours) Not repeatable for credit.

## **CHE 415 - Occupational and Environmental Safety Engineering and Management**

(3 units)

Prerequisite: [CHEM 227](#)

or [CHEM 220A](#)

or [CE 364](#)

, with a grade of "C" or better.

Safety analysis and management, legislation, regulations and standards; toxicology and personal protective equipment; fire hazards; noise control; electrical safety; container and spill management; statistical analysis. Extra requirements for graduate students.

Letter grade only (A-F). (Lecture-problems 3 hours) Double Numbered with: [CHE 515](#)

## **CH E 420 - Heat and Mass Transport**

(3 units)

Prerequisites: [CHE 220](#)

, [CHE 320](#)

all with a grade of "C" or better.

Heat exchange by conduction, convection and radiation. Diffusion in fluids and solids. Simultaneous heat and mass transport.

Letter grade only (A-F). (Lecture-problems 3 hours)

## **CH E 426 - Polymer Science and Engineering**

(3 units)

Prerequisites: [CHE 320](#)

, or [CE 335](#)

, or [MAE 333](#)

all with a grade of "C" or better.

Analysis of mechanical tests of polymers in the glassy, rubbery, and fluid states. Glass transition, amorphous and crystalline materials. Mechanical behavior of thermoplastics, vulcanized rubber, and thermosets. Viscoelastic properties, failure mechanics, yielding of polymers. Fatigue and fracture mechanics for polymers.

Letter grade only (A-F). (Lecture-Problems 3 hours)

## **CH E 428 - Fundamentals of Soft Materials**

(3 units)

Prerequisite(s): CH E 220 and CH E 320, all with a grade of "C" or better.

Dive into soft materials, studying their deformable nature and weak intermolecular interactions.

Explore key concepts and emerging applications, from soft robotics to flexible electronics and energy production. Topics include polymers, colloids, surfactants, gels, and biomaterials, alongside characterization and fabrication techniques.

Letter grade only (A-F). Not repeatable for credit.

## **CH E 430 - Chemical Reactor Kinetics**

(3 units)

Prerequisite: [CHE 310](#)

Mechanism and rate law of chemical reaction, temperature and pressure effects, homogeneous and heterogeneous reactions and application to reactor design, catalysts.

Letter grade only (A-F).

(Lecture-problems 3 hours)

## **CH E 431 - Heterogeneous Catalysts**

(3 units)

Prerequisite: [CHE 430](#)

with a grade of "C" or better or consent of instructor.

Basic principles of solid catalysts and solid catalyzed reactions. Proper choice of catalysts and how to solve catalyst-related problems in chemical engineering. Development of chemical processes that utilize innovative catalysts. Graduate students will need to do more assignments.

Letter grade only (A-F). (Lecture-problems 3 hours). Double Numbered with: [CHE 531](#)

## **CH E 432 - Microfabrication and Microfluidics Technology**

(3 units)

Prerequisite(s): ([CHE 320](#)

or [C E 335](#)

) and ([CHEM 227](#)

or [CHEM 220A](#)

or [C E 364](#)

) and ([MATH 370A](#)

or [CHE 480](#)

) all with a grade of "C" or better.

Fundamentals of major microfabrication techniques for device construction and microfluidics technology. Topics: photolithography, wet/dry etching, metal/dielectric deposition, soft lithography, diffusion/mixing/separation in microfluidic devices, and chip-to-world interfaces. Graduate students need to do more assignments.

Letter grade only (A-F). (Lecture-problems 3 hours). Double Numbered with: [CHE 532](#)

## **CH E 433 - Green Engineering I: Alternative Energy**

(3 units)

Prerequisites: [CHE 220](#)  
or [MAE 330](#)

) all with a grade of "C" or better.

Aspects of green engineering. Sustainable liquid fuels: ethanol and biodiesel from renewable sources.

Photovoltaic solar devices: semiconductor- and polymer-based solar cells. Solar array collectors:

power cycles to convert heat to electrical power. Hydrogen fuel cells: electrochemical cells, and proton exchange membranes. Graduate students will submit final written reports.

Letter grade only (A-F). (Lecture-Problems 3 hours). Double Numbered with: [CHE 533](#)

## **CHE 434 - Waste Valorization and Resource Recovery**

(3 units)

Prerequisites: [CHE 200](#)  
and [CHE 220](#)

all with a grade of "C" or better.

Fundamentals of generation, processing, and disposal of municipal and industrial wastes and shifts towards zero waste. These topics are addressed from a technical and economic point of view by emphasizing beneficial reuse and resource recovery compared to traditional waste management.

Letter grade only (A-F). (Lecture 3 hours) Not repeatable for credit.

## **CHE 437 - Materials Purification Processes**

(3 units)

Prerequisite: [CHE 330](#)  
, [CHE 420](#)

all with a grade of "C" or better or consent of instructor.

Rate-controlled separation processes such as membrane separations, pressure swing adsorption, molecular sieve separation, supercritical fluid extraction, reverse osmosis, and spray drying.

Additional projects required for [CHE 537](#)

Letter grade only (A-F). (Lecture-problems 3 hours) Double Numbered with: [CHE 537](#)

## **CHE 439 - Fuel Cell Fundamentals and Theory**

(3 units)

Prerequisites: [CHE 220](#)  
and [CHE 320](#)

) or [CHE 335](#)

and [MAE 330](#)

) or [CHEM 371A](#)

or [CHEM 377A](#)

, all with a grade of "C" or better

Theory of electrochemistry. Survey of electrochemical fuel cell systems. Fundamentals of electrochemical thermodynamics, electrochemical kinetics, charge transport, and mass transport.

Review of fuel cell modeling and characterization techniques. Atomic level density functional theory (DFT) calculations of a fuel cell catalyst reaction.

Letter grade only (A-F). (Lecture-problem 3 hours).

## **CH E 440 - Chemical Engineering Laboratory I**

(2 units)

Prerequisites: [CH E 320](#)

, [CH E 330](#)

, and [CHE 365](#)

all with a grade of "C" or better.

Laboratory study of fluid mechanics, separation processes and thermodynamics. Experimental design and analysis and preparation of engineering reports.

## **CH E 445 - Pollution Prevention**

(3 units)

Prerequisites: [CH E 220](#)

or [MAE 330](#)

) with a grade of "C" or better.

Pollution prevention strategies in chemical industry. Hierarchical approach of waste minimization.

Life cycle analyses of wastes. Identification of pollution source. Environmentally compatible materials. Unit operations for minimizing waste. Economics of pollution prevention. Extra requirement for graduate students.

Letter grade only (A-F). (Lecture-problems 3 hours) Double Numbered with: [CHE 545](#)

## **CH E 446 - Industrial Pollution Mitigation and Control**

(3 units)

Prerequisite: [CHE 200](#)

with a grade of "C" or better.

Corequisite: [CHE 445](#)

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Overview of environmental pollutants and their adverse effects. Engineering methods for preventing or reducing pollution to achieve compliance with human health laws, sustainable development and



environmental laws. Sensors and control techniques to monitor and treat polluted air, water and soil.

Letter grade only (A-F). (3 hours lecture) Not repeatable for credit.

## **CH E 450 - Chemical Engineering Laboratory II**

(2 units)

Prerequisites: [CH E 420](#)

with a grade of "C" or better.

Prerequisite(s)/Corequisite(s): [CH E 420](#)

, [CH E 430](#)

, and [CH E 460](#)

Apply fundamental knowledge of heat transfer, chemical separations, process control and chemical kinetics to practical experiments. Remote data acquisition and control of process equipment. Design experiments to collect data, and perform data analysis. Written reports and oral/poster presentations.

Letter grade only (A-F). (Laboratory 6 hours)

## **CH E 455 - Environmental Compliance**

(3 units)

Prerequisites: [CHEM 227](#)

or [CHEM 220A](#)

or [C E 364](#)

) with a grade of "C" or better.

Physical and chemical properties of hazardous materials and wastes. Environmental hazards. An examination of environmental laws, regulations and standards dealing with storage, transportation, treatment and disposal of hazardous wastes. Emergency planning and preparedness. Extra requirement for graduate students: term papers or projects.

Letter grade only (A-F). (Lecture-problems 3 hours) Double Numbered with: [CH E 555](#)

## **CH E 460 - Chemical Process Control**

(3 units)

Prerequisites: [CH E 420](#)

, [CH E 430](#)

, and [MATH 370A](#)

or [CH E 480](#)

) all with a grade of "C" or better.

Control theory and practice, instrumentation, system responses, transfer functions, feed-back control, and stability as applied to chemical engineering processes.

Letter grade only (A-F). (Lecture-problems 2 hours, lab 3 hours)

## **CH E 461 - Chemical Process Automation I: Theory**

(3 units)

Prerequisite/Corequisite: [CH E 460](#)

Provides an introduction of Boolean algebra, basic concepts on digital control system, fundamental programming techniques for programmable logic controllers (PLC) and their applications on chemical systems.

Letter grade only (A-F). (2 hours discussion, 3 hours lab).

## **CH E 462 - Chemical Process Automation II: System Integration**

(3 units)

Prerequisite: [CH E 461](#)

with a grade of "C" or better

Analytical instrumentation, chemical sensors, valves, analog data acquisition, process control. Design and build basic automation system.

Letter grade only (A-F). (2 hours discussion, 3 hours lab).

## **CH E 470 - Chemical Engineering Design**

(4 units)

Prerequisites: [CH E 330](#)

, [CH E 420](#)

, [CH E 430](#)

, and [C E 406](#)

all with a grade of "C" or better. Exclude first-time, first-year students.

One-semester capstone design course fulfilling integrative learning. Design and optimization of chemical processing plants using analytical methods and modern computer simulation tools.

Chemical process equipment sizing. Economic, ethical and safety issues considered. Teamwork, oral presentations and written reports are required.

(Lecture-problems 3 hours, problem-design session 3 hrs) Same course as [CH E 470H](#)

## **CH E 470H - Chemical Engineering Design**

(4 units)

Prerequisites: [CH E 330](#)

, [CH E 420](#)

and [CH E 430](#)

all with a grade of "C" or better. Engr Honors Program track I or II. Exclude Freshmen.

One-semester capstone design course fulfilling integrative learning. Design and optimization of chemical processing plants using analytical methods and modern computer simulation tools.

Chemical process equipment sizing. Economic, ethical and safety issues considered. Teamwork, oral presentations and written reports are required.

Additional assignments/projects adding depth to the course materials required for Engineering

Honors students. CH E 470H is open only to students in the Engineering Honors Program. Not open for credit to students with credit in CH E 470.

## **CH E 471 - Fundamentals of Pharmaceutical Processes**

(3 units)

Prerequisites: [CH E 320](#)

or [BME 370](#)

or [C E 335](#)

or [MAE 333](#)

all with a grade of "C" or better.

An introduction to the essential operations and regulatory aspects used in manufacturing pharmaceutical products, scale-up, troubleshooting and optimization. Discussions of the pharmaceutical product lifecycle, variability, testing and ingredients specifications. Unit operations addressed include feeding, blending, granulation, drying and compaction.

Letter grade only (A-F). Lecture 3 hours May be repeated for 3 units in different semester.

## **CH E 475 - Environmental Pollution**

(3 units)

Prerequisites: [CHEM 220A](#)

or [CHEM 227](#)

or [C E 364](#)

) all with a grade of "C" or better.

Application of chemistry to the problems of pollution. Graduate students have additional assignments.

Letter grade only (A-F). (Lecture-problem 3 hours) Double Numbered with: [CH E 575](#)

## **CH E 480 - Theoretical Methods in Chemical Engineering**

(3 units)

Prerequisites: [CH E 420](#)

, [CH E 430](#)

all with a grade of "C" or better.

Simulation and optimization of chemical engineering processes by mathematical formulation and computer modeling. Extra requirements for graduate students: term papers or projects.

Letter grade only (A-F). (Lecture-problems 3 hours) Double Numbered with: [CHE 580](#)

## **CHE 485 - Air Pollution**

(3 units)

Prerequisites: [CHEM 227](#)

or [CHEM 220A](#)

or [CE 364](#)

all with a grade of "C" or better.

Air pollution chemistry; control strategies; origin of pollutants; meteorology; vapor dispersion models; control principles for particulates, sulfur dioxide, and nitrogen oxides.

Letter grade only (A-F). Extra requirements for graduate students: term papers or projects. (Lecture-problems 3 hrs) Double Numbered with: [CHE 585](#)

## **CHE 490 - Special Problems**

(1-3 units)

Prerequisite: Consent of instructor.

Assigned topics in technical literature or laboratory projects and reports on same.

Letter grade only (A-F).

## **CHE 491 - Special Topics in Chemical Engineering**

(1-3 units)

Prerequisite: Department consent

Special topics in chemical engineering that may not be covered in current courses. Topics may include but are not limited to chemical process simulation software, finite element software, and molecular simulations.

Letter grade only (A-F). (Lecture 1-3 hours) May be repeated to 3 units in different semesters.

## **CHE 505 - Advanced Chemical Engineering Thermodynamics**

(3 units)

Prerequisite: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.

Modern equations of state. Theoretical treatment of non-ideal multiphase equilibria. Statistical mechanics and ensembles to describe thermodynamic properties and fundamental property relations. Non-equilibrium thermodynamics with applications to chemical reaction kinetics. Optimization of power and refrigeration cycles.

Letter grade only (A-F). (Lecture-problem 3 hours).

## **CH E 515 - Occupational and Environmental Safety Engineering and Management**

(3 units)

Prerequisite: Open to Chemical Engineering, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.

Safety engineering and management, legislation, regulations and standards; toxicology and personal protective equipment; fire hazards; noise control; electrical safety; system safety analysis; container and spill management; use of computer systems and statistical methods.

Letter grade only (A-F). Extra requirements for graduate students: term papers or projects. (Lecture-problems 3 hours) Double Numbered with: [CH E 415](#)

## **CH E 520 - Advanced Transport Phenomena**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Aerospace Engineering MS, Mechanical Engineering MS, or Engineering MS students only.

Application of differential and integral mass, momentum and energy balances to chemical engineering processes. Analysis of fluid flow, heat transfer, diffusion and chemical reaction in various unit operations.

Letter grade only (A-F). (Lecture-Problems 3 hours)

## **CH E 526 - Advanced Polymer and Composite Materials**

(3 units)

Prerequisite: Open to Chemical Engineering, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only. Consent of instructor.

Principles of thermoplastic and thermoset polymers preparation, thermal/electrical/mechanical properties, performance and applications. Concepts of polymer matrix resin, particulate and fiber reinforcement, interface/interphase, processing and characterization.

Letter grade only (A-F).

## **CH E 530 - Advanced Reactor Kinetics**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Aerospace Engineering MS, Mechanical Engineering MS, or Engineering MS students only.

Modeling of chemical reactors; effects of multiple phases, mixing, adsorption, diffusion and catalysts on reactor performance.

Letter grade only (A-F). (Lecture-Problems 3 hrs)

## **CH E 531 - Heterogeneous Catalysts**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Aerospace Engineering MS, Mechanical Engineering MS, or Engineering MS students only.

Basic principles of solid catalysts and solid catalyzed reactions. Proper choice of catalysts and how to solve catalyst-related problems in chemical engineering. Development of chemical processes that utilize innovative catalysts. Graduate students will need to do more assignments.

Letter grade only (A-F). (Lecture-Problems 3 hours). Double Numbered with: [CH E 431](#)

## **CH E 532 - Microfabrication and Microfluidics Technology**

(3 units)

Prerequisite: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.

Fundamentals of major microfabrication techniques for device construction and microfluidics technology. Topics: photolithography, wet/dry etching, metal/dielectric deposition, soft lithography, diffusion/mixing/separation in microfluidic devices, and chip-to-world interfaces. Graduate students need to do more assignments.

Letter grade only (A-F). (Lecture-Problems 3 hours). Double Numbered with: [CH E 432](#)

## **CH E 533 - Green Engineering I: Alternative Energy**

(3 units)

Prerequisite: Open to Chemical Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.

Aspects of green engineering. Sustainable liquid fuels: ethanol and biodiesel from renewable sources.

Photovoltaic solar devices: semiconductor- and polymer-based solar cells. Solar array collectors: power cycles to convert heat to electrical power. Hydrogen fuel cells: electrochemical cells, and proton exchange membranes. Graduate students will submit final written reports.

Letter grade only (A-F). (Lecture-Problems 3 hours). Double Numbered with: [CH E 433](#)

## **CH E 537 - Materials Purification Processes**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Aerospace Engineering MS, Mechanical Engineering MS, or Engineering MS students only.

Rate-controlled separation processes such as membrane separations, pressure swing adsorption, molecular sieve separation, supercritical fluid extraction, reverse osmosis, and spray drying.

Additional projects required for CH E 537.

Letter grade only (A-F). (Lecture-problems 3 hours). Double Numbered with: [CH E 437](#)

## **CH E 545 - Pollution Prevention**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.

Pollution prevention strategies in chemical industry; hierarchical approach waste minimization; life cycle analyses of wastes; identification of pollution source; environmentally compatible materials; unit operations for minimizing waste; economics of pollution prevention.

Letter grade only (A-F). Extra requirement for graduate students. (Lecture-problems 3 hours) Double Numbered with: [CH E 445](#)

## **CH E 555 - Environmental Compliance**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.  
Physical and chemical properties of hazardous materials and wastes. Environmental hazards. An examination of environmental laws, regulations and standards dealing with storage, transportation, treatment and disposal of hazardous wastes. Emergency planning and preparedness.

Letter grade only (A-F). Extra requirement for graduate students: term papers or projects. (Lecture-problems 3 hours) Double Numbered with: [CH E 445](#)

## **CH E 560 - Advanced Chemical Process Control**

(3 units)

Prerequisite: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.  
Principles and practices of controller selection and tuning, advanced control loops, model predictive control, decoupling, hands-on experience of control loop design and implementation using Labview.

Letter grade only (A-F). (Lecture-Problems 3 hours)

## **CH E 575 - Environmental Pollution**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.  
Application of chemistry to the problems of pollution. Graduate students have additional assignments.

Letter grade only (A-F). (Lecture-problem 3 hours). Double Numbered with: [CH E 475](#)

## **CH E 580 - Theoretical Methods in Chemical Engineering**

(3 units)

Prerequisites: Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only.  
Simulation and optimization of chemical engineering processes by mathematical formulation and computer modeling. Extra requirements for graduate students: term papers or projects.

Letter grade only (A-F). (Lecture-problems 3 hours). Double Numbered with: [CH E 480](#)

## **CH E 582 - Mathematical Modelling in Fluid Dynamics**



(3 units)

Prerequisite(s): Open to Chemical Engineering MS, Engineering MS, Aerospace Engineering MS, or Mechanical Engineering MS students only; or consent of instructor.

The objectives of this course are to teach the principles of mathematical modelling in fluid dynamics with applications in Chemical Engineering to develop the students' ability in analyzing the fundamental and applied aspects of fluid flow problems such as equations of motion, exact solutions, dynamic similarity, specialized equations, laminar boundary layers, turbulence, and flow over immersed bodies. Additionally, to further, develop the students' ability to apply the basic principles of fluid mechanics, mathematical concepts, experimental data, and engineering judgment to specific Chemical Engineering problems.

Letter grade only (A-F).

## **CH E 585 - Air Pollution**

(3 units)

Prerequisites: Open to Engineering MS, Aerospace Engineering MS, or Mechanical MS students only. Air pollution chemistry; control strategies; origin of pollutants; meteorology; vapor dispersion models; control principles for particulates, sulfur dioxide, and nitrogen oxides. Extra requirement for graduate students: term papers or projects.

Letter grade only (A-F). (Lecture-problems 3 hrs). Double Numbered with: [CH E 485](#)

## **CH E 697 - Directed Research**

(1-3 units)

Prerequisite: Open to Chemical Engineering MS and Engineering MS students only. Individual research or intensive study under the guidance of a faculty member on theoretical or experimental problems in chemical engineering.

Letter grade only (A-F). (Independent Study)

## **CH E 698 - Thesis or Industrial Project**

(2-6 units)

Prerequisite: Advancement to Candidacy. Engineering MS, Chemical Engineering MS students only. Preparation and completion of a thesis or industrial project in chemical engineering.

Both grading options. May be repeated to a maximum of 6 units.

